ESTRELA D'ALVA
The Morning Star

IAU XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL

DAY 01

MONDAY, AUGUST 3rd, 2009

WELCOME TO THE IAU GENERAL ASSEMBLY 2009

I have the honor and great pleasure of welcoming you to the XXVII General Assembly (GA) of the International Astronomical Union, in beautiful Rio de Janeiro. After the Buenos Aires GA in 1991, this is the second GA taking place in South America. In the intervening time, as regular participants of the Latin American Regional Meetings can testify, astronomy has much expanded and matured in this part of the world and we will bear witness here to its present vitality and vigour.

At the 2003 GA, in Sydney, the IAU General Assembly voted unanimously a resolution to declare 2009 the International Year of Astronomy (IYA), at the 400th anniversary of the first astronomical observation using a telescope by Galileo Galilei. UNESCO has promptly joined IAU in the organization of the celebration and, in due time, the United Nations proclaimed 2009 the International Year of Astronomy (IYA). Many astronomers throughout the world are engaged in IYA activities, putting their knowledge and their enthusiasm at the disposal of public and educators, helping them to reach out to "the universe, yours to discover". Here, we will have a Special Session on IYA, and be able to make a first assessment of its impact. Many IYA tasks are related to education at all levels and to the global development of astronomy. Indeed, only 63 countries are IAU National Members, while 142 countries are enrolled in IYA. To bridge the gap, it has become necessary to review the long term strategy of IAU in development and education, and to devise a strategic plan for the next ten years. The draft plan, which is an ambitious one, will be presented for discussion to the astronomers attending the GA, and we look forward to your inputs to arrive, with all your help, at the definitive version.

The scientific programme is diverse and attractive. The six Symposia, and 26 Special Sessions and Joint discussions cover a wide variety of topics in contemporary astrophysics. As is suitable in this IYA, historical topics will be addressed, including a Special Session for the 400th anniversary of the publication of Kepler's Astronomia Nova. There will be three Invited Discourses, supplemented by a special presentation on Galileo for the 400th anniversary of his first viewing through a telescope, and by a lecture by the recipients of the Gruber cosmology Prize. As astronomy is moving forward at an unprecedented speed, it is more and more valuable to have chances to catch up on the news in other topics. Thus, one of the reviews of each of the Symposia will be turned into a plenary talk, and we hope that many of you are able to attend these new plenary sessions. Also, there will be three lunch meetings, devoted respectively to young astronomers, women in astronomy, and astronomy education.

I wish you all a memorable time in the Rio GA, a meeting held just Ninety years after the foundation of our Union.

CATHERINE CESARSKY

CELEBRATING THE 90TH ANNIVERSARY

IAU's creation was the result of a merger of several international projects. One of them was the Carte du Ciel ('Map of the Sky', in French), an ambitious effort to catalogue and map the positions of millions of stars up to the 12th magnitude. Others were the Solar Union and the Bureau International de l'Heure (International Time Bureau). All of those pointed out the need of an international organization that could handle astronomy's interests in a proper manner.

So, in 1919, the International Astronomical Union was founded. Its creation occurred during the Constitutive Assembly of the Internacional Research Council (IRC), organized in Brussels from July 18 to 28, and its founding president was Édouard Benjamin Baillaud, a French astronomer who was an enthusiastic supporter of the Carte du Ciel and was the director of the Paris Observatory from 1907 to 1926.

The first General Assembly was held in Rome, in 1922, and others were conducted in three-year periods, except during World War II. The organization grew steadily, and now has true worldwide representation, with 63 national members, and over 9,000 individual members. During the last 90 years, the IAU organized 26 General Assemblies, 200 Colloquia, 261 Symposia, 23 Regional Meetings, 30 International Schools for Young Astronomers, and many other activities, proving it is possible to promote the science of astronomy efficiently through international cooperation.

SALVADOR NOGUEIRA

Welcome to Rio

It is my great pleasure and honor to warmly welcome all the participants of the XXVIIth IAU General Assembly to Rio de Janeiro, Brazil, on behalf of the National Organizing Committee, in this occasion.

I know that for all of you, this is the starting point of two weeks dedicated to intense work and to reencounter and discuss with friends and collaborators from all over the world, of course. This is also a great opportunity to know closely the Brazilian astronomical community and to discover this beautiful city and the nice living style of *cariocas*.

For me, and the NOC, this is almost the end point of a long journey started nearly ten years ago when the Brazilian astronomical community asked itself: "why not organize an IAU General Assembly?" This was raised rather innocently at that time, but now we know how a serious question it was. I can proudly say that we have come a long way over many hard obstacles. We have even lost dearest friends and collaborators, but we continued as a way to honour their work and enthusiasm to make this a perfect moment. I ask your leave, in this happy moment, to remember with sadness the passing away of Francisco X. de Araujo, NOC member, and Antares Kleber, member of the Associated Events Sub-committee, both occurring this year, the former less than one month ago. The sadness is only compensated by the work accomplished, which, I am sure, would have had their complete approval.

It is true however, that today is not the end point of the long jorney: we have ahead the two most important weeks, and it will be our duty and pleasure to make them as perfect as possible to you both from the scientific and the personal point of view. You are now in Rio de Janeiro, worldwide known as "The Marvellous City" and simply called "Rio" by the *cariocas*. Enjoy it! Get to know its beauties as well as the hospitality and kindness of the local people.

Squeezed between the mountains and the sea, Rio is the city most visited in Brazil. Who has not dreamed to know the famous beaches of Copacabana and Ipanema? Although having lost much of their glamour, these still preserve the charm that enchants visitors from all over the world.

It is noteworthy that the first IAU General Assembly in Brazil took place in this city where the astronomical research officially began in the country. It was back in 1827, when the Emperor, Don Pedro I, created the Observatório Imperial, later renamed Observatório Nacional, which during these 182 years never stopped to contribute to the research in astronomy in Brazil.

Today, *cariocas* and Brazilian researchers are happy to be able to welcome you with open arms, as the Redeemer.

Daniela Lazzaro

Virtual Observatories Move from Development to Operations

Over the past several years, the international Virtual Observatory development efforts have made remarkable progress in developing the standards and protocols necessary for worldwide discovery and access to astronomical data. These developments are coordinated by the International Virtual Observatory Alliance (IVOA), a self-organizing coalition of virtual observatory development projects. Astronomers can now locate, download, and compare images, spectra, and catalogs from hundreds of collections using a variety of tools. The stage is now set for VO efforts to go beyond the initial development phase into an era akin to real telescope operations, with resources dedicated to user support, documentation, and system integration and testing. The US National Virtual Observatory project is being superseded by the Virtual Astronomical Observatory. The UK AstroGrid project will be refocusing efforts on support for data producers and archive centers. The European VO is now emphasizing the Astronomical Infrastructure for Data Analysis, or AIDA, program, which supports astronomers in using VO tools in their research efforts. Astronomers should soon be seeing the benefits of this new emphasis on operations and end-user tools.

In May the IVOA welcomed a new VO project to its membership: the Brazilian Virtual Observatory, or BraVO. BraVO is led by Prof. Albert Bruch (Laboratório Nacional de Astrofísica), and Dr. Reinaldo de Carvalho (Instituto Nacional de Pesquisas Espaciais) represents BraVO on the IVOA Executive Committee.

The IAU has a Working Group on Virtual Observatories, Data Centers, and Networks under Commission 5 (Astronomical Data) that was formed at the IAU General Assembly in Prague three years ago. The Working Group is the voice for all matters related to the VO within the IAU. Anyone interested in VO-related issues is welcome to attend the Working Group business meeting on Tuesday 4 August at 11:00am.

Robert Hanisch

WHAT'S NEXT FOR **STELLAR POPULATIONS**

Mature galaxies populated with stars exist in large numbers in the early universe out to z ~ 10. The mere existence of these galaxies poses formidable challenges for models of galaxy formation and hierarchical clustering. In the local universe, very large samples of galaxies have been observed photometrically and spectroscopically. Comparing these observations with models of stellar populations has enabled new constraints on physical parameters such as age and stellar mass. The results show that, for example, galaxies more massive than 9.5 dex $M_{\odot}$ populate a red sequence in a color-magnitude diagram, while less massive ones are found in a blue cloud. Understanding the details of how star formation is quenched in blue galaxies and how they move to the red sequence is a major open question today. Identifying the progenitors of nearby galaxies in the most distant universe is another challenge for models of galaxy formation and evolution.

IAU Symposium 262, Stellar Populations – Planning for the Next Decade, will bring together world experts who will discuss modern issues in the physics of stellar evolution and stellar populations as individual entities and as the main constituents of nearby and distant galaxies. The keynote and invited speakers have been asked to present an update view of the current status of their field of expertise and also their view of the pressing problems that should be solved in the next decade to bring progress into the subject.

We expect IAU Symposium 262 to establish a common groundwork to answer now or in the near future questions like: Are star formation processes seen in local dwarf and resolved galaxies typical in giant galaxies? What determines the galaxy mass threshold for star formation quenching to be effective? Are giant ellipticals formed monolithically, by merger events, or both? Are there chemical abundance patterns which can decide in favor or against one of these scenarios? How can we reliably model the UV emission from early-type galaxies? Does dark matter play any role in the evolution of stellar populations? How universal is the IMF? In what direction should stellar evolution theory go to provide tools needed to understand the chemical abundance patterns observed in stellar populations? What do we know about population III stars?

IAU Symposium 262 should provide an excellent forum for stimulating discussion on these and related questions that will trigger progress in stellar population research.

GUSTAVO BRUZUAL & STÉPHANE CHARLOT

SOLAR SYSTEM **ON ICE**

The study of the different populations of small solar system bodies is very important for understanding the accretion processes in the protoplanetary disk, the different materials that condensed, and even the origin and transport of life among different worlds. Certainly, not all the planetesimals that formed in the protoplanetary disk contained ice, since only refractory materials could condense in the warmest regions close to the early Sun. But beyond the snowline (where water could condense), planetesimals became ice-rich forming the dominant populations in the region of the Jovian planets and in the trans-neptunian region.

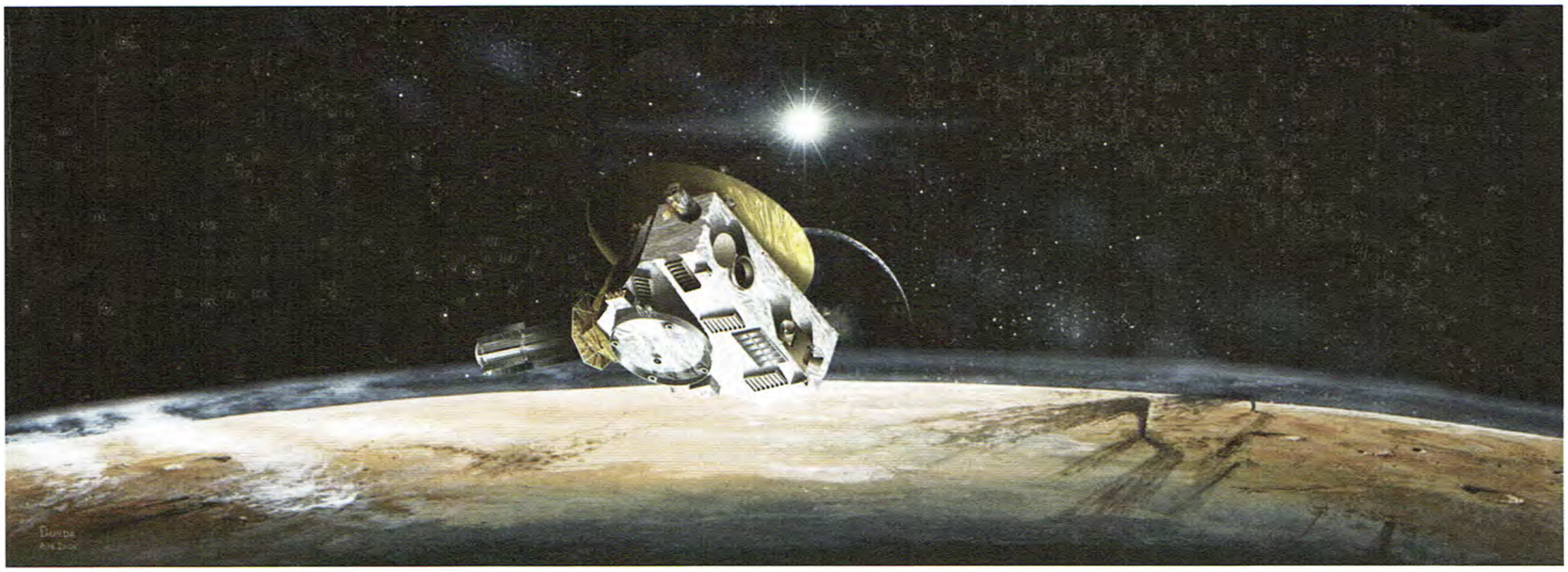
In Symposium 263, Icy Bodies of the Solar System, we look forward to a stimulating meeting where several planetology problems at the frontier of knowledge will be addressed. We can mention the interior structure of icy moons, tidal heating and the prospect of preserving liquid water in some of them, which is relevant for our search of prebiotic conditions beyond Earth. In this regard there's also the study of the chemistry of Titan's atmosphere and surface, greatly enhanced by the Cassini-Huygens mission. But we expect to discuss not only the presence of water ice beyond Earth, but also where the Earth's water came from, bearing in mind that our planet formed in a region where water could not condense. We also expect to analyze the primitive conditions of the icy material in the protoplanetary disk and how the UV radiation and ion irradiation helped to build complex carbon compounds.

There will be also contributions on the physics of comets. Several of these are based on data obtained by the Deep Impact mission. The suspiction that there is not a clearcut distinction between rocky and icy bodies has been strengthened by the discovery of the so called "main belt comets", i.e. bodies on orbits typical of main belt asteroids but that have shown some sporadic activity under the form of dust comae and tails.

At the other extreme we have the trans-neptunian population, where we have just started to learn the basic features of some of its members, as shape, mass and surface composition. Another matter is the presence of several dwarf planets in this region, according to the recent IAU definition.

Last but not least, future space missions to primitive bodies, Dawn, Rosetta and New Horizons, will be presented. In summary, we look forward to having a very stimulating meeting.

JULIO FERNÁNDEZ



PROPOSALS FOR RESOLUTIONS TO BE SUBMITTED TO THE **IAU XXVII GENERAL ASSEMBLY**

The Executive Committee has received the following Resolutions to be submitted to the vote of the Individual Members of the International Astronomical Union in the Second Session of the IAU XXVII General Assembly in Rio de Janeiro, Brazil, 13 August 2009.
Karel A. van der Hucht, General Secretary
International Astronomical Union – Union Astronomique Internationale
98bis bd Arago, F-75014 Paris, France

RESOLUTION B1
on

IAU Strategic Plan:
Astronomy for the Developing World

Proposed by: the IAU Executive Committee

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Robert Williams <wms@stsci.edu>
Seconder:
George K. Miley <miley@strw.leidenuniv.nl>

The XXVII General Assembly of the International Astronomical Union,

recognizing
1. the goal of the IAU to encourage the development of astronomy and facilitate better understanding of the universe,
2. that the current activities of the International Year of Astronomy 2009 have made great strides in advancing knowledge of astronomy among citizens of all nations and awareness of its value to society,
3. that science education and research is an essential component of modern technological and economic development,
therefore resolves that the IAU should

1. place increasing emphasis on programs that advance astronomy education in developing countries,
2. approve the goals specified in the Strategic Plan "Astronomy for the Developing World" as objectives for the IAU in the coming decade,
3. assess programs undertaken during the IYA to determine which activities are most effective in advancing astronomy.

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RESOLUTION A1
on

Implementing the IAU Strategic Plan

Proposed by:
the IAU Executive Committee

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Robert Williams <wms@stsci.edu>
Seconder:
George K. Miley <miley@strw.leidenuniv.nl>

The XXVII General Assembly of the International Astronomical Union,

recognizing
1. the goal of the IAU to encourage the development of astronomy and facilitate better understanding of the universe,
2. that the current activities of the International Year of Astronomy 2009 have made great strides in advancing knowledge of astronomy among citizens of all nations and awareness of its value to society,
3. that science education and research is an essential component of modern technological and economic development,
4. Resolution B1 adopting the IAU Strategic Plan and passed by the XXVII General Assembly,

therefore resolves that the IAU should
1. give high priority to supporting the development of astronomy infrastructure in emerging nations,
2. proceed with the implementation of this plan through the creation of a Global Development Office and seek appropriate additional resources for this purpose.

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RESOLUTION B2
on

Current best estimates of astronomical constants

Proposed by:
IAU Division I WG Numerical Standards in Fundamental Astronomy
Supported by:
IAU Division I

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Brian J. Luzum <brian.luzum@usno.navy.mil>
Seconder:
Nicole Capitaine <nicole.capitaine@obspm.fr>

The XXVII General Assembly of the International Astronomical Union,

considering
1. the need for a self-consistent set of accurate numerical standards for use in astronomy,
2. that improved values of astronomical constants have been made available by recent observations, and
3. that conventional values have been adopted by IAU GA 2000 and IAU GA 2006 resolutions for a number of astronomical quantities,
recognizing
1. the continuing need for a set of Current Best Estimates (CBEs) of astronomical numerical constants, and
2. the need for an operational service to the astronomical community to maintain the CBEs
recommends
1. that the list of constants in the report of the Working Group on Numerical Standards for Fundamental Astronomy be adopted as the IAU (2009) System of Astronomical Constants.
2. that Current Best Estimates of Astronomical Constants be permanently maintained as an electronic document,
3. that, in order to ensure the integrity of the CBEs, IAU Division I develop a formal procedure to adopt new values and archive older versions of the CBEs, and
4. that the IAU establish within IAU Division I a permanent body to maintain the CBEs for fundamental astronomy.

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RESOLUTION B3
on

the Second Realization of the International Celestial Reference Frame

Proposed by:
IAU Division I WG on the Second Realization of the International Celestial Reference Frame
Supported by:
IAU Division I

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Ralph A. Gaume <rgaume@usno.navy.mil>
Seconder: Chopo Ma <chopo.ma@nasa.gov>

The International Astronomical Union XXVII General Assembly,

noting
1. that Resolution B2 of the XXIII General Assembly (1997) resolved "That, as from 1 January 1998, the IAU celestial reference system shall be the International Celestial Reference System (ICRS)",
2. that Resolution B2 of the XXIII General Assembly (1997) resolved that the "fundamental reference frame shall be the International Celestial Reference Frame (ICRF) constructed by the IAU Working Group on Reference Frames",
3. that Resolution B2 of the XXIII General Assembly (1997) resolved "That IERS should take appropriate measures, in conjunction with the IAU Working Group on reference frames, to maintain the ICRF and its ties to the reference frames at other wavelengths",
4. that Resolution B7 of the XXIII General Assembly (1997) recommended "that high-precision astronomical observing programs be organized in such a way that astronomical reference systems can be maintained at the highest possible accuracy for both northern and southern hemispheres",
5. that Resolution B1.1 of the XXIV General Assembly (2000) recognized "the importance of continuing operational observations made with Very Long Baseline Interferometry (VLBI) to maintain the ICRF",

recognizing
1. that since the establishment of the ICRF, continued VLBI observations of ICRF sources have more than tripled the number of source observations,
2. that since the establishment of the ICRF, continued VLBI observations of extragalactic sources have significantly increased the number of sources whose positions are known with a high degree of accuracy,
3. that since the establishment of the ICRF, improved instrumentation, observation strategies, and application of state-of-the-art astrophysical and geophysical models have significantly improved both the data quality and analysis of the entire relevant astrometric and geodetic VLBI data set.,
4. that a working group on the ICRF formed by the International Earth Rotation and Reference Systems Service (IERS) and the International VLBI Service for Geodesy and Astrometry (IVS), in conjunction with the IAU Division I Working Group on the Second Realization of the International Celestial Reference Frame has finalized a prospective second realization of the ICRF in a coordinate frame aligned to that of the ICRF to within the tolerance of the errors in the latter (see note 1),
5. that the prospective second realization of the ICRF as presented by the IAU Working Group on the Second Realization of the International Celestial Reference Frame represents a significant improvement in terms of source selection, coordinate accuracy, and total number of sources, and thus represents a significant improvement in the fundamental reference frame realization of the ICRS beyond the ICRF adopted by the XXIII General Assembly (1997) (see note 2),

resolves
1. that from 01 January 2010 the fundamental astrometric realization of the International Celestial Reference System (ICRS) shall be the Second Realization of the International Celestial Reference Frame (ICRF2) as constructed by the IERS/IVS working group on the ICRF in conjunction with the IAU Division I Working Group on the Second Realization of the International Celestial Reference Frame (see note 1),
2. that the modified Hipparcos Celestial Reference Frame (HCRF) (see note 2) shall continue to be the primary realization of the ICRS at optical wavelengths,
3. that the organizations responsible for astrometric and geodetic VLBI observing programs (e.g. IERS, IVS) take appropriate measures to continue existing and develop

improved VLBI observing and analysis programs to both maintain and improve ICRF2,
4. that the IERS, together with other relevant organizations continue efforts to improve and densify high-accuracy reference frames defined at other wavelengths and continue to improve ties between these reference frames and ICRF2.

Note 1: The Second Realization of the International Celestial Reference Frame – Chopo Ma, et al. (IERS Technical Note 35, Frankfurt am Main: Verlag des Bundesamts für Kartographie und Geodäsie, 2009). See <www.iers.org/MainDisp.csl?pid=46-25772> or <hpiers.obspm.fr/icrs-pc/> . Note 2: Resolution B1.2 of the IAU XXIV General Assembly (2000)
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RESOLUTION B4
on
Supporting Women in Astronomy

Proposed by: the EC WG IYA Task Group She is an Astronomer
Supported by: the EC WG Women in Astronomy

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer: Helen J. Walker <helen.walker@stfc.ac.uk>
Seconder: Sarah T. Maddison <smaddison@swin.edu.au>

The International Astronomical Union XXVII General Assembly,

recalling
1. the UN Millennium Development Goal 3: promote gender equality and empower women,
2. the IAU/UNESCO International Year of Astronomy 2009 goal 7: improve the gender-balanced representation of scientists at all levels and promote greater involvement by underrepresented minorities in scientific and engineering careers,

recognising
1. that individual excellence in science and astronomy is independent of gender,
2. that gender equality is a priority of the global scientific community.

considering
1. the role of the IAU Working Group for Women in Astronomy items 1 and 6 (1. monitoring the status of women in astronomy and recommending future actions that will improve the environment for all astronomers; **6.** provide a voice for women in non-western countries to ensure that they are well represented in the international community),
2. the role of the IYA2009 Cornerstone Project She is an Astronomer (provide access to excellent role models and mentors, formally and informally, and publicise them; provide information about the female 'dual-career' problem and possible solutions),

recommends
1. that all IAU members encourage and support the female astronomers in their communities,
2. that all IAU members and National Representatives encourage national organisations to break down barriers and ensure that men and women are given equal opportunities to pursue a successful career in astronomy at all levels and career steps.
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RESOLUTION B5
in
Defence of the night sky and the right to starlight

Proposed by: IAU EC WG IYA Cornerstone Project Dark Skies Awareness and the members of the Starlight Declaration
Supported by: IAU Division XII/ Commission 50 WG Controlling Light Pollution

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Richard J. Wainscoat <rjw@ifa.hawaii.edu>
Seconder:
Malcolm G. Smith <msmith@noao.edu>

The International Astronomical Union XXVII General Assembly,

recalling
1. the IAU/UNESCO International Year of Astronomy 2009 goal 8: facilitate the preservation and protection of the world's cultural and natural heritage of dark skies in places such as urban oases, national parks and astronomical sites,
2. the Declaration approved during the International Conference in Defence of the Quality of the Night Sky and the Right to Observe Stars (La Palma, Canary Islands, 2007) promoted by UNESCO, UNWTO, IAC, MaB Programme, IAU, and other international agencies,

recognising
that the night sky has been and continues to be an inspiration of mankind, and that its contemplation represents an essential element in the development of scientific thought in all civilisations,

considering
1. the role of the IAU Division XII Commission 50 WG Controlling Light Pollution,
2. the role of the IYA2009 Cornerstone Project Dark Skies Awareness,

declares that
1. An unpolluted night sky that allows the enjoyment and contemplation of the firmament should be considered an inalienable right equivalent to all other socio-cultural and environmental rights. Hence the progressive degradation of the night sky must be regarded as a fundamental loss.
2. Knowledge – armed with education – is a powerful vector that can heal the growing rift between today's society and science and contribute to the advancement of mankind as a whole. The dissemination of astronomy and associated scientific and cultural values should be considered as basic content to be included in educational activities.
3. Protection of the quality of astronomical areas suitable for scientific observation of the Universe must be given priority in national and international scientific and environmental policies.
4. Control of obtrusive light must be a basic element of nature conservation policies since it impacts on several species, habitats, ecosystems, and landscapes.
5. The intelligent use of artificial lighting that minimises sky glow and avoids obtrusive visual impact on both humans and wildlife should be promoted. This strategy would involve more efficient use of energy so as to meet the wider commitments made on climate change, and for the protection of the environment.
6. Tourism, among other players, can become a major instrument for a new alliance in defence of the quality of the nocturnal skyscape. Responsible tourism, in its many forms, can and should take on board the night sky as a resource to protect and value in all destinations.
7. Necessary measures should be implemented to involve all parties related to skyscape protection in raising public awareness – be it at local, regional, national, or international level – about the contents and objectives of the International Conference in Defence of the Quality of the Night Sky and the Right to Observe Stars.

PROPOSAL FOR MODIFICATION OF **IAU STATUTES AND BYE-LAWS**

The Executive Committee submits a revision of the IAU Statutes and Bye-Laws to the vote of the Representatives of the National Members of the IAU in the First Session of the IAU XXVII General Assembly, in Rio de Janeiro, Brazil, 4 August 2009. The revisions compared to the current Statutes and Bye-Laws (approved by the IAU XXVI GA in Prague, 2006) are either in bold-underlined (for additions) or barred (for deletions).
Karel A. van der Hucht, General Secretary
International Astronomical Union – Union Astronomique Internationale
98bis bd Arago, F-75014 Paris, France

Proposal for modification of IAU Statutes for consideration at the IAU XXVII GA

IAU STATUTES
~~Prague, Czech Republic, 15 August 2006~~ Rio de Janeiro, Brazil, 4 August 2009

I. OBJECTIVE
1. The International Astronomical Union (hereinafter referred to as the Union) is an international non-governmental organization. Its objective is to promote the science of astronomy in all its aspects.

II. DOMICILE AND INTERNATIONAL RELATIONS
2. The legal domicile of the Union is Paris, Republic of France.
3. The Union adheres to, and co-operates with the body of international scientific organizations through ~~ICSU~~: the International Council for Science (ICSU). It supports and applies the policies on the Freedom, Responsibility, and Ethics in the Conduct of Science defined by ICSU.

III. COMPOSITION OF THE UNION
4. The Union is composed of:
4.a. National Members (adhering organizations)
4.b. Individual Members (adhering persons)

IV. NATIONAL MEMBERS
5. An organization representing a national professional astronomical community, desiring to promote its participation in international astronomy and supporting the objective of the Union, may adhere to the Union as a National Member. ~~Exceptionally, a National Member may represent the community in the territory of more than one nation, provided that no part of that community is represented by another National Member.~~
6. An organization desiring to join the Union as a National Member while developing professional astronomy in the community it represents may do so:
6a. on an interim basis, on the same conditions as above, for a period of up to nine years. After that time, it ~~will either~~ must apply to become a National Member on a permanent basis or its membership in the Union will terminate;

6b. on a prospective basis for a period of up to six years if its community has less than six Individual Members. After that time it must apply to become a National Member on either an interim or permanent basis or its membership in the Union will terminate.
7. A National Member is admitted to the Union on a permanent, ~~or~~ interim, or prospective basis by the General Assembly. It may resign from the Union by so informing the General Secretary in writing.
8. A National Member may be either:
8.a. the organization by which scientists of the corresponding nation or territory adhere to ICSU or:
8.b. an appropriate National Society or Committee for Astronomy, or:
8.c. an appropriate institution of higher learning.
9. The adherence of a National Member is automatically suspended if its ~~dues~~ annual contributions, as defined in Articles 23c and 23e below have not been paid for five years; it resumes, upon the approval of the Executive Committee, when the arrears in contributions have been paid in full. After five years of suspension of a National Member, the Executive Committee may recommend to the General Assembly to terminate the ~~m~~Membership.
10. A National Member is admitted to the Union in one of the categories specified in the Bye-Laws.

V. INDIVIDUAL MEMBERS

11. A professional scientist who is active in some branch of astronomy may be admitted to the Union by the Executive Committee as an Individual Member. An Individual Member may resign from the Union by so informing the General Secretary in writing.

VI. GOVERNANCE

12. The governing bodies of the Union are:
12.a. The General Assembly;
12.b. The Executive Committee; and
12.c. The Officers.

VII. GENERAL ASSEMBLY

13. The General Assembly consists of the National Members and of Individual Members. The General Assembly determines the overall policy of the Union.
13.a. The General Assembly approves the Statutes of the Union, including any changes therein.
13.b. The General Assembly approves Bye-Laws specifying the Rules of Procedure to be used in applying the Statutes.
13.c. The General Assembly elects an Executive Committee to implement its decisions and to direct the affairs of the Union between successive ordinary meetings of the General Assembly. The Executive Committee reports to the General Assembly.
13.d. The General Assembly appoints a Finance Committee, consisting of one representative of each National Member having the right to vote on budgetary matters according to §14.a., to advise it on the approval of the budget and accounts of the Union. The General Assembly also appoints a Finance Sub-Committee to advise the Executive Committee on its behalf on budgetary matters between General Assemblies.
13.e. The General Assembly appoints a Special Nominating Committee to prepare a suitable slate of candidates for election to the incoming Executive Committee.
13.f. The General Assembly appoints a Nominating Committee to advise the Executive Committee on the admission of Individual Members.
14. Voting at the General Assembly on issues of a primarily scientific nature, as determined by the Executive Committee, is by Individual Members. Voting on all other matters is by National Member. Each National Member authorises a representative to vote on its behalf.
14.a. On questions involving the budget of the Union, the number of votes for each National Member is one greater than the number of its category, referred to in article 10. National Members with interim status, or which have not paid their dues for years preceding that of the General Assembly, may not participate in the voting.
14.b. On questions concerning the administration of the Union, but not involving its budget, each National Member has one vote, under the same condition of payment of dues as in §14.a.
14.c. National Members may vote by correspondence on questions concerning the agenda for the General Assembly.
14.d. A vote is valid only if at least two thirds of the National Members having the right to vote by virtue of article §14.a. participate in it by either casting a vote or signaling an abstention. An abstention is not considered a vote cast.
15. The decisions of the General Assembly are taken by an absolute majority of the votes cast. However, a decision to change the Statutes ~~can only be taken with~~ requires the approval of at least two thirds ~~of the votes~~ of all National Members having the right to vote by virtue of article §14.a. Where there is an equal division of votes, the President determines the issue.
16. Changes in the Statutes or Bye-Laws can only be considered by the General Assembly if a specific proposal has been duly submitted to the National Members and placed on the Agenda of the General Assembly by the procedure and deadlines specified in the Bye-Laws.

VIII. EXECUTIVE COMMITTEE

17. The Executive Committee consists of the President of the Union, the President-Elect, six Vice-Presidents, the General Secretary, and the Assistant General Secretary, elected by the General Assembly on the proposal of the Special Nominating Committee.

IX. OFFICERS

18. The Officers of the Union are the President, the General Secretary, the President-Elect, and the Assistant General Secretary. The Officers decide short-term policy issues within the general policies of the Union as decided by the General Assembly and interpreted by the Executive Committee.

X. SCIENTIFIC DIVISIONS

19. As an effective means to promote progress in the main areas of astronomy, the scientific work of the Union is structured through its Scientific Divisions. Each Division covers a broad, well-defined area of astronomical science, or deals with international matters of an interdisciplinary nature. As far as practicable, Divisions should include comparable fractions of the Individual Members of the Union.
20. Divisions are created or terminated by the General Assembly on the recommendation of the Executive Committee. The activities of a Division are organized by an Organizing Committee chaired by a Division President. The Division President and a Vice-President are elected by the General Assembly on the proposal of the Executive Committee, and are ex officio members of the Organizing Committee.

XI. SCIENTIFIC COMMISSIONS

21. Within Divisions, the scientific activities in well-defined disciplines within the subject matter of the Division may be organized through scientific Commissions. In special cases, a Commission may cover a subject common to two or more Divisions and then becomes a Commission of all these Divisions.
22. Commissions are created or terminated by the Executive Committee upon the recommendation of the Organizing Committee(s) of the Division(s) desiring to create or terminate them. The activities of a Commission are organized by an Organizing Committee chaired by a Commission President. The Commission President and a Vice-President are appointed by the Organizing Committee(s) of the corresponding Division(s) upon the proposal of the Organizing Committee of the Commission.

XII. BUDGET AND DUES

23. For each ordinary General Assembly the Executive Committee prepares a budget proposal covering the period to the next ordinary General Assembly, together with the accounts of the Union for the preceding period. It submits these, with the advice of the Finance Sub-Committee, to the Finance Committee for consideration before their submission to the vote of the General Assembly.
23.a. The Finance Committee examines the accounts of the Union from the point of view of responsible expenditure within the intent of the previous General Assembly, as interpreted by the Executive Committee. It also considers whether the proposed budget is adequate to implement the policy of the General Assembly. It submits reports on these matters to the General Assembly before its decisions concerning the approval of the accounts and of the budget.
23.b. The amount of the unit of contribution is decided by the General Assembly as part of the budget approval process.
23.c. Each National Member pays annually a number of units of contribution corresponding to its category. The number of units of contribution for each category shall be specified in the Bye-Laws.
23.d. A vote on matters under article 23 is valid only if at least two thirds of the National Members having the right to vote by virtue of article §14.a. ~~participate in it~~ cast a vote. In all cases an abstention is note a vote, but a declaration that the Member declines to vote.
23.e. National Members having interim status pay annually one half unit of contribution.
23.f. National Members having prospective status pay no contribution.
23.g. The payment of contributions is the responsibility of the National Members. The liability of each National Members in respect of the Union is limited to the amount of contributions due through the current year.

XIII. EMERGENCY POWERS

24. If, through events outside the control of the Union, circumstances arise in which it is impracticable to comply fully with the provisions of the Statutes and Bye-Laws of the Union, the Executive Committee and Officers, in the order specified below, shall take such actions as they deem necessary for the continued operation of the Union. Such action shall be reported to all National Members as soon as this becomes practicable, until an ordinary or extraordinary General Assembly can be convened.
The following is the order of authority:
The Executive Committee in meeting or by correspondence; the President of the Union; the General Secretary; or failing the practicability or availability of any of the above, one of the Vice-Presidents.

XIV. DISSOLUTION OF THE UNION

25. A decision to dissolve the Union is only valid if taken by the General Assembly with the approval of three quarters of the National Members having the right to vote by virtue of article §14.a. Such a decision shall specify a procedure for settling any debts and disposing of any assets of the Union.

XV. FINAL CLAUSES

26. These Statutes enter into force on ~~15 August 2006~~ 4 August 2009.
27. The present Statutes are published in French and English versions. ~~In case of doubt~~ For legal purposes, the French version is ~~the only authority~~ authorative.

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Proposal for modification of IAU Bye-Laws for consideration at the IAU XXVII GA

IAU BYE-LAWS

~~Prague, Czech Republic, 15 August 2006~~ Rio de Janeiro, Brazil, 4 August 2009

I. MEMBERSHIP

1. An application for admission to the Union as a National Member shall be submitted to the General Secretary by the proposing organization at least eight months before the next ordinary General Assembly.
2. The Executive Committee shall examine the application and resolve any outstanding issues concerning the nature of the proposed National Member and the category of membership (§ VII.25). Subsequently, the Executive Committee shall forward the application to the General Assembly for decision, with its recommendation as to its approval or rejection.
3. The Executive Committee shall examine any proposal by a National Member to change its category of adherence to a more appropriate level. If the Executive Committee is unable to approve the request, either party may refer the matter to the next General Assembly.
4. Individual Members are admitted by the Executive Committee upon the nomination of a National Member or the President of a Division. The Executive Committee shall publish the criteria and procedures for membership, and shall consult the Nominating Committee before approving applications for admissions as Individual Members.

II. GENERAL ASSEMBLY

5. The ordinary General Assembly meets, as a rule, once every three years. Unless determined by the previous General Assembly, the place and date of the ordinary General Assembly shall be fixed by the Executive Committee and be communicated to the National Members at least one year in advance.

6. The President may summon an extraordinary General Assembly with the consent of the Executive Committee, and must do so at the request of at least one third of the National Members. The date, place, and agenda of business of an extraordinary General Assembly must be communicated to all National Members at least two months before the first day of the Assembly.

7. Matters to be decided upon by the General Assembly shall be submitted for consideration by those concerned as follows, counting from the first day of the General Assembly:

7.a. A motion to amend the Statutes or Bye-Laws may be submitted by a National Member or by the Executive Committee. Any such motion shall be submitted to the General Secretary at least nine months in advance and be forwarded, with the recommendation of the Executive Committee as to its adoption or rejection, to the National Members at least six months in advance.

7.b. The General Secretary shall distribute the budget prepared by the Executive Committee to the National Members at least eight months in advance. Any motion to modify this budget, or any other matters pertaining to it, shall be submitted to the General Secretary at least six months in advance. Any such motion shall be submitted, with the advice of the Executive Committee as to its adoption or rejection, to the National Members at least four months in advance.

7.c. Any motion or proposal concerning the administration of the Union, and not affecting the budget, by a National Member, or by the Organizing Committee of a Scientific Division of the Union, shall be placed on the Agenda of the General Assembly, provided it is submitted to the General Secretary, in specific terms, at least six months in advance.

7.d. Any motion of a scientific character submitted by a National Member, a Scientific Division of the Union, or by an ICSU Scientific Committee or Program on which the Union is formally represented, shall be placed on the Agenda of the General Assembly, provided it is submitted to the General Secretary, in specific terms, at least six months in advance.

7.e. The complete agenda, including all such motions or proposals, shall be prepared by the Executive Committee and submitted to the National Members at least four months in advance.

8. The President may invite representatives of other organizations, scientists in related fields, and young astronomers to participate in the General Assembly. Subject to the agreement of the Executive Committee, the President may authorise the General Secretary to invite representatives of other organizations, and the National Members or other appropriate IAU bodies to invite scientists in related fields and young astronomers.

III. SPECIAL NOMINATING COMMITTEE

9. The Special Nominating Committee consists of the President and past President of the Union, a member proposed by the retiring Executive Committee, and four members selected by the Nominating Committee from among twelve ~~Members~~ candidates proposed by Presidents of Divisions, with due regard to an appropriate distribution over the major branches of astronomy.

9.a. Except for the President and immediate past President, present and former members of the Executive Committee shall not serve on the Special Nominating Committee. No two members of the Special Nominating Committee shall belong to the same nation or National Member.

9.b. The General Secretary, ~~and~~ the Assistant General Secretary and the President-Elect participate in the work of the Special Nominating Committee in an advisory capacity.

10. The Special Nominating Committee is appointed by the General Assembly, to which it reports directly. It assumes its duties immediately after the end of the General Assembly and remains in office until the end of the ordinary General Assembly next following that of its appointment, and it may fill any vacancy occurring among its members.

IV. OFFICERS AND EXECUTIVE COMMITTEE

11.

11.a. The President of the Union remains in office until the end of the ordinary General Assembly next following that of election. The President-Elect succeeds the President at that moment.

11.b. The General Secretary and the Assistant General Secretary remain in office until the end of the ordinary General Assembly next following that of their election. Normally the Assistant General Secretary succeeds the General Secretary, but both officers may be re-elected for another term.

11.c. The Vice-Presidents remain in office until the end of the ordinary General Assembly following that of their election. They may be immediately re-elected once to the same office.

11.d. The elections take place at the last session of the General Assembly, the names of the candidates proposed having been announced at a previous session.

12. The Executive Committee may fill any vacancy occurring among its members. Any person so appointed remains in office until the end of the next ordinary General Assembly.

13. The past President and General Secretary become advisers to the Executive Committee until the end of the next ordinary General Assembly. They participate in the work of the Executive Committee and attend its meetings without voting rights.

14. The Executive Committee shall formulate Working Rules to clarify the application of the Statutes and Bye-Laws. Such Working Rules shall include the criteria and procedures by which the Executive Committee will review applications for Individual Membership; standard Terms of Reference for the Scientific Commissions of the Union; rules for the administration of the Union's financial affairs by the General Secretary; and procedures by which the Executive Committee may conduct business by electronic or other means of correspondence. The Working Rules shall be published electronically and in the Transactions of the Union.

15. The Executive Committee appoints the Union's official representatives to other scientific organizations.

16. The Officers and members of the Executive Committee cannot be held individually or personally liable for any legal claims or charges that might be brought against the Union.

V. SCIENTIFIC DIVISIONS

17. The Divisions of the Union shall pursue the scientific objects of the Union within their respective fields of astronomy. Activities by which they do so include the encouragement and organization of collective investigations, and the discussion of questions relating to international agreements, cooperation, or standardization.

They shall report to each General Assembly on the work they have accomplished and such new initiatives as they are undertaking.

18. Each Scientific Division shall consist of:

18.a. An Organizing Committee, normally of 6-12 persons, including the Division President and Vice-President, and a Division Secretary appointed by the Organizing Committee from among its members.

18.b. Members of the Union appointed by the Organizing Committee in recognition of their special experience and interests. The Committee is responsible for conducting the business of the Division.

19. Normally, the Division President is succeeded by the Vice-President at the end of the General Assembly following their election, but both may be re-elected for a second term. Before each General Assembly, the Organizing Committee shall organize an election from among the membership, by electronic or other means suited to ~~the Commission~~ its scientific structure ~~of the Division~~, of a new Organizing Committee to take office for the following term. Election procedures should, as far as possible, be similar among the Divisions and require the approval of the Executive Committee.

20. Each Scientific Division may structure its scientific activities by creating a number of Commissions. In order to monitor and further the progress of its field of astronomy, the Division shall consider, before each General Assembly, whether its Commission structure serves its purpose in an optimum manner. It shall subsequently present its proposals for the creation, continuation or discontinuation of Commissions to the Executive Committee for approval.

21. With the approval of the Executive Committee, a Division may appoint Working Groups to study well-defined scientific issues and report to the Division. Unless specifically re-appointed by the same procedure, such Working Groups cease to exist at the next following General Assembly.

VI. SCIENTIFIC COMMISSIONS

22. A Scientific Commission shall consist of:

22.a. A President and an Organizing Committee consisting of 4-8 persons elected by the Commission membership, subject to the approval of the Organizing Committee of the Division;

22.b. Members of the Union, appointed by the Organizing Committee, in recognition of their special experience and interests, subject to confirmation by the Organizing Committee of the Division.

23. A Commission is initially created for a period of six years. The parent Division may recommend its continuation for additional periods of three years at a time, if sufficient justification for its continued activity is presented to the Division and the Executive Committee. The activities of a Commission is governed by Terms of Reference, which are based on a standard model published by the Executive Committee and are approved by the Division.

24. With the approval of the Division, a Commission may appoint Working Groups to study well-defined scientific issues and report to the Commission. Unless specifically re-appointed by the same procedure, such Working Groups cease to exist at the next following General Assembly.

VII. ADMINISTRATION AND FINANCES

25. Each National Member pays annually to the Union a number of units of contribution corresponding to its category as specified below. National Members with interim status pay annually one half unit of contribution, and those with prospective status pay no dues.

Categories as defined in article 10 of the Statutes

I	II	III	IV	V	VI	VII	VII	IX	X	XI	XII
01	02	04	06	10	14	20	27	35	45	60	80

number of units of contribution

26. The income of the Union is to be devoted to its objects, including:

26.a. the promotion of scientific initiatives requiring international co-operation;

26.b. the promotion of the education and development of astronomy world-wide;

26.c. the costs of the publications and administration of the Union.

27. Funds derived from donations are reserved for use in accordance with the instructions of the donor(s). Such donations and associated conditions require the approval of the Executive Committee.

28. The General Secretary is the legal representative of the Union. The General Secretary is responsible to the Executive Committee for not incurring expenditure in excess of the amount specified in the budget as approved by the General Assembly.

29. The General Secretary shall consult with the Finance Sub-Committee (cf. Statutes § 13.d.) in preparing the accounts and budget proposals of the Union, and on any other matters of major importance for the financial health of the Union. The comments and advice of the Finance Sub-Committee shall be made available to the Officers and Executive Committee as specified in the Working Rules.

30. An Administrative office, under the direction of the General Secretary, conducts the correspondence, administers the funds, and preserves the archives of the Union.

31. The Union has copyright to all materials printed in its publications, unless otherwise arranged.

VIII. FINAL CLAUSES

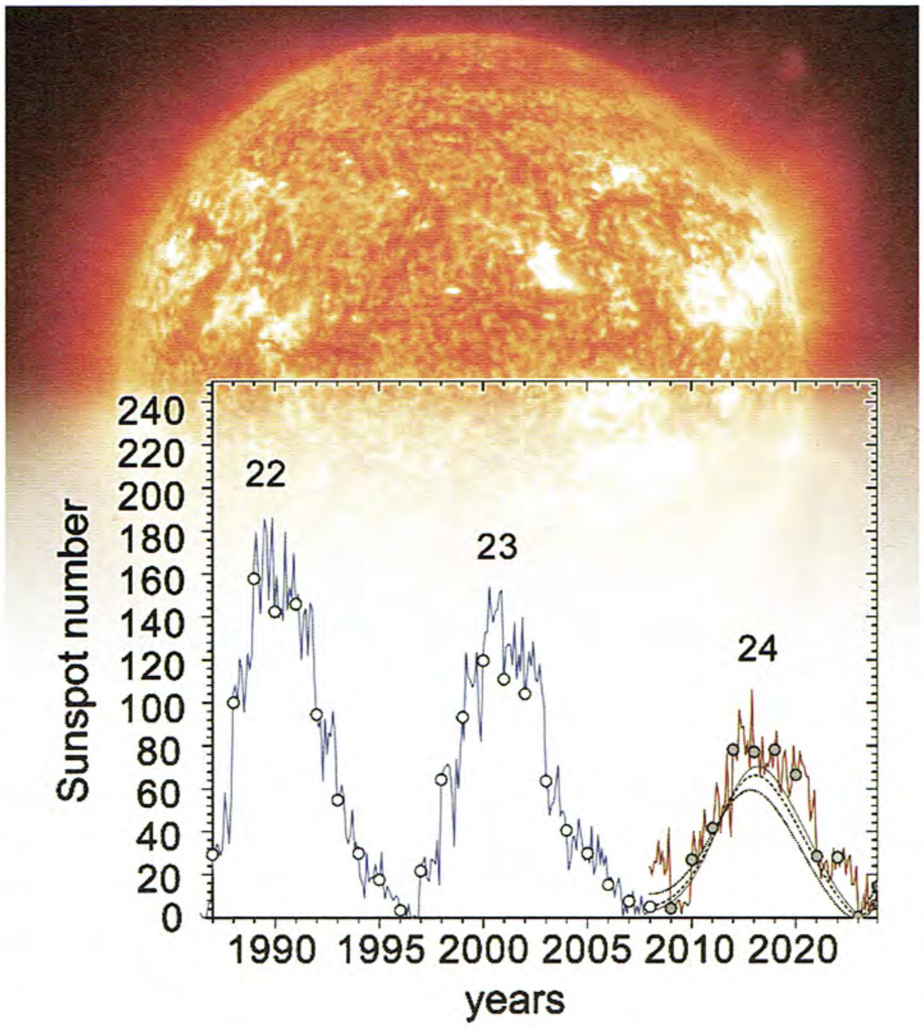
32. These Bye-Laws enter into force on ~~15 August 2006~~ 4 August 2009.

33. The present Bye-Laws are published in French and English versions. ~~In case of doubt~~ For legal purposes, the French version is ~~the only authority~~ authorative.

Solar and Stellar Variability and Impact on Earth and Planets

The Sun is a variable star. Understanding the physical mechanisms of the variability and its effect on Earth and planets is one of the central and long-standing problems of astronomy and astrophysics. Variability of the similar type has been observed in other stars. It has been realized that it is essential to investigate the similarities and differences between solar and stellar variabilities in order to understand the physical mechanisms and impacts on planets.

During the past decade multi-wavelength observations from several solar and stellar space missions and ground-based observatories have provided a tremendous amount of new information about physical processes in the Sun and solar-type stars associated with their magnetic activity and variability. However, despite the great amount of new data, it is still unclear where and how magnetic fields are generated in the Sun, and why it has a regular 22-year magnetic cycle. Can observations of other stars help us to understand the solar magnetic cycle, which is so important not only for astrophysics but also for our life and society? What are the essential components of the solar variability? Key observational results, new theoretical ideas and models will be discussed at Symposium 264.



Recent optical, UV and X-ray observations of other stars with significant subsurface convection zones reveal starspots and other surface and atmospheric structures that are similar to solar magnetic features. In many cases, the long-term evolution of these features is similar to the solar cycle. Advances in the Doppler imaging technique have allowed us to obtain maps of starspot distribution and tracking their evolution. This led to the first accurate measurements of the stellar differential rotation, a key property of dynamo mechanisms. In addition, UV and X-ray observations detected stellar coronas similar to the solar corona.

The impact of the solar variability on the Earth atmosphere and climate has been a subject of significant debates in recent years. The current unusually long and deep minimum of solar activity has significantly increased the interest in the mechanisms of solar and stellar variability and the impact of such long periods of low activity on planets. It is well known that a long period of low solar activity between 1645 and 1715, the Maunder Minimum, coincided with a significant climate change called the "Little Ice Age". Could this happen again? Observations of other stars indicate that such long low-activity periods are quite common. Various attempts to predict the next solar cycle indicate that it will be significantly weaker than the previous cycle. Some researchers even suggest that the Sun is in a state of prolonged period of low activity, similar to the Maunder Minimum.

Of course, these studies are not only of great practical importance, but are also directly related to some of the most important astronomical problems: what are the basic physical mechanisms of solar and stellar activity, and how the stellar variability affects planetary systems and their habitability.

A.G. Kosovichev, A.H. Andrei and J.-P. Rozelot

Why Estrela D'Alva

As in several other languages, the planet Venus has received various popular designations in Portuguese that depend on the time of its appearance in the sky. "Estrela D'Alva" is one of those designations, meaning, literally, 'The Dawn Star' or, semantically, 'The Morning Star'.

> Estrela D'Alva, The Morning Star

Other popular names for the morning Venus are "Estrela Matutina" ('Morning Star') and "Estrela do Pastor" ('Shepherd's Star'). In its evening appearance, Venus is called "Estrela Vésper", "Estrela Vespertina" or "Estrela da Tarde", all having the same literal meaning of 'Evening Star'. Just like the Morning Star announces the coming of a new day, we expect to welcome you with bright news every morning during this General Assembly.

Hélio J. Rocha Pinto

ESTRELA D'ALVA
The Morning Star
XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 02
TUESDAY, AUGUST 4th, 2009

ASTRONOMY FOR THE DEVELOPING WORLD: AN IAU DECADAL PLAN

The IAU regards stimulating astronomy education and development throughout the world to be one of its most important tasks. The Executive Committee (EC) decided to instigate a re-examination of IAU strategy to continue the momentum engendered by IYA. Following a "brainstorm" by relevant stakeholders during January 2008 the draft of a strategic plan was produced. This plan was approved by the EC on 7 April and envisages a substantial expansion of astronomy development activities. It can be downloaded from the IAU web site. The plan will be discussed at SpS4 on 10th August and at a lunch sponsored by the Norwegian Academy on 11th August. We hope that you will support the resolutions endorsing the plan that will be considered at the Closing Business Meeting.

THE ASTRO-BUS. CHILDREN BOARDING THE ASTRO-BUS AT A VILLAGE IN TUNISIA. THE ASTRO-BUS IS AN INNOVATIVE ACTIVITY OF LA CITÉ DES SCIENCES, TUNIS. THE BUS TRANSPORTS A SMALL TELESCOPE, A MINI-PLANETARIUM AND AN EXHIBITION THROUGHOUT TUNISIA, INSPIRING CHILDREN EVEN IN THE REMOTEST VILLAGES. DURING 2008 MORE THAN 150,000 CHILDREN VISITED THE ASTRO-BUS.

I shall here briefly review the plan. **Firstly**, it shows that astronomy can play a unique role in furthering education and capacity building throughout the world. Astronomy combines science and technology with inspiration and excitement. The South African government's 1996 policy on science & technology puts an argument for this view succinctly: "It is important to maintain a basic science competence in 'flagship' sciences such as physics and astronomy for cultural reasons. Not to offer them would be to take a negative view of our future – the view that we are a second-class nation, chained forever to the treadmill of feeding and clothing ourselves".

Secondly, the plan summarises present educational activities and analyses the present state of astronomy development globally. The program groups (PGs) of IAU Commission 46 have long conducted an impressive range of activities to further astronomy in developing countries. These include the organisation and funding of national and regional astronomy schools and visits by astronomers to developing nations. A new PG is presently being set up directed at primary and secondary schools. Outside the formal IAU ambit, there are now also several complementary activities devoted specifically to astronomy education and outreach, including programs for children.

Thirdly, the long-term vision of the plan is that eventually all countries should participate at some level in astronomical research and that all children throughout the world will be exposed to knowledge about astronomy and the Universe. The plan outlines specific goals for working towards this vision.

Fourthly, the "meat" of the plan is a strategy for achieving these goals. Ingredients include:

• **An integrated strategic approach** based on the future potential for research and education in each country. Because of its relative underdevelopment, sub-Saharan Africa will receive special attention.

• **Enlarging the number of active volunteers** by recruiting more members and augmenting the pool of volunteers by doctoral and postdoctoral trainees and talented non-member experts on pre-tertiary education and outreach.

• **Initiation of new activities**. Major new initiatives proposed include (i) an endowed lectureship program to provide semi-popular lectures on inspirational topics at the high-schcol level and (ii) long-term **"institute twinning"** between established astronomy institutes and university departments in less developed countries.

• **Creation of a small Global Development Office (GDO)**. Mobilizing large number of volunteers and implementing new programs need professional coordination.

• **Increasing regional involvement** and the adoption of a "bottom-up" approach, with a substantial degree of decentralization.

• **Exploiting new tools**, such as archives, robotic telescope networks, the web and mobile tools such as the astro-bus.

Fifthly, the plan envisages a flexible implementation of the strategy, in step with available funding. The annual direct cost will be an order of magnitude larger than that of the present cost of the IAU development program. Obtaining resources will be a huge challenge that will need action on various fronts. Several possibilities are outlined in the plan.

A vigorous fund-raising campaign will be needed, coordinated by the GDO. Although this is a difficult time for fund raising, the funding climate is likely to improve during the decade. Before attempting to raise external funds, there are three prerequisites. 1. A credible plan. Without one that appeals to potential fund-givers, there is no chance of obtaining increased funding. 2. Management must be seen to be sufficiently professional to warrant support. Setting up the GDO is essential. 3. The IAU must show commitment. The EC has approved an increase in funding for relevant activities from 10.3% to 16.7% of the IAU budget, i.e. € 144,000 annually.

Should astronomical researchers become involved in such development activities? I suggest that the answer is a resounding "yes", both for reasons of morality and expediency. Facilities needed to carry out frontier astronomical research become more expensive every year. The willingness of society to fund these magnificent machines sets an ultimate limit to what can be achieved. The decision of whether or not to construct a billion-dollar astronomical research facility is inevitably a political one. By devoting a tiny fraction of astronomical resources to global development and education, we enhance the image of astronomy as a whole and make politicians more receptive to our research proposals. Mobilizing astronomy in the service of global development is an extremely cost-effective strategy.

GEORGE MILEY

2009: THE INTERNATIONAL YEAR OF ASTRONOMY

The year 2009 will be remembered for many reasons, but we hope that IYA2009 will be particularly memorable for the many people having their first contact with astronomy results and with sky gazing activities. IYA2009 fosters a global appreciation of the role and value of science, technology and astronomy as a unifying activity for humanity and because of this IYA2009 is a global endeavour, promoting astronomy and its contribution to society and culture. IYA2009 aims to unite nations under the umbrella of astronomy and science, while at the same time acknowledging cultural, national and regional diversity, with strong emphasis on education and public engagement. The response from all the corners of the world has been extremely positive and encouraging, making the Year a great success already.

Although January 1st 2009 marked the "real" beginning of IYA2009, this immense worldwide science outreach and education programme began more than six years earlier with the IAU's initiative during the IAU General Assembly in 2003. With the IAU General Assembly in Rio de Janeiro, IYA2009 reaches its eight-month milestone. In less than one year, more than a million people have looked at the sky through a telescope for the first time, and even more have newly become engaged in astronomy. This is just one of many achievements, as there are countless ongoing projects, and also planned initiatives still to come. Never before has such a network of scientists, amateur astronomers, educators, journalists, and scientific institutions joined together.


PARISIANS PARTICIPATE IN EVENT WITH THE GALILEOSCOPE

As IYA2009 comes to an end, we will join in a celebration of astronomy and astronomical experiences. We believe that the momentum generated by IYA2009 will leave a lasting legacy in the minds of the public, as well as in world astronomy and in IAU activities.

CATHERINE CESARSKY AND PEDRO RUSSO

THE INTERNATIONAL YEAR OF ASTRONOMY IN BRAZIL

After six months of activities, the Brazilian astronomical community is proud of its achievements. Our activities are being organized and carried out by more than 230 local nodes, all of them supported by the national committee. In this first semester, thousands of people observed the skies for the first time ever on a telescope, observing the Orion Nebula, the Jewel Box and the edge of Saturn's rings. Almost 750,000 students, from more than 32,500 schools, attended the Brazilian Olympiad of Astronomy and Astronautics, an increase of more than 85%, compared to the 2007 edition!

And there is more to come. Headed by Prof. Augusto Damineli, the national committee is distributing the promotional material that includes 20 posters which are part of the "From the Earth to the Universe" exhibition and the 5-meter long poster "The Evolution of the Universe." As the winter arrived, bringing clearer skies down the equator, the Brazilian nodes are engaged in the citizen-science "The Milky Way Marathon." From June up until September, people are rating the sky, grading it from 0 (a blank sky, with no stars) to 7 (a perfect dark sky). Bringing together amateur and professional astronomers, this marathon helps to remind the public that the Milky Way is becoming less and less known by the people, as the light pollution is increasing in Brazil. And now enters Jupiter! Arising earlier night after night, finally the moons that inspired Galileo will be visible.

CÁSSIO LEANDRO BARBOSA

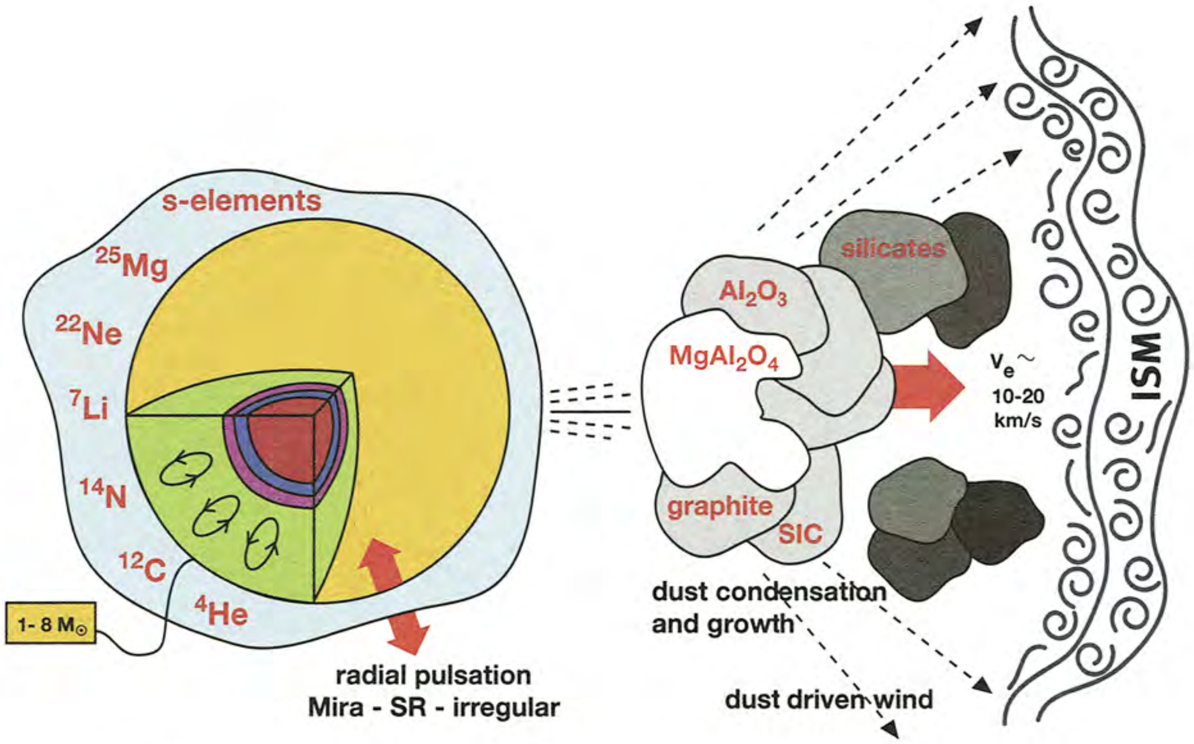
AN EVENTFUL TIME FOR **RED GIANTS**

Close to the end of their nuclear lifetimes low- and intermediate-mass stars ($1\ M_\odot < M < 8\ M_\odot$) go through the thermally-pulsing asymptotic giant branch (TP-AGB) phase which, in spite of its shortness (10^5 - 10^6 yr), is characterized by an extraordinary richness of features. TP-AGB stars are luminous red giants that do experience many peculiar events: dramatic luminosity variations driven by periodic He-shell flashes, a very fruitful nucleosynthesis whose products may be exposed to the surface by convection (e.g. He, Li, C, N, Mg, Ne, s-process elements), long-period radial pulsation, mass loss by stellar winds and planetary nebula ejection, dust condensation in the outer envelopes. The extreme complexity of the physical processes involved makes the modelling of the TP-AGB phase a real challenge to theoreticians.

On the other hand, it is well recognized that TP-AGB stars provide a significant fraction of the integrated light of stellar populations over a wide range of stellar ages, say from 0.1 to 10 Gyr, as clearly indicated by AGB stars in Magellanic Cloud star clusters. They make an important contribution to the chemical enrichment of the interstellar medium as witnessed by the chemical abundances of planetary nebulae, and yield a reservoir of remnants in the form of white dwarfs. One major difficulty is to quantify these contributions, and predict how they vary as a function of both age and metallicity.

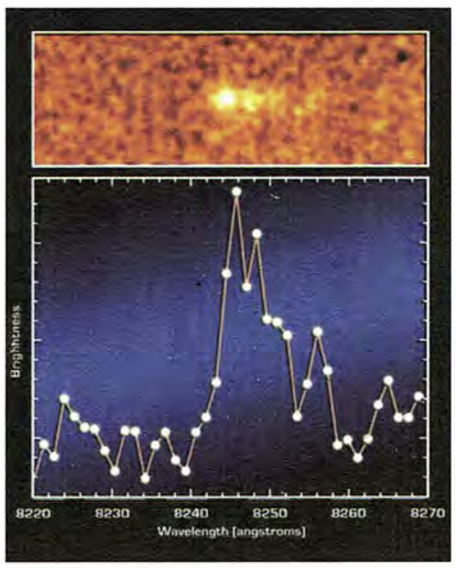
In this respect present-day surveys are incredibly expanding our knowledge about the properties of TP-AGB stars, and how they depend on the properties of their parent stellar populations. A real breakthrough has been achieved thanks to the wide-field near-infrared and microlensing surveys, and most recently the mid-infrared satellites and multi-fiber spectrographs. The expectation that these data may lead to a coherent picture of the TP-AGB evolution, guiding at the same time the development of reliable population synthesis models, is now well-founded.

PAOLA MARIGO



A SKETCH OF A TP-AGB STAR

OLD STARS AT HIGH REDSHIFT? **IMPLICATIONS FOR REIONIZATION**



SPECTRUM OK A DISTANT GALAXY | KECK - DEIMOS
L. EYLES, A. BUNKER, E. STANWAY, MARK LACY, RICHARD ELLIST, MICHELLE DOHERTY.

In recent years the discovery of distant galaxies has been pushed to a new frontier of redshift 6 and beyond. This epoch, within a billion years of the Big Bang, is critical as it coincides with the end of reionization - and Lyman continuum photons from OB stars in star-forming galaxies might be responsible for this phase change of the intergalactic medium. Galaxies at z>6 have been identified both through Lyman-α narrow-band imaging, and by the Lyman-break technique which uses broad-band colours to isolate the sharp flux decrement from absorption in intervening clouds of neutral hydrogen. This method has been pushed from its original application at z=3 to z=6, accessible through improved sensitivity beyond 9000 Å with instruments such as ACS on HST. However, at this redshift it seems that there are too few star-forming galaxies down to our detection limits to achieve reionization.

Perhaps there is a significant contribution from unobserved faint dwarf galaxies, or perhaps the bulk of reionization occurred even earlier in history. In this latter scenario, it might be possible to identify light from old stars in the z=6 population we have discovered. Observing beyond the age-sensitive Balmer/4000 Å breaks became possible with the sensitivity of the Spitzer Space Telescope's IRAC camera (4-8 μm). In a substantial sub-set of the z=6 Lyman-break population we find evidence for Balmer breaks and stellar ages of 100-500 Myr, with stellar masses of $\sim 10^{10} M_\odot$. Discovering old stars at high redshift allows us to probe the preceding star formation histories, and conclude that there was sufficient star formation at z>8 to achieve reionization if the escape fraction of these ionizing photons is high. Future spectroscopic observations on the James Webb Space Telescope will test the ages and masses inferred from the Spitzer/HST colours.

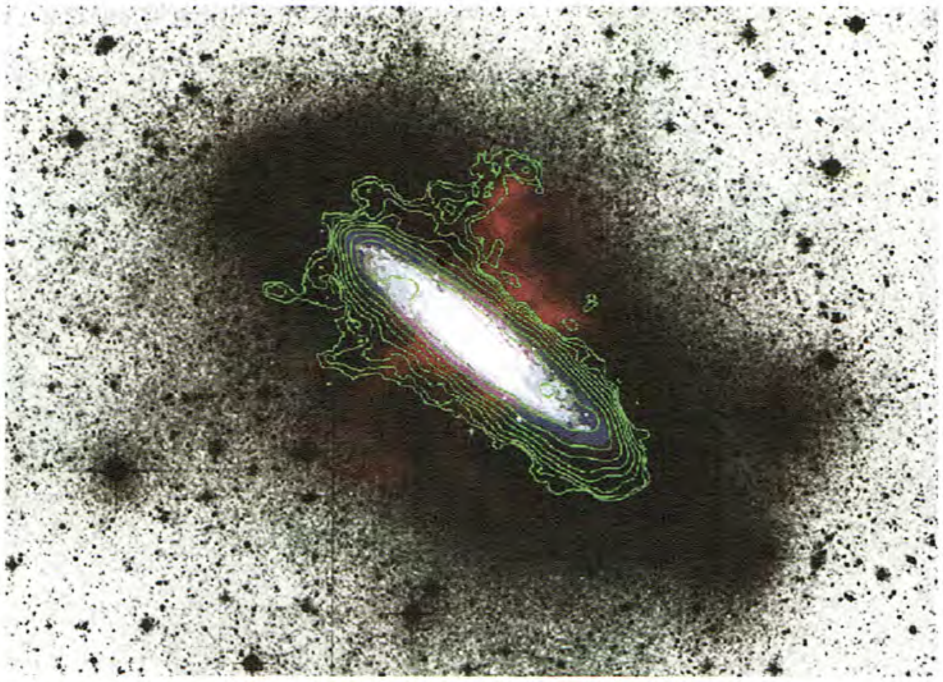
ANDREW BUNKER

DIFFUSE LIGHT IN **GALAXY CLUSTERS**

The simple question of where a galaxy ends does not yet have an easy answer. Galaxies are in fact very large, of the order of 200,000 light years, and it is difficult to measure with high accuracy the distance from the galaxy's center at which the stars are no longer bound. The bound stars are like the Hubble Space Telescope orbiting the Earth, and the unbound stars are similar to a spacecraft that has been launched at high speed from the Earth's surface, escaping its gravitational field.

The problem is complicated because the distribution of stars and gas in galaxies change their morphology as we go further out, as can be seen in spiral galaxies like our own, the Milky Way. From their bright, round, bulge-like centers and flattened disks decorated with beautiful spiral arms, they transform into rounder, puffed-up structures, becoming more and more irregular towards the outer edges, with plumes and filamentary structures extending out. These faint outer structures are made up of stars that move around the galaxy center with motions that are more chaotic and scattered in space. The irregularities indicate that these outer parts have not had time to settle into an organized structure yet.

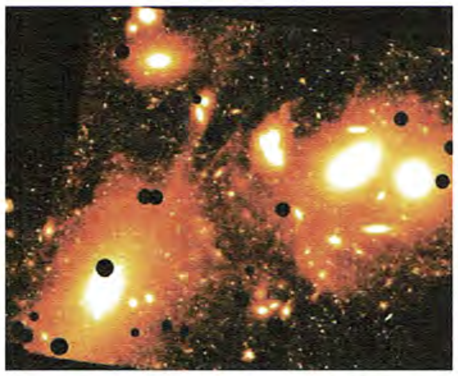
The changes in light distribution and the different morphologies are illustrated in the beautiful picture of the spiral galaxy NGC 253 (right). This picture shows a bright central part consisting of a flattened disk hosting a bar and two spiral arms, where both stars and gas (the green contours) reside. Outside the flat disk and the gas distribution, there is an extended faint halo of stars that is not distributed as a disk, but rather as a spheroid, whose edges are quite jagged and irregular.



BOOMSMA ET AL. 2005, A&A 431,65

In the case of NGC 253, we can measure where the inner disk ends, but the galaxy's stars extend further out, and we must measure their motions to determine whether they are truly bound to the galaxy or not.

The identification of galaxies and their boundaries becomes even more complicated in clusters of galaxies. Deep observations show that galaxies in clusters grow in size so that their outer parts seem to connect with those of the nearby galaxies. When observing these crowded regions, the outskirts of galaxies become part of a wonderful network of light, often referred to as diffuse light in clusters. The fantastic image of the Virgo cluster core by the American Astronomer Chris Mihos (left) shows that the giant elliptical galaxies extend in size, from their round bright centers to flattened outer spheroids. These outer halos then extend further and become more irregular, when they finally seem to connect with each other on the sky.



DIFFUSE LIGHT IN VIRGO
MIHOS ET AL 2005

This network of extended halos and filamentary structures is called 'diffuse intracluster light' and has now been observed in nearby and in intermediate-redshift clusters. The questions of how these outer regions form, where galaxies end, and why features like streams and plumes form at their edges are being discussed at the Joint Discussion #2.

Scientists are interested in understanding the properties of the diffuse light in clusters because they think they can learn more about the formation of galaxies. At this conference, they will discuss the observational evidence collected so far and compare them with the current results from numerical simulations of structure formation. This is the first time that a JD dedicated to this subject of research will confront observational evidence and theoretical predictions. It aims at identifying future directions for understanding the origin and implications of this new component in galaxy clusters.

MAGDA ARNABOLDI AND ORTWIN GERHARD

WHY STILL **STUDY STARS?**

Anyone who has stood under a starry sky on a dark night, escaping for a moment the artificial lights of human civilisation, understands why we study stars. They are the dominant visual content of the Universe and understanding their nature is a key part of astrophysics. And indeed, we do understand stars fairly well.

We use this knowledge to infer the stellar mass, age and history of star formation of galaxies, from observations of their constituent stars, either individually for the most nearby galaxies, or through integrated light for more distant galaxies. This has led to dramatic advances in our understanding of galaxy evolution - we can now trace the build-up of galaxies with cosmic time, we can reconstruct the very first phases of star formation in the Universe, and we can use our knowledge to compare and contrast galaxies in a way that was not possible 10 years ago.

But we still need to know more about stars! One of the main reasons is that rare, but very bright, phases of stellar evolution, such as close binaries, AGB stars and very massive stars, often can be major contributors to the luminosity of a galaxy. These are stars whose properties are hard to predict in theoretical models and so far and few between in our Galaxy that they are hard to study observationally. Until we understand them, however, our knowledge of the distant, and nearby, Universe will remain uncertain!

Another reason is that with future facilities we will be able to study galaxies in much more detail than before, and uncertainties in our models for stellar evolution will often be the dominant source of uncertainty. Until we can improve our understanding of stars, we will not be able to make full use of future astronomical facilities.

JARLE BRINGHMANN

ESTRELA D'ALVA
The Morning Star
XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 03
WEDNESDAY, AUGUST 5th, 2009

OPENING CEREMONY WITH **BRAZILIAN SPICE**

With a wide range of different presentations, the XXVII General Assembly of IAU got its official kickoff yesterday, highlighting the speedy progress of science in Brazil over the last years and the great success of the International Year of Astronomy. Several local authorities were present, including Eduardo Paes, Mayor of the City of Rio de Janeiro, Sergio Cabral, Governor of the State of Rio de Janeiro, and Sergio Rezende, Minister of Science and Technology.

They were preceded in stage by a brief message from the IAU President, Catherine Cesarsky, and by a short speech from the President of the Brazilian Academy of Sciences, Jacob Palis. "Brazilian science is at its best performance ever", said Palis. As to make that point even clearer, Minister Rezende anticipated that a newly-formed Committee within the Ministry of Science and Technology will come up with a plan for what was described as "the next major step in Brazilian astronomy."

For a change of pace, the Folklore Company of Rio presented, literally, "A Taste of Brazil". The performance combined dance and music to display the diverse Brazilian cultures – with, of course, a lot of samba!

The official ceremony for the Gruber Foundation Cosmology Award came up next. The Prize was awarded to Wendy Freedman, Robert Kennicutt and Jeremy Mould, for their measurement of the Hubble constant with HST. The winner of the Gruber Fellowship, Thijs Kouwenhoven, from University of Sheffield, was also announced.

Finally, two short presentations: a talk by Clive L. N. Ruggles on astronomy and UNESCO's World Heritage project, and an overview of Brazilian astronomy, presented by Kepler de Oliveira. After a short break, Union members went on to conduct the first session of the GA.

SALVADOR NOGUEIRA

TO SEE THE VIDEO OF THE EVENT, ACCESS http://www.video.rnp.br/overmedia/videos.jsp?_contexto=grupo&_idContexto=57

ARE **EXOPLANETS** "PLANETS"?

The IAU Working Group on Extrasolar Planets (WGESP) was charged in 1999 with maintaining a list of extrasolar planets. A prerequisite for developing this list was defining what is an exoplanet. A working definition was agreed upon in 2001 and updated in 2003. IAU Commission 53 on Extrasolar Planets (C53) replaced the WGESP in 2006. But the WGESP definition of an exoplanet remains the official IAU definition, though C53 may decide to revisit it in the future.

According to the WGESP:

1) Objects with true masses below the limiting mass for thermonuclear fusion of deuterium (about 13 Jupiter masses for objects of solar metallicity), that orbit stars or stellar remnants, are "planets", no matter how they formed. The minimum mass/size required for an extrasolar object to be considered a planet should be the same as that used in our Solar System.

2) Substellar objects with true masses above the limiting mass for thermonuclear fusion of deuterium are "brown dwarfs", no matter how they formed nor where they are located.

3) Free-floating objects in young star clusters with masses below the limiting mass for thermonuclear fusion of deuterium are not "planets", but "sub-brown dwarfs" (or whatever name is most appropriate).

The WGESP left the question of the minimum planet mass to be decided on the basis of the Solar System's planets. In 2006, the IAU GA voted to require that, in addition to being in orbit around the Sun, a Solar System planet must be massive enough to be nearly round and to have cleared the neighborhood around its orbit. The latter constraint resulted in Pluto becoming a "dwarf planet". The lowest mass exoplanet to date is a pulsar planet, PSR B1257+12-A, on a 25-day orbit and with a minimum mass of 0.015 Earth masses, about 7.5 times more massive than Pluto.

More details at: http://www.dtm.ciw.edu/users/boss/iauindex.html

ALAN BOSS

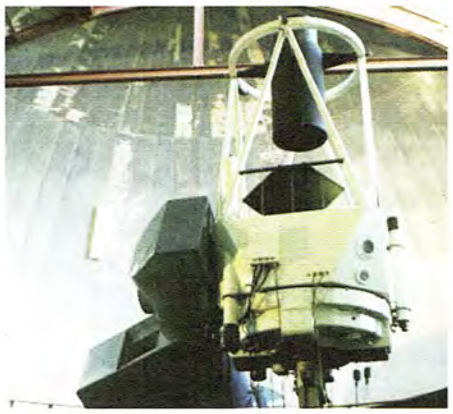
BRAZILIAN ASTRONOMY: RESEARCH GROUPS AND GRADUATE PROGRAMS

There are presently 500 people involved in research activities in Astronomy in Brazil. This is an impressive number, considering that systematic research in Astronomy is relatively recent in the country. Until 1970 there was very little astronomical research, and the main research groups formed at the same time that specialized graduate courses were established, which occurred in the late 1960s and early 70s.

However, these activities proceeded at a very fast pace, leading to approximately 500 researchers in Astronomy, including professionals with the title of PhD or equivalent, and graduate students. Most of these have obtained their degree in one of the Brazilian graduate programs, which amount to a dozen institutes today. Despite this growth, the fraction of astronomers to the total population of the country is still a tenth of what it is in developed countries.

Most (90%) work in state universities and institutes, either federal universities and institutes (57%) or universities sponsored by one of the Brazilian states (33%). Only 6% work in private universities, but it shoud be mentioned that this number has grown at a faster pace in the last few years. Most people (77%) work in the Southeast, 11% in the South and 9% in the Northeast. The remaining 2% are working abroad as post-docs, while the central region and northern Brazil practically do not carry professional astronomical activities, with less than 1% of the total.

OBSERVATÓRIO PICO DOS DIAS



1.6 M PERKIN-ELMER TELESCOPE IN OPD

W. J. MACIEL

SOME NUMBERS

In the period of 2005 to 2007, 142 students completed their graduate studies, either MSc (83 students) or PhD (56 students). In 2008 there were 220 students overall, being 90 MSc students and 130 PhD students. Most of these (96 students) work in the two largest institutes, the University of Sao Paulo and the National Observatory in Rio. Five of the graduate programs have started their activities very recently, so their first students are expected to complete their courses in the next few years.

SHOULD WE GO FOR ELECTRONIC PROCEEDINGS ONLY?

A surefire way to start a lively conversation with another astronomer is to mention conference proceedings! Scientists probably have been complaining about them since the days of parchment and quill pens, but the advent of electronic publishing has intensified the debate. Are printed proceedings another dinosaur that should become extinct along with printed journals, or do they offer something unique and precious that needs to be preserved?

When I discuss the topic with my colleagues (usually at meetings like this one!), I find that opinions are deeply divided, and roughly along lines of seniority and age. Most senior people tend to loathe having to write up their talks in conference proceedings, whatever their form. Many of them know from experience that few other people read them, and almost nobody will cite them (a study several years ago showed that proceedings papers are cited 20 times less than papers in refereed journals). Moreover the timeliness of a proceedings article tends to decline much more rapidly, as the results they contain are published in the journals. A potential advantage of electronic proceedings (or web postings of the talks themselves), is their rapid dissemination, while the papers are most valuable. In short, if we left the fate of printed proceedings to the senior astronomers they would probably disappear quickly, and I doubt whether their electronic replacements would last much longer.

However there is another side to the story, and to hear it you need to talk to the younger members of our profession, students and postdocs in particular. For many of them proceedings provide a unique and vital introduction to major subfields and problems, where much of the latest research in a subject is presented together, and where the reader has the opportunity to compare different approaches and points of view. A seasoned expert in the field may be able to glean much of that from a selective reading of the journals, but that is much more difficult for a scientist who is new to a subject. Proceedings were a critical resource to me early in my career, and I am impressed to see them fulfilling that same function today, despite all of the other changes in our profession in the meantime.

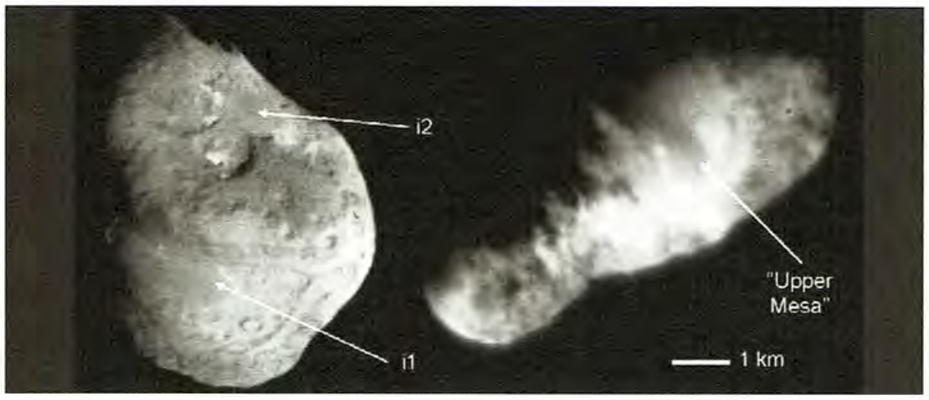
So where does that leave printed proceedings today? In principle all of the advantages highlighted above could be incorporated into an electronic proceedings, just as they have for e-journals. But I remain skeptical; some time ago I was asked to write up a proceedings talk for web posting alone, and I, along with about half of the speakers, decided it was not worth our effort. Moreover, I have yet to see a viable business model for all-electronic proceedings (or monographs for that matter) that really works. The real question probably is not the role of electronic versus printed proceedings, but the future of proceedings themselves. So what does the future hold? These issues are not unique to our profession, so I suspect that this is an area where future experimentation will be needed, to see whether another model works. In the meantime the IAU should appreciate the special legacy of its premier conference proceedings, and be very cautious toward changing a model that has served our profession so well for more than 50 years.

ROBERT C. KENNICUTT

ACTIVE **COMETARY NUCLEI**

New ideas on the processes that govern the internal structure of comets and the origin of their activity are surfacing as a result of the *Deep Impact* mission to comet 9P/Tempel 1 and the missions that preceded it to 81P/Wild2, 19P/Borrelly and 1P/Halley

Three of these comets may show evidence of geologically recent flows on their surfaces. In one case the origin of the flow is associated with a large, circular, collapse feature and an enhancement of water ice content of a small surface region. One explanation argues for gas-fluidization of particulate material in the interior and its episodic transport to the surface – a process that could be described as cryogenic volcanism. The accompanying figure shows a comparison of such flows on comets 9P and 19P.



THE ARROWS POINT TO POSSIBLY GEOLOGICALLY RECENT FLOWS ON THE SURFACE OF COMETS 9P/TEMPEL 1 (LEFT) AND 19P/BORRELLY (RIGHT) THAT COULD BE THE RESULT OF COMETARY CRYO-VOLCANISM (COMPARISON COURTESY L.A. SODERBLOM).

Comet 9P was shown to have repetitive (nearly–periodic) mini-outbursts which occur at places on the surface near the ends of the long axis of the roughly prolate shaped nucleus. The mini-outbursts occur both at night and during the day indicating that a process operating in the interior is probably responsible. Observations of all four comets, from both the Earth and spacecraft, show that most of the active areas on the nucleus also occur in "preferred" places: near the ends of the long axis and at one or both of the rotation poles. These and other facts provide a basis for strong arguments that interior processes may be at work in producing even "normal" cometary activity.

It appears that the space exploration of comets is paying off in ways previously unsuspected and that, even in objects as small as comets, nature is again showing us its power to both evolve and to confound us.

MICHAEL J.S. BELTON

ASTEROID 'SHOWERS' EARTH

The amount of volatile elements in meteorite parent bodies and comets shows an evident correlation with heliocentric distance. This suggests a negative gradient of temperature throughout the proto-planetary disk. Consequently, the planetesimals that were originally in the terrestrial planet region are expected to have formed from refractory materials -the only ones that could condense in such high-temperature regions of the disk. Thus, they should have been essentially deprived of water. However, about 0.1% of the Earth's mass is made of water; how is this possible?

> FOR DECADES, ASTRONOMERS THOUGHT THE EARTH FORMED DRY AND LATER ACQUIRED WATER THROUGH THE BOMBARDMENT OF COMETS. WE NOW KNOW THAT THIS IS UNLIKELY.

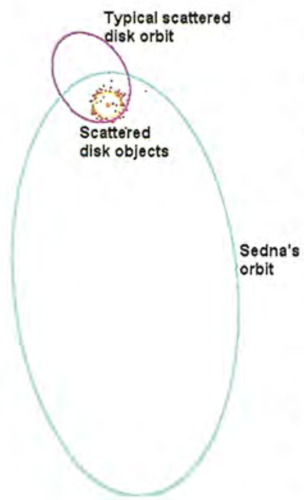
For decades, astronomers thought that Earth formed dry and later acquired a late veneer of water and other volatile elements through the bombardment of comets. We now know that this is unlikely. The probability of comets to strike Earth is tiny, so that even a massive disk of comets in the giant planets region and beyond could not have brought enough water to our planet. In addition, the isotopic (D/H) composition of water in comets appears different from that of Earth. Finally a recent model for the isotopic equilibration of the Earth and the Moon during the giant impact event that led to the formation of our satellite implies that Earth was already water-rich at that time. So, water delivery could not be a late veneer.

Modern computer simulations, though, show that Earth and the other terrestrial planets, during – but towards the end of – their growth history, should have accreted a significant fraction of their mass from objects originally formed in the outer asteroid belt. Outer belt asteroids, i.e. the parent bodies of carbonaceous chondrites, are quite water rich, so they could have been enough of a source for Earth's water. Moreover, the water of carbonaceous chondrites has the same isotopic content as that of our planet, providing additional evidence for such a genetic link.

ALESSANDRO MORBIDELLI

HOW WAS **SEDNA** PLACED ON ITS **ORBIT?**

Sedna is a Solar System icy body presently at 13×10^9 km from the Sun. Not much is known about its physical properties but its orbit is conspicuous enough so as to raise important questions on the origin of the Solar System. Although Sedna's perihelion distance at 11×10^9 km is relatively small as compared to its average distance from the Sun (75×10^9 km), it is nevertheless more than twice Neptune's distance from the Sun.



Since the most accepted Solar System formation models predict that Sedna's perihelion was primordially much closer to Neptune's orbit than it is today, an explanation turns out to be required to account for the detachment of Sedna's present orbit from Neptune's orbit.

A proposed scenario claims that a brown dwarf came quite close to the Sun and delivered part of its putative own disk of icy bodies to the Solar System in which case Sedna would have an extrasolar origin. A present or past Solar Companion of planetary to brown dwarf size could also raise Sedna's perihelion. A third reasonable scenario requires that the Sun primordially inhabited a dense star cluster in which the potential coming from the cluster gas and the perturbation from passing stars might also have detached Sedna's perihelion from Neptune's influence.

Although Sedna presents the most peculiar orbit for a distant detached icy body, there are probably other two such objects (2000 CR105 and 2004 VN112). However, their perihelions are not so distant.

On the other hand, the very observation of theses objects at remote distances from the Sun argues for a population of Sedna-like objects of roughly 10 times that of the Kuiper Belt.

The discovery of other members of this population will certainly give new constraints that can enable us to choose among the proposed scenarios and consequently foster a new understanding of the primordial Solar System evolution.

RODNEY GOMES

ARE THE MAIN BELT COMETS **COMETS?**

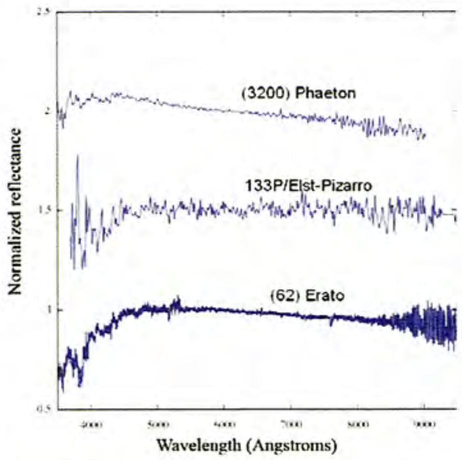
Icy minor bodies were known to originate from the trans-neptunian Belt (TNB) and the Oort Cloud. Recently, a third class of objects has been discovered: the Main Belt Comets (MBCs). Currently, only 4 MBCs are known, two of them (133P/Elst-Pizarro and 176P/LINEAR) are within the Themis collisional family of asteroids, a third one, P/2005 U1 (Read) is almost within it, and P/2008 R1 (Garradd) is near the 8:3 mean motion resonance with Jupiter. All of them have Tisserand parameter T_J>3.15, suggesting they have an unlikely cometary origin. 133P is the best characterized having been seen active at 3 perihelion passages, which supports the hypothesis that the activity is driven by sublimation of water ice.

Understanding the asteroidal or cometary nature of these bodies is crucial. If they are formed "in situ" and, in particular, if they are members of a collisional family, there should be water ice in a large population of asteroids. If they are captured TNB or Oort cloud comets the mechanisms that drove them to their present orbits needs to be understood.

The asteroidal nature of MBCs is supported by results we present in this Symposium. We present the spectrum of 133P and 176P and show that they are similar to that of Themis family asteroids (see Figure 1) supporting that both MBCs are likely fragments of the collision that formed the family. We also show that they are similar to the spectrum of the Near Earth Asteroid (NEA) 3200 Phaethon, that probably had past activity. Phaethon's surface contains hydrated silicates and this does not support its possible cometary nature. The similarity between Phaethon's spectrum and MBC's suggests an asteroidal nature.

In conclusion, there are some "activated asteroids" in the NEA and main belt population that were probably able to retain some water ice that sublimates under certain circumstances.

Exploring the volatile content of icy minor bodies is critical for understanding the physical conditions and the mechanisms of planetary formation, and also addresses the question of the origin of Earth's water. If the outer main belt has a large population of asteroids with ice, they could have contributed to the water on Earth. Additionally, this indicates the extent and origin of volatiles in asteroids that could be used as resources for space exploration.



FROM TOP TO BOTTOM, VISIBLE SPECTRUM OF 3200 PHAETHON, 133P/ELST-PIZARRO AND THEMIS FAMILY ASTEROID 62 ERATO. THEIR SIMILARITY SUGGESTS AN ASTEROIDAL ORIGIN FOR 133P.

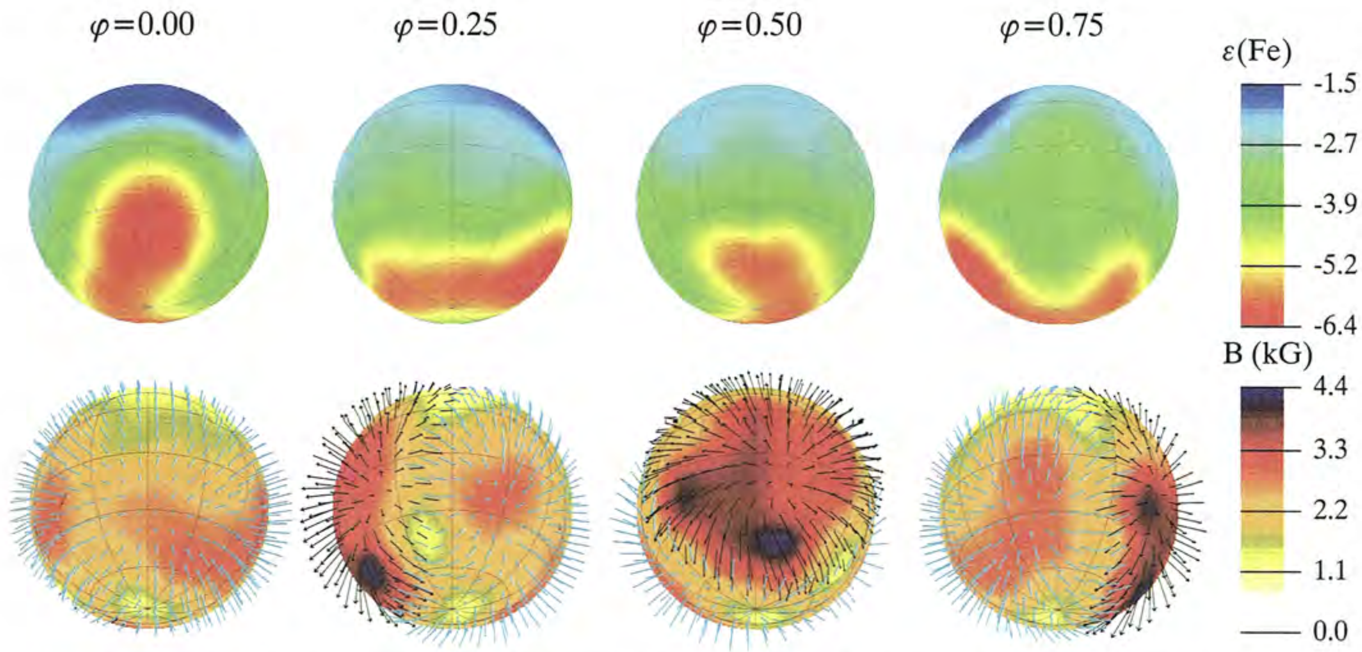
JAVIER LICANDRO AND HUMBERTO CAMPINS

CHEMICALLY **PECULIAR STARS** AS ASTROPHYSICAL **LABORATORIES**

Chemically peculiar stars can serve as a starting point to the discussion of a number of physical phenomena that are of relevance to a wide range of astrophysical contexts. Although they have been studied for more than 50 years their relevance as astrophysical laboratories has substantially grown in recent times.

Stellar pulsations, magnetic fields, mixing and separation processes are among the topics to which the study of these stars can bring a significant contribution. What are the signatures left by physical phenomena like these on the observations and what are the techniques required to disentangle and correctly interpret these signatures? Do we understand the relation between these phenomena and stellar evolution?

Ground and space-based new instrument capabilities are expected to have a large impact in this research field. As an example, the GAIA mission (ESA) will lead to a dramatic increase in the number of known Chemically Peculiar stars as well as to a significant improvement in the determination of their global parameters. From the ground, observations with high-resolution spectropolarimetric instruments, such as ESPaDOnS (CFHT), have recently confirmed the presence of magnetic fields in pre-main sequence and post-main sequence stars, promising a new insight into the origin and evolution of stellar magnetism. At the same time, the disentangling and interpretation of the signatures of the different physical processes taking place in Chemically Peculiar stars require an accurate and detailed modeling of their atmospheres. A challenging problem for these models is the vertical stratification of elements and the need to take into account departures from local thermodynamics equilibrium when considering elements that accumulate in the uppermost layers of the atmospheres.



MAP OF CHEMICAL ANOMALIES (IRON ABUNDANCES) AND MAGNETIC FIELD STRENGTH IN A TYPICAL CHEMICALLY PECULIAR STAR

These are great challenges that require expertise from the trans-disciplinary fields of laboratory astrophysics, atomic data, instrumentation and theory of stellar astrophysics. We plan to discuss these ideas during the Joint Discussion 4, on the "Progress in understanding the physics of Ap and related stars". We hope we can count on the input from all researchers that share with us the will to make some progress in the understanding of any of the above mentioned astrophysical phenomena.

MARGARIDA CUNHA

ESTRELA D'ALVA
The Morning Star
XXVII GENERAL ASSEMBLY
AUGUST 2009 • RIO DE JANEIRO • BRAZIL
DAY 04
THURSDAY, AUGUST 6th, 2009

WITH GREAT POWER COMES GREAT RESPONSIBILITY: A DISCUSSION ON SCIENTIFIC FREEDOM

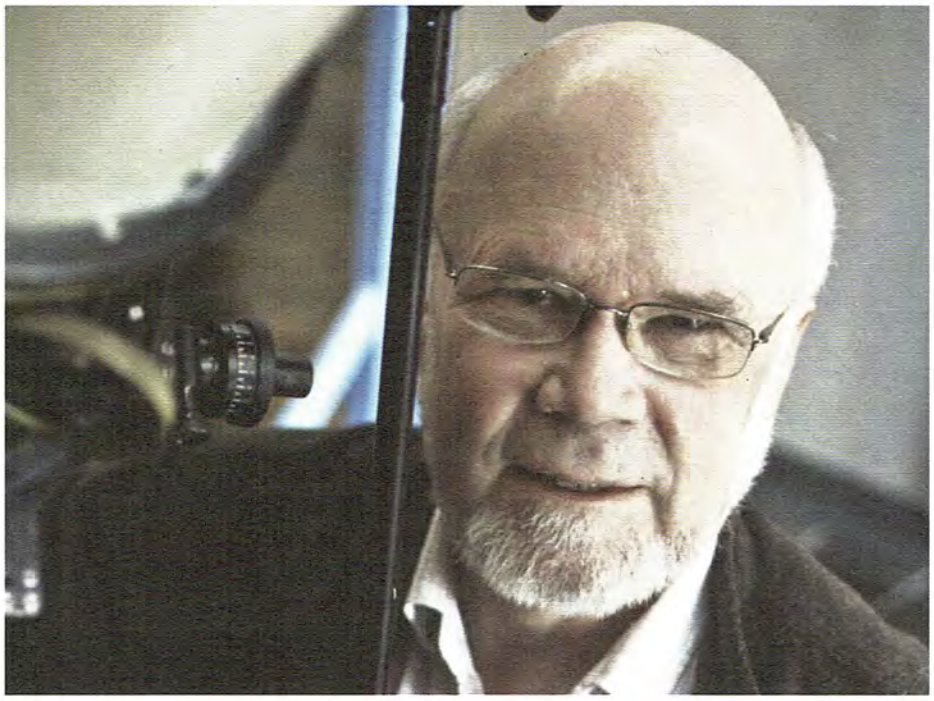
The world was not the same after September 11, 2001. Those terrorist acts, and the government initiatives that followed, had impacts in every segment of society. Scientists were hardly unaffected. Many researchers in Muslim countries began to experience difficulties when traveling abroad. Their colleagues in the West, on the other hand, started to face difficulties when trying to collaborate with them.

The International Council for Science (ICSU), parent organization to the IAU, is always worried about scientific freedom, i.e. the scientists' right to travel wherever they have to and to associate themselves with whoever they see fit, and in late years had to work more than ever to protect such rights.

Through the Committee for Freedom and Responsibility in the Conduct of Science, headed by astronomer Bengt Gustafsson, of Uppsala University, ICSU has focused its efforts in order to help scientists do their jobs the best they can. But those efforts also include establishing responsibilities – a process that could potentially change the way academia currently works.

Among the ideas suggested by the committee, there is one that is going to stir attention: the creation of a yearly limit on the number of papers a scientist can produce. It is a radical movement, sure, but one that certainly would make all scientists think about what their work really is supposed to be, instead of blindly following the sad but true motto, "publish or perish."

In the following interview, Gustafsson talks about these and other hot topics on scientific responsibility and freedom.



BENGT GUSTAFSSON

It seems the preocupation with scientific freedom has gained a lot of momentum lately, especially after the events of September 11, 2001. Was that the pivotal moment that brought an all-new attention to this problem?

Bengt Gustafsson - Yes, I think that the restrictions concerning visa regulations following the Sept 11 events were one of these circumstances. Others were the situations for scientists in post-war Iraq, as well as in several other conflict areas in the world. In general, the new type of wars ("wars of the fourth type") where no clear frontiers are defined and much of the civic society is taken as hostage, is a particular threat to universities and science that requires international observance. Also, in many states science is ever more recognized to be of strategic significance, which does not always promote openness and freedom of research.

Do you feel there are already advancements inspired by your work?

Gustafsson - Yes, ICSU, and its Committee for Freedom and Responsibility in the Conduct of Science, is working together with several other organizations and networks on individual cases where the Principle of Universality of Science is violated, and we can see advancements in many of those. On the systemic and global level it is more difficult to demonstrate progress, but I trust that it does help to state the principles, make them known and, when violaions occur, require them to be respected.

One of the problems you've been addressing, and one that plagues the astronomy community, is the concept of "publish or perish." ICSU seems determined to fight that. But wouldn't it be too much to suggest a yearly top limit for a scientist's production?

Gustafsson - That limit is intended to be provocative. I am personally convinced that science would benefit from more selective and quality conscious publication practices. One has to change this sloppy way of calculating merits, instead of scientifically evaluating them, in order to reach that goal. One of the reasons why this simpleminded algorithmic method is used, is that it seems easy. Simultaneously, however, it takes power away from the scientific community and gives it to the bureaucracy and politicians, which then can run science policy and career systems without relying on scientific judgement.

What about "knowledge is power?" We know there's science that, if misused, could have catastrophic results, even when well-intended. How should the new risks posed by science be combined with your defense of the freedom of movement and investigation by scientists everywhere?

Gustafsson - This is of course a very good question, and its answer depends on how optimistic you are. In 1984 we had an attempt at Uppsala University to formulate an ethical code for scientists. There, a main idea was that any individual scientist has an obligation to at least try to consider whether the use and consequences of his or her research would be good or bad for humanity. If, after serious reflection, the scientist found that the outcome would probably be more negative than positive, the research activity should be interrupted and the conclusion should be made public (see J. Peace Res. 21, 311). Thus, we left this responsibility to the individual. Was that too optimistic? Should the scientific community take it on collectively? Or is it, as many colleagues argued in the subsequent debate, basically a political issue? If so, are the politicians well qualified and informed enough to take it on?

SALVADOR NOGUEIRA

UNIVERSE AWARENESS: A CHILDREN'S COMPREHENSIVE ASTRONOMY PROGRAMME

Do you remember when you first wanted to become an astronomer? If you are like most astronomers, you probably heard the call of the stars when you were very young. Do you remember thinking that astronomy was only for certain types of people? You probably didn't. At a young age, such considerations have not yet pervaded our universe.

This is exactly why Universe Awareness (UNAWE) tries to reach out to the youngest members of our society and inspire them with the beauty of the Universe. In fact, it does not matter whether they are privileged or less so, whether boys or girls, or what country they are born in. We believe that every child on this planet deserves to see the mesmerizing views of the universe that astronomy - collective endeavour par excellence - has given us.

UNAWE VENEZUELA | MERIDA KINDERGARTEN

Universe Awareness started in 2005 with the idea of using the scale and beauty of the universe to inspire young children in underprivileged environments, where the need is the greatest. The goals of UNAWE are to (i) broaden young children's minds, (ii) nurture their natural curiosity in the sciences, (iii) demonstrate the power of rational thought and (iv) stimulate a sense of global citizenship and tolerance.

After it was pioneered in Venezuela, Tunisia, Germany, Italy, Indonesia and India among others, UNAWE became a Cornerstone project of the IYA2009. This led to many more countries and organisations joining the programme and developing their own. From Colombia to South Africa, from Tanzania to Ireland, from Turkey to China, astronomers, teachers, communicators, artists, child development specialists from about 30 countries have come together to create a programme that is as vast in its diversity as it is united in its goals.

In addition to a growing database of tested and approved educational materials and best practice resources, UNAWE's biggest asset is its international network. Both its geographical and professional diversity make it a thriving community of people, all brought together by the same vision; that astronomy can broaden young children's minds and inspire them. In their programmes, they imaginatively use astronomy to stimulate children's interest in science, but also their cultural development, their imagination, numeracy and literacy, and even their identity formation with the inclusion of traditional astronomical legends and international internet exchanges across countries.

Three UNAWE International Multidisciplinary workshops have been held, that brought the UNAWE community together and each of them was a memorable and enriching experience. It is our pleasure to invite the delegates of the IAU GA to join us for a very informal 4th international UNAWE workshop on Saturday, August 8. We invite the participants to meet and share their UNAWE experience in a friendly and informal manner. We also wholeheartedly welcome those who have run UNAWE activities in relative isolation so far (e.g. as part of IYA2009 independently of UNAWE International), and those who wish to set it up, or who are curious about the children's cornerstone. We hope the experience will inspire many of you.

The Brazilian Center for Physics Research (CBPF) has kindly agreed to host this workshop at the weekend between the two weeks of the IAU GA. More information about this extra-GA workshop can be found here: http://unawe.org/workshop2009 . We would be grateful if you could signal your intention to participate to us by email before August 6.

In the UN era of Millennium Development Goals and of unanimous votes in favour of an International Year of Astronomy, the message is clear. People believe in astronomy's potential for development. Gender equality and access to schooling are among the cornerstones of a sustainable developing society.

Astronomy has demonstrated its potential to bring people together across all borders; the IAU and this meeting prove it. In education it has been shown that offering astronomy courses attracts more university students into the sciences, and astronomy has possibly the highest proportion of women compared to its cousin disciplines in the physical sciences. Astronomy is the 'cool' science at high school and now, the success of Universe Awareness shows that it can be used to stimulate children's development from the youngest age. Perhaps in a few academic generations' time, we will hear astronomers recall how a UNAWE experience got them into astronomy.

For more information see the UNAWE website: http://www.unawe.org/ or contact me directly at carolina.odman@unawe.org.

CAROLINA ODMAN

ASTRONOMY EDUCATION LUNCHEON

As part of the collaboration between the IAU and the Norwegian Academy of Science & Letters (NASL) on the Kavli Prize in Astrophysics, the NASL has agreed to support certain Commission 46 education and outreach activities. On the occasion of the General Assembly the NASL has kindly provided funds to the IAU for a planning luncheon devoted to astronomy education, to take place at 12:15 pm, Tuesday 11 August at the Convention Center. The luncheon will be devoted to a discussion of education strategies for the IAU for different regions of the world. Representatives of the NASL and members of the Comm. 46 Program Groups will participate in the luncheon together with GA attendees who have an interest in education and outreach.

Members and invited participants at the GA who wish to contribute to astronomy activities in education and outreach are invited to the lunch. Interested persons who have not yet been involved with such activities and people from developing countries are particularly encouraged to attend. The number of people who can be accommodated at the lunch is limited and therefore the Organizing Committee asks people to sign up for the luncheon in the IAU office (Room 1.10) beginning Friday 7 August at 10 am. We should be able to accommodate about 80 participants on a first come, first served basis who will receive a voucher when they sign up, to be presented at the luncheon on Tuesday.

ROBERT WILLIAMS AND GEORGE MILEY

DIVISION IV MEETING

Friday - August 7 | Room 2.7

Program - *14:00* M. Pinsonneault | Direct seismological measurements of solar abundances. *14:20* M. Asplund | New determination of the abundances in the solar atmosphere. *14:40* H. Ludwig | Solar abundances from spectroscopy. What we know and what we need. *15:00* General discussion.

Solar Grand Minima and **Cosmic Catastrophes**

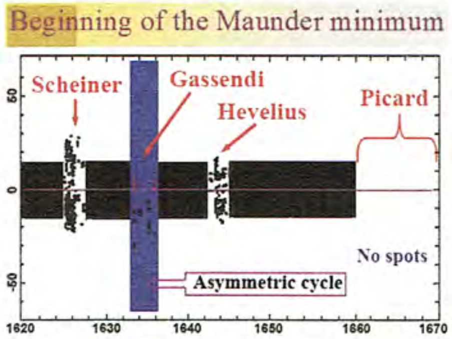
Cosmic catastrophes are usually considered an attractive topic for Hollywood movies. However, solar astronomers know that in fact some catastrophic events occur from time to time in the action of the solar engine driving the 11-year solar activity cycle.

The last event of such kind happened about 300 years ago. Fortunately, archive data provide us with rich information about this peculiar epoch known as the Maunder Minimum. These data include an important contribution from the King of France, Louis XIV, who founded at that time the Observatoire de Paris for solar activity monitoring.

The available data confirm a peculiar behavior of the solar magnetic field as recorded in sunspots. A butterfly diagram (i.e. time-latitude) of sunspot activity at the beginning of the Maunder Minimum is shown in the figure (black boxes show the times not covered by regular observations).

Apart from an epoch of total absence of sunspots (Picard data), it is possible to see an asymmetric solar cycle (sunspots are preferably in the southern hemisphere) observed by Gassendi somewhere before the Minimum. Scheiner and Hevelius data show that the neighboring cycles were symmetric, as usual.

Meteorological data indicate strong impact of the Minimum on terrestrial weather and climate. Isotopic data show that such events, known as Grand Minima, occurred at least several times in recent millennia. Experts in solar physics presented various scenarios to explain the phenomenon of Solar Grand Minima.



Dmitry Sokoloff

Stars as primary energy input in **planetary atmospheres**

Our planet Earth orbits around a dependable star that has provided a suitable environment for life to thrive. But the apparent stability of the Sun is just an illusion. Thanks to our vantage point we are able to scrutinize the solar properties with exquisite detail. Centuries of observation have shown a variety of effects related to the magnetic activity that reveal our Sun as a variable star. Sunspots, faculae, coronal mass ejections, are all different facets of the active Sun.

Firsthand experience on Earth has also demonstrated that such phenomena have a powerful influence on our planet's upper atmosphere and, perhaps, even on our climate. But take the current Sun and increase its high-energy and particle emissions by two or three orders of magnitude. According to the results of the Sun in Time project, this would have been the infant Sun; a plethora of phenomena related to stellar activity at its maximum.

Our planet and the rest of its Solar System siblings had to endure an epoch of heavy irradiations early in their history. The atmosphere of Mars, once it lost its magnetic shielding, succumbed to the intense erosion. But the strong emissions also left their imprint in the isotopic ratios of the atmospheres of Venus and Titan, for example.

Fortunately, the mass of the Earth and its magnetic protection helped our planet to keep its volatile inventory and eventually allowed for the development of complex life. While our Sun's wild ages lasted for a few hundred million years, other less massive stars may have kept the strong emissions for much longer. One may just wonder what could happen to a terrestrial planet orbiting a red dwarf star, which stays active for billions of years. Future research will tell us whether a habitable planet can exist in such hostile environment. We are in for surprises.

Artist's concept of extrasolar planet HD 189733b | ESA/NASA/G. Tinetti (University College London & ESA) and M. Kornmesser (ESA/Hubble)

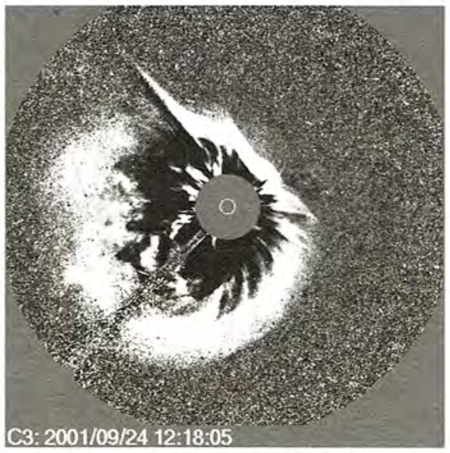
Ignasi Ribas

Coronal Mass **Ejections** and Geomagnetic **Storms**

Coronal mass ejections (CMEs) from the Sun are billion-ton magnetized plasmas with a helical structure hurled into space with speeds ranging from about 100 km/s to more than 3,000 km/s. When erupting on the Earth-facing side of the Sun, the CMEs can cause intense geomagnetic storms. The Solar and Heliospheric Observatory (SOHO) spacecraft has recorded roughly 1000 CMEs per month on the average over the past 13 years (solar cycle 23).

The instruments that detect the CMEs are known as coronagraphs, blocking out the bright photospheric light using an occulting disk in front of the telescope so that the faint corona can be observed. Earthward or anti-Earthward CMEs are observed as a giant white cloud surrounding the Sun, dramatically increasing in size over a matter of minutes. Such CMEs are known as "halo CMEs" because of their appearance in sky-plane projection. They move with a typical speed of 1,000 km/s and hence reach Earth within 2 days, provided they are not significantly slowed down by the background solar wind or deflected by other CMEs.

About 400 halo CMEs were observed during solar cycle 23, with roughly half of them heading toward Earth. The helical field structure of the CMEs implies that the magnetic field lines can have different orientations locally. Earth's magnetic field, we all know, points roughly to the north. When the south-pointing filed lines of the CME come in contact with Earth's magnetic field, the field lines reconnect, thus allowing the CME plasma to enter the magnetosphere and leading to geomagnetic storms.



The halo CME of 2001 September 24. The circular field of view has a radius of ~22.4 million km, which is the diameter of the halo CME. The halo CME resulted in a major geomagnetic storm the next day.

The storm process was nicely described by Dungey in 1962, a decade before the discovery of CMEs. The idea that CMEs cause huge geomagnetic storms became firmly established only in the early 1990s. SOHO observations have shown that nearly 75% of the Earth-directed halo CMEs produce geomagnetic storms. Geomagnetic storms can also be caused by structures created by the collision of fast and slow solar wind streams from the Sun. However, these storms are generally less intense.

Nat Gopalswamy

THE OBSERVATÓRIO NACIONAL: A BRIEF HISTORY

On October 15th, 1827, Brazilian emperor Pedro I signed an imperial decree creating an astronomical observatory for “gathering astronomical and meteorological data, as well as training military engineers”. After several changes, this institution became the present Observatorio Nacional, being the oldest scientific institution in Brazil.

In 1871, Emmanuel Liais was nominated director and carried out a major scientific and bureaucratic reorganization. He was replaced by Luiz Cruls in 1881, who planned to install an equatorial photographic eyeglass to join the observatory to the project ‘Carte du Ciel’. Between 1886 and 1891, the observatory published the first magazine of popularization of astronomy in Brazil.

After the beginning of the Republic, in 1892, Cruls and his co-workers were involved in determining the geographical location to transfer the capital to the hinterland of the country. Sixty years later, Cruls’ studies would be used to decide the location of the present capital, Brasília.

MAIN BUILDING OF THE OBSERVATORIO NACIONAL IN SÃO CRISTÓVÃO, 1920.

Initially, the observatory was located in downtown Rio, but this location became inadequate at the beginning of the 20th century. Henrique Morize, named director in 1908, managed to transfer the observatory to its present location in 1921. In 1919, Morize and his co-workers observed the solar eclipse of May 29th in the city of Sobral that helped to confirm the deflection of light predicted by Einstein’s General Relativity.

In the decade of 1930, there was an attempt to build an astrophysical laboratory, but the Second World War interrupted the task, to be resumed only three decades later. The Observatório Nacional played a major role in getting the appropriate funds and choosing the site for the 1.5 m telescope, and in 1981 the Brazilian Astrophyisical Observatory was finally inaugurated. The country then entered the era of modern astrophysics.

ANTONIO AUGUSTO PASSOS VIDEIRA

MODELLING THE MILKY WAY IN THE ERA OF GAIA

If there is dark matter in our galaxy, how is it distributed? How did the Galaxy’s bulge form? Why is its disc made up of two chemically distinct components, one thick and the other thin? How was the Galaxy assembled, and at what rate is it still growing? Large sums of money are currently being invested in surveys on the understanding that these surveys will provide answers.

Studies of the Galaxy can be confusing because it is all around us and it’s hard to focus on the big picture. All data sets are dominated by observational biases, especially towards nearby stars and against stars within the plane. On account of these biases, Galaxy models have a crucial role to play in the extraction of science from survey data.

Through the spectra of relatively nearby stars we can study the Galaxy in enormously greater detail than any external galaxy, with the result that effective exploitation of the data for our Galaxy requires models of unprecedented sophistication. Even now our ability to extract science from the available observational data is limited by the quality of our Galaxy models. Unless there is a step change in modelling technology, this gap between what the observations demand and what models offer will widen rapidly as data comes in from upcoming surveys, which include the ground-based surveys (HERMES, APOGEE and Pan-STARRS), and ESA’s Gaia satellite, which is scheduled for launch at the end of 2011.

Gaia will determine the positions, motions and spectra of a billion stars and the Gaia catalogue, which will become available towards the end of the next decade, will remain definitive for a generation.

At Joint Discussion 5 astronomers from around the world are meeting to review the challenge for modellers posed by upcoming surveys and to discuss how to build better models of the Galaxy and how to tune them by comparing their predictions with data from current and future surveys.

JAMES BINNEY

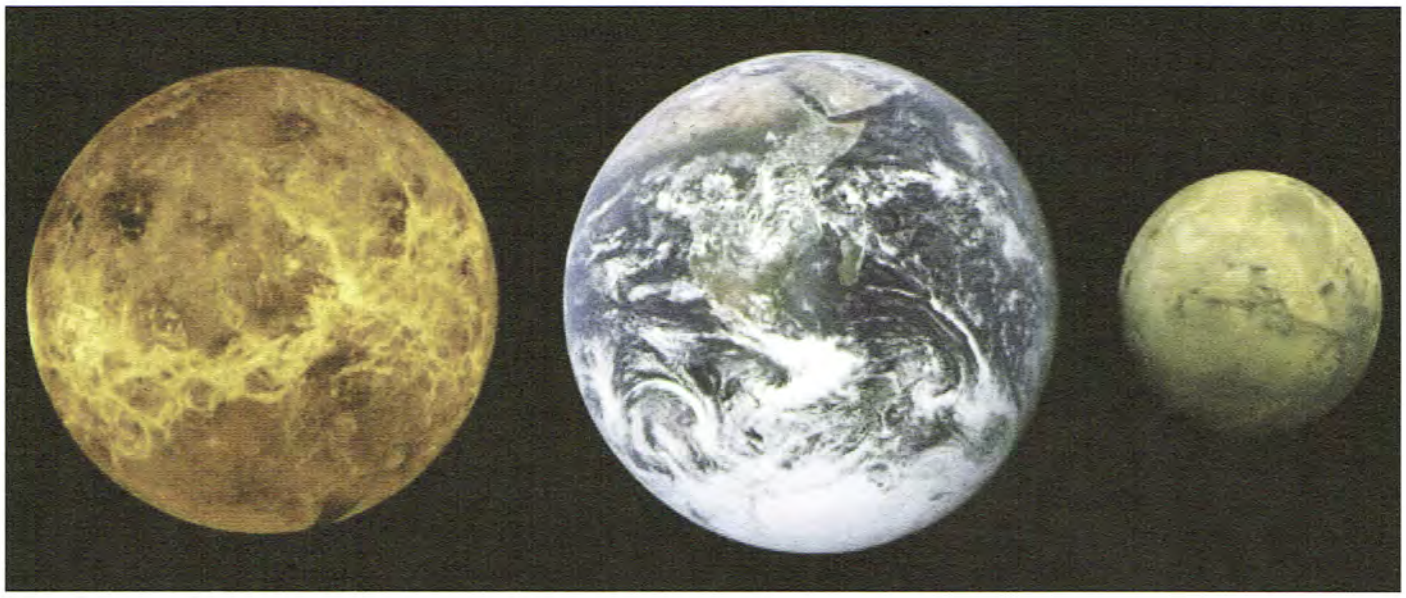

ARTIST’S CONCEPT OF THE SATELLITE GAIA

TOWN HALL MEETING – DISCUSSION OF IAU STRATEGIC PLAN – 7 AUGUST

In addition to the session of SpS4 on 10 August and the NASL lunch on 11 August, there will be a ”Town Hall Meeting” to present and discuss the IAU Strategic Plan at 12.45 pm on Friday 7 August in Room 2.1. This meeting will provide a forum for members unable to attend the SpS4 discussion to discuss and provide feedback on the plan. The plan can be downloaded from the IAU web site.

Estrela D'alva
The Morning Star
XXVII General Assembly
August, 2009 • Rio de Janeiro • Brazil
Day 05
Friday, August 7th, 2009

All bets are off: Water on Planets



Venus, Earth, and Mars: three neighbor planets and three different outcomes

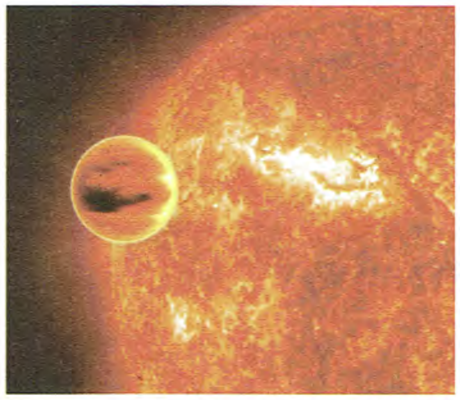
Water (H_2O) is a ubiquitous molecule in the Cosmos, which is perhaps not surprising since H and O are the most and third-most abundant elements in the Universe, respectively. And, of course, water is a critical ingredient in assessing the habitability of worlds and the biochemistry of any potential life forms on those worlds. As such, the origin, distribution, and evolution of water in our solar system, in other solar systems, and in other interstellar and galactic reservoirs, is the topic of intense research and debate.

Models of solar system formation can be used to predict the heliocentric distance beyond which primordial water could have condensed from the solar nebula as ice (the so-called "snow line") and thus have been available for accretion into planetesimals. Today the snow line occurs around 2.0 to 2.5 AU, where temperatures range from about 160 to 200 K. However, 4.6 billion years ago the solar nebula and disk from which the planets formed was warmer, meaning that the snow line would have been out near 4-5 AU. It is probably not a coincidence that the largest concentration of mass in our solar system besides the Sun – Jupiter – formed just beyond the edge of this primordial snow line. From the outer main asteroid belt and out into the Kuiper Belt and the Oort Cloud we would expect to find bodies dominated by water rather than by refractory materials. Except for tidally-heated Io and a few remaining classes of poorly-explored objects (like Jupiter's Trojan asteroids), telescopic and spacecraft observations have indeed confirmed the presence of water ice on or in all outer solar system bodies for which good, relevant data exist.

Simple nebular/disk formation models do not factor in possible mixing of condensed water throughout the solar system via "stirring" from planetary migration or other complex interactions that can lead to impacts between icy and rocky bodies. Thus, simple explanations for the origin and inventory of water in particular parts of the solar system compete for viability with chaotic, potentially ad hoc explanations involving chance impacts. While it may once have been inappropriate to invoke stochastic processes to explain planetary evolution, those days are gone. Astronomers and planetary scientists, armed with new geochemical data and highly sophisticated computer modeling capabilities, now understand the important role that early impacts played in forming the solar system that we live in today.

The existence of a significant amount of water on the Earth's surface is a case in point. It is unlikely that the Earth's oceans formed directly from "wet" planetesimals so far inside the snow line. Instead, a late "veneer" of water may have been delivered to Earth via impacts from outer solar system objects perturbed by the migrating orbits of Jupiter and Saturn. Comets are probably not the source of Earth's oceans because of a significant difference in D/H ratios. Outer main belt asteroids (hydrated C-types and primitive D-types and Trojans) may instead prove to be the source, as meteorite analogs to the C-types, carbonaceous chondrites, have similar D/H ratios as Earth's oceans. However, given all the indirect assumptions and the lack of enough adequate data, the origin of Earth's water is still quite uncertain. Similar conundrums can be invoked when considering the likely loss of large amounts of water from Venus (based on the present very high D/H ratio) and Mars (where rover and lander data have proved that liquid water once flowed on the surface and has subsequently been lost to space and / or the subsurface).

While there is substantial data available on the distribution and abundance of water on solar system bodies from direct observations as well as from laboratory and meteorite studies, significant mysteries obviously remain unsolved. With the recent discoveries of water in extrasolar disks and in exoplanet atmospheres, the topic is deepening to encompass more solar systems than just our own, and to involve not only planetary scientists but also astrophysicists, chemists, and even biologists. The search for water on planets and beyond is, ultimately, a search for our own origins.



Artist's concept of the giant extrasolar planet around the Sun-like star HD 209458 -- the first to have its atmosphere directly detected. | NASA and G. Bacon (STScI)

An artist's depiction of the "hot Jupiter" HD 189733b, where scientists have detected water vapors. | ESA, C. Carreau

James F. Bell III

THE **EYES** OF THE **ASTRONOMICAL WORLD** OVER **BRAZIL**

The opportunity of hosting the IAU GA at the same time the world around celebrates the International Year of Astronomy was a great boost for science in Brazil. And it goes to show that the country is clearly making strides in scientific activities. That is the opinion of Beatriz Barbuy, an astronomer from University of São Paulo who also serves as vice-president of the IAU.

"It has clearly an emerging economy", says Barbuy, mentioning Brazil's progress in science: the country is currently 13th place globally, in terms of published papers. She believes the progresses show in partnerships with major players in projects like Gemini and SOAR, and thinks the IAU is of foremost importance for the flourishment of astronomy and science in Latin American. See below what else she has to say.

How do you see the development of science in Brazil?

Beatriz Barbuy - Until the 1950s there were only sparse scientific activities in this country. The Brazilian national agencies CNPq and Capes were both created in 1951. Since then there has been a continuous effort from the Brazilian Government to develop all fields of science. In the early 60s, FAPESP, the agency of the State of São Paulo, was founded, and in 1971, FINEP, a federal development bank, also started to support science. Nowadays we graduate over 10,000 PhDs per year in all fields.

Which fields of science are ahead?

Barbuy - The areas of agrarian sciences as well as basic biological and health sciences are at the top of the list, with 3% - 5% of the world's scientific production. Physics and Astronomy also rank well, with nearly 2% of the world's papers in these fields. Brazil is now the 13th country in number of papers per year. This is to be compared with having the 10th GDP, but only 64th in GDP/capita. It has clearly an emerging economy.

Is astronomy still growing?

Barbuy - Astronomy in Brazil began in the early 70s. There are now over 500 astronomers, including graduate students and more than 300 PhDs (recent census by J. Steiner). In recent years many post-docs have been hired in universities and new groups have been formed. The participation of our country in projects like Gemini and SOAR has given a new impetus to our community. We are also improving our capabilities in building world-class instrumentation. With continuous support from funding agencies, I foresee Astronomy as a growing activity in this country and we intend to enlarge our observing capabilities.

As vice-President of IAU how do you do you see the role of this organization for developing countries?

Barbuy - Brazil joined the IAU in 1961, a time we did not have a single PhD in this area. The role of the IAU in the process of building up astronomy in Latin America has been huge. As IAU member, we already accepted to move from category II to category III. In the last years, the decision of the IAU in having 2009 as the Year of Astronomy has been particularly rewarding. The impact is impressive, and it is clear that a long term involvement of many more countries in Astronomy will be reached, as well as a development of education in Astronomy in those countries.

BEATRIZ BARBUY

What about having the IAU XXVII General Assembly in Rio?

Barbuy - As co-chair of this event, I consider having the General Assembly in Brazil to be very important to Latin America, as can be seen from the list of participants. Our first letter of intent was sent to the IAU in 2000, and later on the Brazilian Astronomical Society members decided that Rio de Janeiro would be the chosen city. It was crucial to its success that Daniela Lazzaro took it in her hands since December 2002, so we are all grateful to her.

FENCING WITH THE **PRESS**

A few years ago, I was representing the Science desk in a frontpage meeting in a daily newspaper in Sao Paulo. I was about to pitch an astronomy story, when the guy from the Politics desk, jokingly, asked: "What now? Maybe an albine furry dwarf star?"

Well, actually, I guess "half-jokingly" is more accurate. The fact is that, except for those who work for Science desks, virtually all journalists don't know the difference between a red dwarf and a red giant, let alone black holes and neutron stars. (I was once required by one of those folks to show where was South America in a CMB map from WMAP, so there you go).

That happens because most journalists – especially those who get to decide what is coming up in the frontpages of all the daily newspapers and websites tomorrow morning – have a very utilitarian view of science (not to mention the fact they're not very enthusiastic about learning what science is all about).

Terribly misguided, but sadly true. And it seems that view is also strongly contaminating governments all around the world, which now are beginning to think, more than ever, that science is all about patents and innovation, and has nothing to do with satiating our most basic curiosity about nature.

Astronomy has, thus, a little problem with the press: it is, by all utilitarian standards, completely useless. Newspapers seldom like content that doesn't seem useful for its readers (Britney Spears being the obvious exception).

On the other hand, they love gorgeous pictures (especially if they are Britney's, but not necessarily). And that's where Astronomy could find a back door directly into the first page of every daily! The secret here is for astronomers to be aware that, in order to showcase their research, they have to think of how they can tell the story behind those spectacular pictures.

This may be frustrating for some researchers, especially if their topics don't deal with great pictures (exoplanets, for one), but no reason for despair! Artistic imagery could do the trick just as well – and I feel most people in exoplanet research have already perceived that.

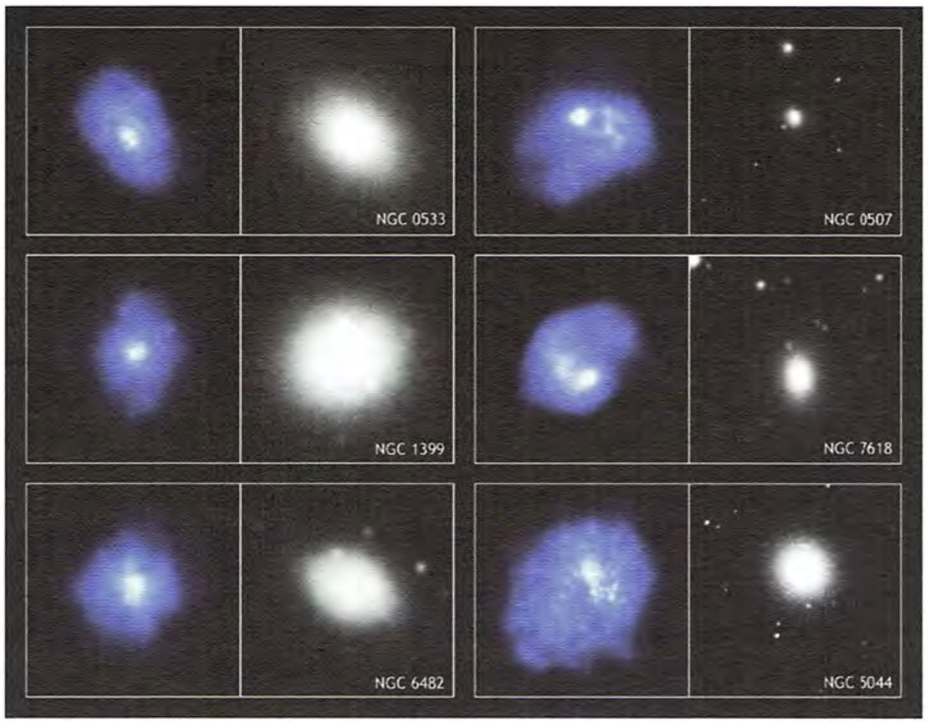
The funny thing is that most contacts between astronomers and journalists can be quite pleasing. Most people writing on the subject are very knowledgeable and interested. But to get across the message of the real importance of Astronomy – basically to fuel the human spirit and provide a context for our existence – we must reach to not only the Science journalist, but to his boss and, most of all, to his readers.

In order to do that, astronomers should follow the old saying: a picture is worth a thousand words. But the real trick is to hand out the image along with the thousand words, just in case.

SALVADOR NOGUEIRA

HOT INTERSTELLAR MATTER IN ELLIPTICAL GALAXIES

The recent successful X-ray space missions have provided a large amount of high precision observational data of the hot ISM in elliptical galaxies. At the same time, theoretical studies of the dynamical and chemical evolution of elliptical galaxies have made a significant progress and start to predict various observable quantities. JD 8 is intended to bring observers and theorists from around the world to review recent results on the hot interstellar matter in elliptical galaxies and to identify important, but unsolved problems for further investigations. The hot interstellar matter in elliptical galaxies is physically related with various dynamical and chemical evolutionary events in these systems, such as star formation episodes with stellar feedback and chemical enrichment, environmental effects with stripping, infall and mergers, and super-massive black hole feedback.



CREDIT X-RAY: NASA/CXC/U. OHIO/T. STATLER & S. DIEHL; OPTICAL: DSS.

As an example of rich sub-structures in the hot ISM, Chandra X-ray (blue & white) and optical (grey & white) images of a few elliptical galaxies are shown above. In contrast to the stellar optical light which is smoothly distributed, the X-ray emitting gas reveals complex structures, indicating that a powerful source of energy must be pushing the hot gas around and stirring it up.

To illustrate the AGN feedback effects, look at the composite image of M84, which overlaps Chandra (blue), SDSS (yellow and white) and VLA (red) data. The hot ISM is structurally complex, but the spatial anti-correlation with the radio emission (jets and lobes) clearly indicates direct interaction between the hot ISM and the AGN.

X-ray observations also provide a unique tool to measure the abundances of elements injected into the hot medium by stars and SNe, giving important clues on galaxy evolution and stellar feedback. However, the discrepancy between observational and theoretically predicted abundances is still a matter of debate. This JD will lead to critical discussions on this controversy and related subjects.

KIM DONG-WOO

ASTROPHYSICAL OUTFLOWS AND ASSOCIATED ACCRETION PHENOMENA

Bringing together world experts to identify the state of art and summarize the progress of the field is the main issue of Joint Discussion 7 on astrophysical collimated outflows and accretion phenomena. The theme is at the confluence of astrophysical observations, theoretical and computational modeling.

In the instrumentation context, we will call attention to the coming generation instruments, like ALMA, APEX, and LLAMA. Employed either as independent antenna(e) in stand-alone mode, or in VLBI experiments, these new instruments will unveil the surroundings of accretion disk/jet launching systems. They will provide images of event horizons in supermassive black holes and allow the investigation of how astrophysical jets are released, accelerated and collimated.

Recent observational results will also be reviewed, like the findings by Auger that have revived the debate over a connection of AGN jets with the ultra-high-energy cosmic rays, whose origin is still an open question. New data about the jet launching area in the Galactic Center black hole Sgr A will also be discussed.

In the theoretical front, high resolution MHD simulations are bringing to this JD new important results on angular momentum transport and dynamo action in accretion disks, and on jet propagation. Fundamental empirical correlations found between radio and hard X-ray emission from jet sources spanning 10 orders of magnitude in mass (from magnetically active stars and proto-stars, to galactic black hole binaries and low luminosity AGNs) suggest an association of the radio emission from jets at the launching with coronal magnetic activity above the accretion disks. Interpretating these and other results is one of the stimulating challenges posed to the over 100 participants of JD 7.

ELIZABETE M. DE GOUVEIA DAL PINO

TIME AND ASTRONOMY

Responsibility for the definition of time scales left the astronomical community some 40 years ago when, in 1967, the second became defined by an atomic transition in the International System of units SI and when TAI was defined as the primary international time scale in 1971. Atomic time is now 10^7 times more stable than the Earth rotation and some 10^4 times more stable than the planetary orbital motions that were used to define time until 1967.

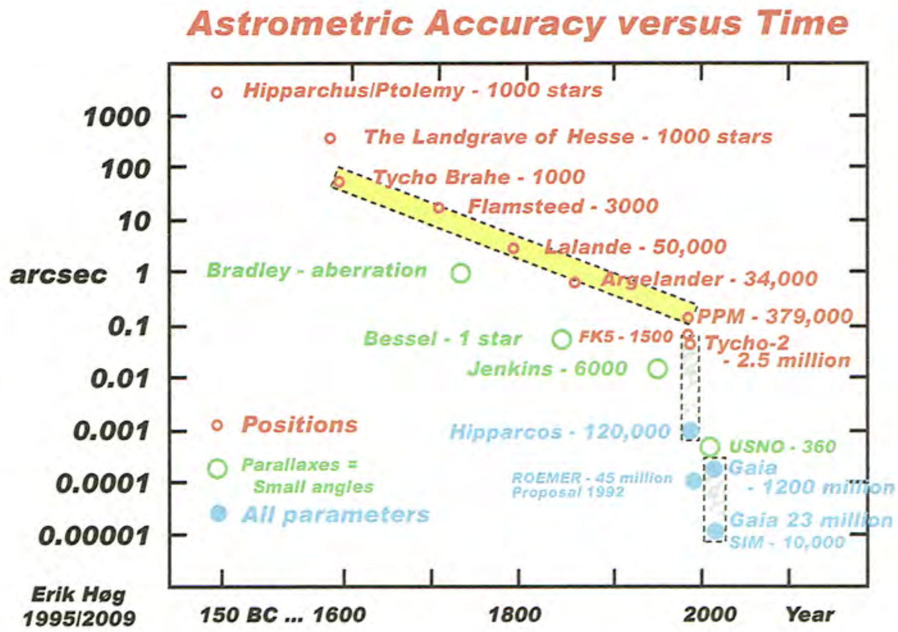
The Joint Discussion 6, "Time and Astronomy", will provide a discussion forum for the astronomical activities directly related to Time. A first session (Thursday 6 August, morning) presented the state of the art of the modeling and prediction of **UT1**, which is the angle of **Earth rotation**, needed for any coordinate transformation between the terrestrial and celestial reference systems.

A second session (Thursday 6 August, afternoon) discussed the present realizations and performance of **atomic time scales**, which are the basis for a large variety of astronomical measurements. A part of the discussion will focus on the future (continuation or discontinuation) of **leap seconds**, which are presently inserted in the official atomic time scale UTC to get it synchronized with the Earth rotation state UT1.

Finally, a third session (Friday 7 August, morning) will present the most recent advances concerning the possibilities of **millisecond pulsars** to establish a new timescale able to detect long-term variations in the atomic-clock-based timescales. As the best pulsar timescale will be based on measurements of an ensemble of pulsars, the session will present the progresses that have been made in the past few years in establishing such ensembles, known as pulsar timing arrays. In parallel, timing of pulsars from these arrays will be presented as a new tool for the search for the low-frequency gravitational waves.

PASCALE DEFRAIGNE

ASTROMETRY LOST AND REGAINED



ASTROMETRIC ACCURACY DURING THE PAST 2,000 YEARS. THE ACCURACY WAS GREATLY IMPROVED SHORTLY BEFORE 1,600 BY TYCHO BRAHE. THE FOLLOWING 400 YEARS BROUGHT EVEN LARGER BUT MUCH MORE GRADUAL IMPROVEMENT BEFORE SPACE TECHNIQUES WITH THE HIPPARCOS SATELLITE STARTED A NEW ERA OF ASTROMETRY

The prospects for astrometry looked bleak at the middle of the 20th century. If an astrometrist retired, the vacancy was usually filled with an astrophysicist, and astrophysics was moving towards the exciting new extragalactic astronomy. But I did not feel any pressure from this trend when I studied in Copenhagen (1950-56). My teachers at the observatory, Bengt Strömgren and Peter Naur, were both very familiar with astrometry, and it was natural to follow their advice.

The revival of astrometry during the last century was obtained by photoelectric astrometry. The chain of ideas and experiments which led to Hipparcos is traced in my talk on 5 August in Commission 41. I shall focus on activities leading from first experiments on the meridian circle in Copenhagen in 1925 up to approval of the Hipparcos mission by ESA in 1980.

Hipparcos was launched in 1989, observed for three years, and the results were extensively published in 1996. Two papers about the Hipparcos and Tycho Catalogues, Perryman et al. (1997) and Høg et al. (2000) are among the 40 most cited articles in Astronomy & Astrophysics and have been reprinted recently. This fact and the figure illustrate the revival of astrometry.

Thanks to the completion of the Hipparcos mission a strong astrometric community now exists in Europe which has been able to propose and develop the Gaia mission and which will carry it to a successful completion. Without Hipparcos the faith in the much more difficult CCD technology of Gaia would have been missing.

ERIK HØG

CELEBRATING THE NAMING OF METEOR SHOWERS

The first batch of 64 meteor showers will receive their official names at the IAU General Assembly in Rio de Janeiro, following a vote by members of Commission 22 at their business meeting on Friday August 7. A fitting tribute to the Year of Astronomy. Astronomers are celebrating, because until now there was much confusion about which showers were real and how to name them.

To create order in this chaos, three years ago at the previous General Assembly in Prague, a Task Group on Meteor Shower Nomenclature was formed to formulate a list of showers that were well enough known to deserve official names. The Task Group started from a working list of showers and nomenclature rules. It then devised ways on how to add showers to the working list and decided, based on the results from recent meteor shower surveys, which showers were undisputed.

The IAU Meteor Data Center maintains a database of known and suspected showers that gradually will grow when more observations become available. Before publication, new showers should be reported to the Meteor Data Center, who will verify any naming conflict with existing showers and assign a unique number and three-letter code to each new shower.

Those showers that are confirmed by others are then deemed established. Each established shower can then be studied to find its parent body and study the comet's past activity.

Now in a manner of speaking meteor showers have become an official part of astronomy, nature itself is providing the fireworks: a rich Perseid shower in the early evening of August 12 on the Northern Hemisphere and occasional bright and flaring alpha Capricornids here in the south. With the IAU keeping an eye on things, we can all sit back and relax.

PETER JENNISKENS

WOMEN IN ASTRONOMY LUNCH

MONDAY 10 AUGUST FROM 12:30

There is a change of venue for the lunch, which will now be held on the Mezzanine floor next to Rooms 2 - 5. This event is fully booked out and we have a waiting list of astronomers wishing to attend. If you have a ticket you cannot use, please return it to the Registration desk so we can have every place occupied. We look forward to interesting discussions and some effective action.

WE NEED YOU!

What are you going to do in Rio over the weekend? Whatever it is, do it, photograph it, and tell us. Send us a short spirited text (up to 150 words) to estreladalva@astro.ufrj.br. Your text may be published in a special issue next week.

Weather forecast: sunny weekend

ESTRELA D'ALVA
The Morning Star
XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 06
MONDAY, AUGUST 10th, 2009

CO-EVOLUTION OF CENTRAL BLACK HOLES AND GALAXIES

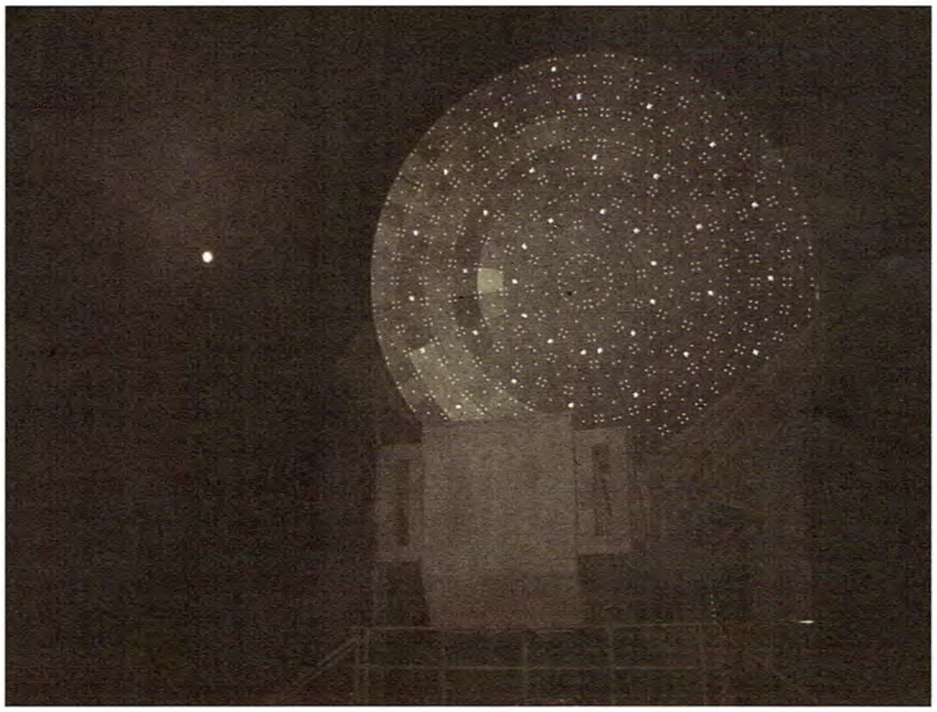
A current theme in extragalactic astronomy is that not only are quasars tracers of the evolution of galaxies, they are agents of that evolution – the hypothesis is that it is energetic "feedback" from the active nucleus that determines the physical state of the interstellar medium of the host galaxy and thus the star formation rate. The emerging scenario is one where the central black holes in galaxies grow by accretion during a quasar-like phase. But the accretion process itself eventually produces energetic feedback in the form of intense radiation, mass outflows, and jets, that heat up and can even remove entirely the interstellar medium from the host galaxy, effectively shutting down star formation. This intense feedback leaves behind a galaxy that is "red and dead" with a massive central black hole.

It is hypothesized that the ability of an active nucleus to suppress star formation is achieved once the black hole reaches a luminosity that depends on the mass of the host system, thus accounting for the surprisingly tight correlations between the black hole mass and large-scale properties of the host, specifically the luminosity or mass of the bulge component and the bulge velocity dispersion. These correlations appear to hold for both active and non-active nuclei, and provide the underpinning for the feeding-and-feedback picture.

IAU Symposium 267 on the "Co-Evolution of Central Black Holes and Galaxies" is a broad attempt to assess and articulate the observational and theoretical state of what is a rapidly developing and exceedingly complex field. Questions to be addressed include: when did the first supermassive black holes appear? How accurate are the various direct and indirect methods of black hole mass measurement? What is the local black hole mass function, and how does it vary with time? How well-correlated are the masses of the central black hole masses with larger-scale properties of the host galaxies and how do these relationships evolve over time? What is the fundamental physical cause of these relationships? What is the evidence that various agents – radiation, mass outflows, relativistic jets – play a role in suppressing star formation in quasar hosts?

The Symposium is intended to define the state-of-the-art in all of these endeavors, from the details to effects on the largest scales.

BRADLEY PETERSON



ASTRONOMY IN ANTARCTICA

The Antarctic continent is full of promises for astronomers. In spite of its inhospitable environment, the conditions are very good for observations. Right now, most of the work has been to determine the actual conditions of promising sites. Even so, there's a lot of solid research being conducted, making it to the pages of prestigious journal.

One such example is the BOOMERanG balloon experiment, which was able to determine, from measurements of the CMB radiation, that the Universe is flat. And much more is expected in this field. A new experiment called BICEP, started in 2005, is making accurate measurements of CMB radiation. Its effort is aimed at detecting, or at the very least, constraining, the marks left by gravitational waves from the inflationary phase of the Universe – a confirmation sorely needed to definitely validate the ideas behind inflation.

Also, the 10-meter South Pole Telescope is aimed at CMB. It is located at the Amundsen-Scott Station. So is the Icecube neutrino observatory, a facility for the study of neutrino emissions.

Right now, a committee is putting together a network of collaborations whose purpose is to foster astronomy in Antarctica, suggesting to the governments responsible for the infra-structure which large-scale projects should be pursued.

SALVADOR NOGUEIRA

BRAZILIAN OPTICAL **ASTRONOMY FACILITIES**

COMPOSITION WITH GEMINI, SOAR AND PICO DOS DIAS OBSERVATORIES | BRUNO CASTILHO LNA

Looking at the official poster of this General Assembly, the reader might wonder about the telescope building depicted beneath the contours of Rio's Sugar Loaf Mountain. It is not one of the major facilities on Earth, nor is it in the host country. So what is it and why did the Organizing Committee choose it as such a prominent feature on the poster?

The building, located on Cerro Pachon, Chile, hosts the 4.1m aperture SOAR Telescope (Southern Telescope for Astrophysical Research). Operated jointly by NOAO, University of North Carolina, Michigan State University and the Brazilian National Laboratory for Astrophysics (LNA), SOAR constitutes the most important element of a suite of facilities for optical and infra-red astronomy open to the entire Brazilian astronomical community.

It all began with the construction, in the 70s of the past century, of a 1.6-m aperture telescope for the Pico dos Dias Observatory (OPD). Complemented later by two smaller telescopes, OPD offered to the national community for the first time guaranteed access to internationally competitive observing facilities and thus fostered an enormous growth of astronomy in Brazil. Consequently, very soon OPD could no longer satisfy the growing demand for telescope time, neither in terms of quantity (number of observing nights) nor in quality (need to have access to larger telescopes).

How to solve this problem? Enlarging the facilities at OPD, an admittedly less than ideal place to put a major telescope? The Brazilian astronomers found a better solution: the participation in international observatory projects. Through LNA, which acts as the National Office, they associated themselves first with the Gemini Observatory. This satisfied the demand for quality. As a Gemini partner Brazil has access to one of the largest, most modern and most competitive observatories currently operational. Moreover, observational astronomical research in Brazil was no longer restricted to the Southern Hemisphere once astronomers can use both, Gemini South and North. But there is a drawback. The small 2.5% share of Brazil is not sufficient of meet the demand in quantity.

Therefore, Brazil, together with the partners already mentioned, engaged in building the SOAR telescope, of which it holds the majority share. Although somewhat smaller than the Gemini, and still ramping up as a well functioning observatory, the superb optical quality of the telescope and the ample access it offers is quickly turning SOAR into the most important observing facility for the Brazilian community.

Since both, Gemini and SOAR, have small fields of view, and thus do not meet the demands of that fraction of the community which needs wider fields (although through SOAR they also have access to the wide field Blanco Telescope on CTIO Observatory), LNA entered more recently into a cooperation with the Canada-France-Hawaii Telescope (CFHT) on Mauna Kea which now opened its superb facilities for wide field astronomy also to Brazilian astronomers.

Fulfilling its mission to provide astronomical infrastructure to the Brazilian scientific community, LNA thus offers to its users a wide variety of facilities, ranging from the small and medium-sized telescopes of OPD, encompassing the 4m class telescopes CFHT and SOAR (and indirectly also Blanco), and culminating in the large Gemini telescopes. Mission accomplished? LNA will go on improving its services!

ALBERT BRUCH

IS THE CURRENT **REFEREEING SYSTEM** ADEQUATE?

Nearly all of us have suffered from a journal referee who was misinformed, obstinate, unprofessional, or all of the above! Such are the liabilities of a system in which a single, often anonymous, referee has such a strong voice in the publication of your research. In many other fields, such as the biosciences, multiple referees are the norm, and this practice greatly improves the "signal to noise" of the peer review process. However, the publishing cultures in those professions are different from ours in other respects, with rejection rates of 80-95% (the reverse of the accept/reject rates of most major astronomy journals), much shorter papers, and fewer of them written. If we were to adopt a 3- or 5-referee system in astronomy, the costs in money and time would be prohibitive, and who would be willing to referee so many papers? Like it or not, the single-reviewer practice is inextricably woven into other facets of our publishing culture.

If we reluctantly accept that reality, is there anything we can do to improve the quality and efficiency of the refereeing system? I believe we can. An informed and engaged editor can exert enormous influence, by offering a guiding hand and intervening when a peer review gets out of hand. Unfortunately, in today's age of point-and-click electronic peer review, it has become all too easy for many editors to shirk their core responsibility to moderate the scientific exchange in a peer review, and instead to become little more than mailing services for referees and authors. We might benefit from a return to Chandrasekhar's more engaged approach.

A more difficult question, about which many will disagree, is whether the problem today is too few papers accepted or too many? From where I stand I am increasingly distressed by the pressure placed on many astronomers, young scientists in particular, to publish reams of papers regardless of quality, simply to document productivity. We risk being drowned in a sea of potentially useful but marginally significant papers, when we could all benefit from the time to slow down and produce a few deeper, well thought out publications. Stricter refereeing could help to bring that about, but are we ready to reform ourselves?

ROBERT C. KENNICUTT

Star Clusters: Basic Galactic Building Blocks

Almost all stars and their planetary systems form in star clusters. Because of the proximity of stars to each other, every star in a cluster will have significant effects on almost every other star, and will be affected by almost all other stars in turn. Star clusters span a huge range of sizes, from small associations of a few hundred stars, via "typical" clusters like the Orion Nebula Cluster, to extremely massive globular and "super" star clusters. The latter are the most massive star clusters known; they are the hallmarks of massive starbursts in their host galaxies.

Stars form from their natal molecular clouds in binary and multiple systems. These systems are initially so close that they interact, destroying some multiple systems and swapping partners in others. The most massive stars become supernovae, blasting away the gas left over after star formation, and causing the cluster to expand. Many clusters do not survive this expansion and are destroyed, but those that do survive may last long enough to become counterparts of the old globular clusters observed in large numbers in the local Universe. Globular clusters, the oldest galactic building blocks, are thought to be fossil tracers of violent episodes during the galaxy formation process. They provide crucial information about the oldest phases of stellar evolution (and reveal puzzling clues in terms of abundance anomalies and spreads, and hitherto unexpected multiple epochs of star formation), as well as regarding their wider environmental impact and context.

Given the wide range of scientific topics covered by star cluster research, from stellar evolution on the smallest to cosmological implications on the largest scales, Symposium 266 offers sessions of interest to the majority of researchers in astrophysics. We therefore particularly encourage you to attend the Symposium's keynote lecture by Bruce Elmegreen (Tuesday, August 11 at 09:00).

Jacques Lepine and Richard de Grijs

Connecting First Stars to Planets

Cosmic chemistry is a rich and evolving field of astronomy, driven by the increasingly powerful observational capabilities on large telescopes coupled with major advances in modelling stellar atmospheres and improved access to large and accurate nuclear, atomic, and molecular databases. IAU Symposium 265: "Chemical Abundances in the Universe: Connecting First Stars to Planets" aims to provide a broad overview of the production and evolution of chemical elements over cosmic time and how this chemical evolution connects the early universe of metal-free and heavy-element poor first generations of stars, through the formation of galaxies, with their diverse stellar populations, to a universe of heavy-element rich stars and planets.

In recent years, the connections between seemingly different areas have become clearer: the first generation of massive stars drives the era of reionization, and is associated with long duration Gamma-Ray bursts (GRBs). The oldest low mass stars, which are still observable today, were chemically imprinted with the nucleosynthetic products from the energetic events driven by these first massive stars. The Chemical abundances of QSO absorption lines and damped Lyman-alpha systems as a function of redshift can be connected to the abundances of stars as a function of metallicity to provide a view of chemical evolution in the Universe during the first Gyr of its existence. In our Galaxy, chemical abundances in stars from different populations and distinct locations in the Galaxy provide important constraints to our current understanding of the formation and assembly of the Milky Way as an increasingly larger number of stars in the Bulge, disk and halo are scrutinized for abundance patterns of crucial elements which are formed in a variety of astrophysical sites.

The sessions and broad themes which are covered in the IAU Symposium 265 program begin in the early universe with Big Bang Nucleosynthesis, then follow the evolution of the elements to the present epoch, providing a setting on which a current picture of the chemical structure of the universe can be built. The closing session looks to the future in order to frame a set of questions which will help define the next generation of instruments on the extremely large telescopes.

Check out our program and awesome speakers at http://www.on.br/iau-s265/dates.html. We welcome you to IAU Symposium 265 and look forward to bringing you exciting results!

Katia Cunha, Monique Spite and Beatriz Barbuy

A window of opportunity for South American Astronomy

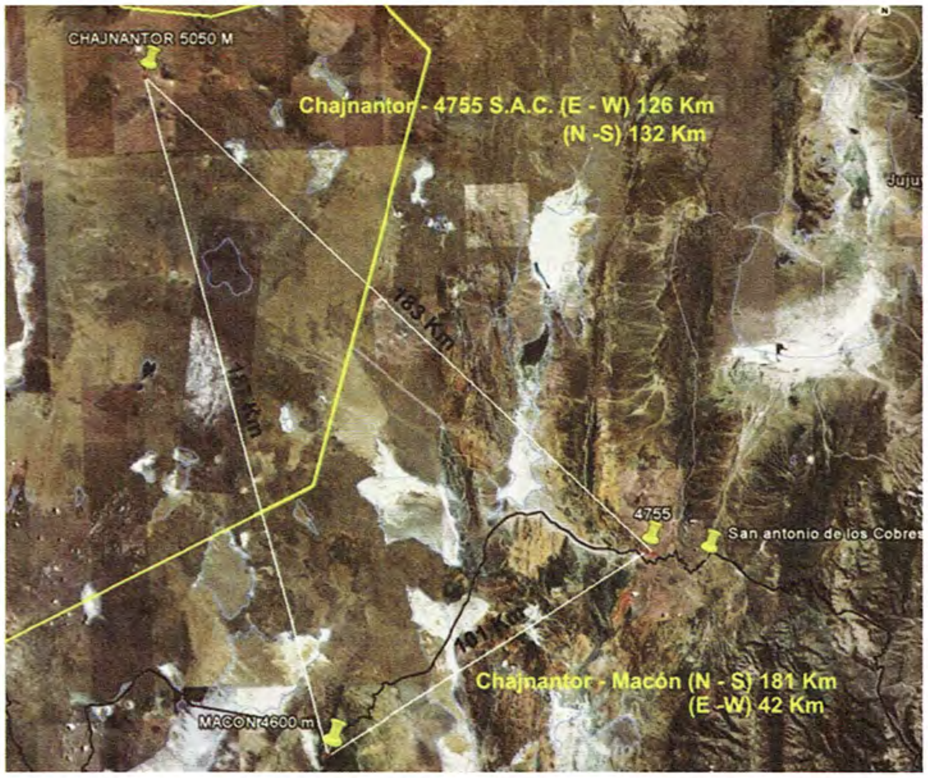
The possibility of installing two radio telescopes for millimeter and sub-millimeter wavelengths, in the Argentinean side of the Atacama desert at distances of 180-210 km from Chajnantor (the site of ALMA), and altitudes greater than 4700 meters, has been discussed among astronomers of Argentina and Brazil.

The support to this idea has been ratified in September 2008 by the Argentinean Astronomical Assembly. In Brazil it is being studied as one of the possible key science goals of the recently approved Astrophysics National Science Institute by the Brazilian National Council of Research - CNPq. Top authorities of Science and Technology in Argentina informed that in the context of regional integration, funds may be available for original projects on basic sciences, with technology transfer components.

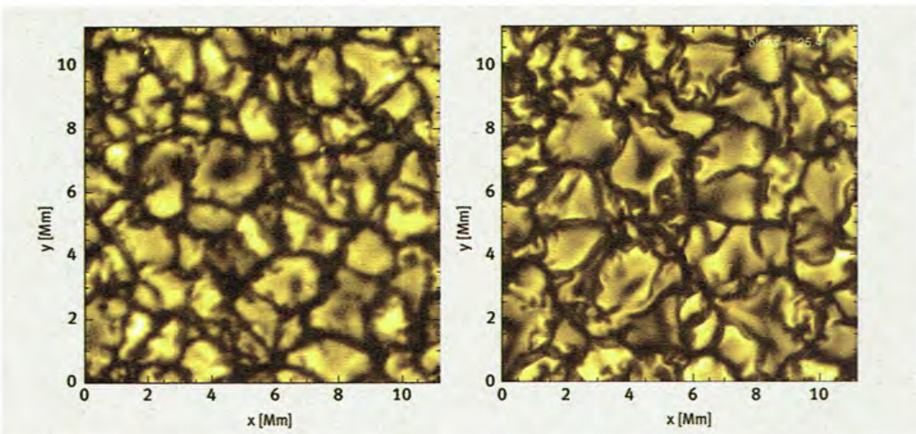
The initial US$ 20 million investment of LLAMA would allow Argentine and Brazilian scientists to develop millimeter and sub-millimeter single dish radio astronomy, as well as integration in global experiments with Very Long Baseline Interferometer networks. Of particular interest may be VLBI with already existing radio telescopes in Chajnantor (APEX and ASTE), and in the long run with elements of the ALMA array. Site testing in Argentina has been carried out for three years in Macón (4600m, 180km SE of ALMA) with equipment provided by UNAM (México), and further site testing started at other site 180 km SE of Chajnantor (see attached map). A proposal for initial funding to carry on the in depth study of this project will be submitted by December 2009.

We invite you for an open meeting on this project that will take place on Tuesday August 11 at 17:30 in room 2.11.

I.F. Mirabel, M. Arnal, R. Morras, G. Romero, J. Lepine, Z. Abraham, El. M. de Gouveira Dal Pino



Location of Chajnantor, Macón and Chorrillos. The yellow line shows the border between Argentina and Chile, the black line the railway track Salta-Antofagasta.



Left: Quiet solar granulation as observed with the 1m Swedish Solar Telescope (courtesy Mats Carlsson 2004). Right: High-resolution simulation of solar surface convection (courtesy Matthias Steffen 2009).

US Navy **CCD Astrograph Catalog** release

Related talks will be presented in session 2 and 4 in room 2.8.

Today, the long wait is over. The 3rd data release of the US Naval Observatory CCD Astrograph Catalog (UCAC3) will be announced at the Commission 8 meeting. UCAC3 is an all-sky astrometric star catalog covering the 8 to 16 magnitude range, using observations made in a single bandpass (between V and R). For stars in the 10 to 14 mag range 15 to 20 mas positional accuracy is achieved, with increased error to about 100 mas at the faint limiting magnitude.

UCAC3 contains 100.7 million objects. Proper motions are provided for about 95 million objects and B,R,I photometry from the SuperCosmos source catalog has been added as well as J,H, and Ks data from the 2MASS project. The 8 GB of data are released on a DVD, and will also become available from the data centers shortly. For details, visit http://www.usno.navy.mil/usno/astrometry.

Norbert Zacharias

3D views on cool stellar atmospheres

Much of what we know about the chemical composition of the Universe is actually stemming from the chemical composition of stars, which is often deciphered from the spectra emerging from their atmospheres. Cool, low-mass and long-living stars allow to study the evolution of the Universe's chemistry from a time shortly after the big bang until today.

The observation and interpretation of stellar spectra is a classical field in astronomy but is still undergoing vivid developments. The enormous increase in available computational resources opened up possibilities which led to a revolution in the degree of realism to which modelists can mimic nature. High-resolution, high-stability, high-efficiency spectrographs are now routinely providing stellar spectra whose full information content can only be exploited if a very much refined description of a stellar atmosphere is at hand.

This situation motivated Commission 36 "Theory of stellar atmospheres" to organize an exchange of latest views on the atmospheres of cool stars, and their inherent complexities related to multi-D hydrodynamics and magnetic fields.

The recent downward revision of the solar photospheric CNO abundances, and questions about the robustness of measurements of the Li6 isotope in metal-poor halo stars will certainly fuel lively debates among the theoretically inclined participants, with repercussions on fields far beyond stellar atmospheres as such.

We also expect to discuss exciting new observational views, ranging from HINODE looking at the Sun to cloud formation and their dynamics in the atmospheres of brown dwarfs and planets. Last but not least, polarimetry and interferometry provides new perspectives for which JD10 is going to serve as a discussion forum.

Hans-G. Ludwig

ESTRELA D'ALVA
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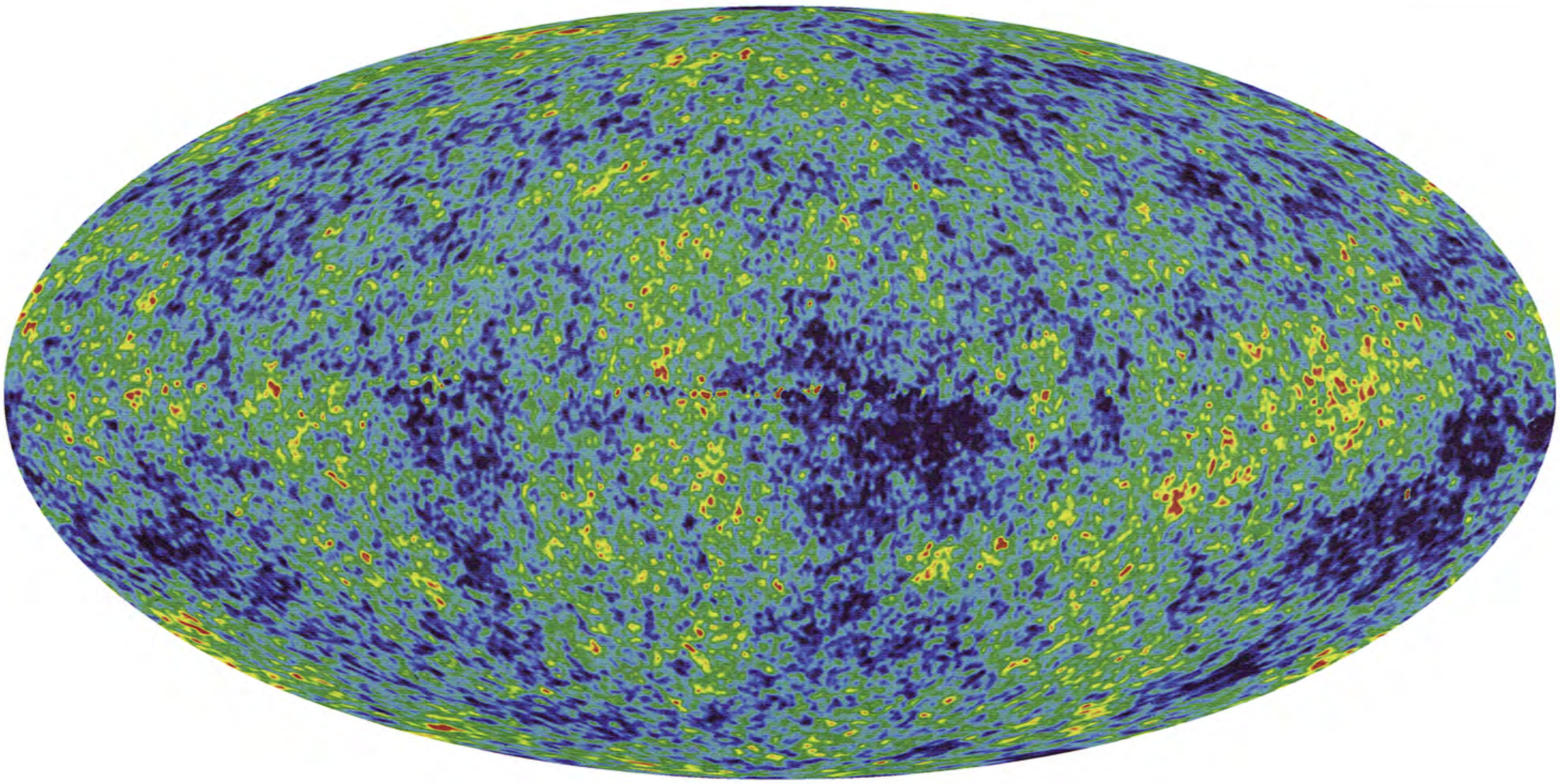
XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 07
TUESDAY, AUGUST 11th, 2009

EVERYTHING CAME FROM NOTHING: THE MODERN THEORY OF STRUCTURE FORMATION



DETAILED MAP OF CMB RADIATION CONSTRUCTED WITH FIVE YEARS OF DATA FROM WMAP

Until a few years ago the origin of structure in the Universe was a subject for occasional philosophical speculation but little serious scientific work. Today the situation has changed dramatically and we have a standard paradigm for cosmic evolution which specifies how physics at early times determined both the material content of the Universe and the small scale-structure imposed upon it.

Recent studies of the Cosmic Microwave Background have provided us with a high quality image of the Universe when it was only 380,000 years old. At that time it was a near-uniform mixture of hydrogen, helium, dark matter and radiation, with no galaxies, no stars, no planets and no people, indeed no atomic nuclei heavier than Lithium. Under the action of gravity, the weak fluctuations observed in the microwave sky evolved into the extraordinarily complex structure of our present Universe. Supercomputer simulations allow us to follow this evolution and to demonstrate that it does indeed reproduce the observed properties of today's galaxies and large-scale structures as well as the evolution of the galaxy population back to the highest redshifts currently observed.

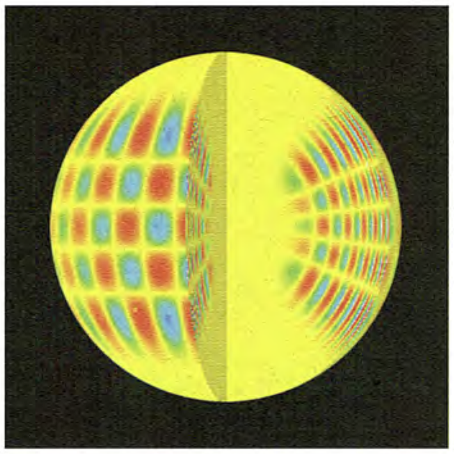
This success appears to confirm the extraordinary and unnatural assumptions of the standard structure formation paradigm. This claims that only a quarter of the energy density of the present Universe is in gravitationally clumped matter; only a sixth of this clumped matter is made of atoms or other known particles; only 5 percent of this baryonic material is currently inside galaxies. Most of today's Universe is in the form of Dark Energy, an unexpected discovery for which current physics has no plausible explanation; most of the gravitationally clumped material is Dark Matter, weakly interacting neutral particles whose existence is still unconfirmed by any Earth-bound experiment; and most of the baryons remain unseen in intergalactic space. Unsurprisingly, not everyone is convinced that all these claims are true.

The fluctuations measured in the microwave sky are the initial conditions from which all present structures grew. Their properties suggest that they were created very close to the Big Bang itself as quantum fluctuations of the inflationary vacuum. If this is true, galaxies, stars and even the elements of the periodic table are a consequence of the lowest energy state of the field which drove inflation. Everything has formed from nothing.

SIMON WHITE

SEEING INSIDE THE STARS

In the opening paragraph of his monumental book, *The Internal Constitution of the Stars*, Sir Arthur Stanley Eddington lamented: "At first sight it would seem that the deep interior of the Sun and stars is less accessible to scientific investigation than any other region of the universe. Our telescopes may probe farther and farther into the depths of space; but how can we ever obtain certain knowledge of that which is hidden behind substantial barriers?" Nobody could guess that there would come a time when we could "see" inside the stars.



In one sense, stars are musical instruments that are able to oscillate in modes which differ from one star to another and change in delicate ways as a star evolves. Though we cannot "listen" directly the music played by stars, the sounds appear in the form of the periodic changes in the star's brightness and of the periodic motion of its surface moving up-and-down. It is now known that the Sun is oscillating in thousands of its proper modes, and this richness in the number of identified modes leads to the great success of "helioseismology," by which we can probe the invisible internal structure of the Sun in detail.

The discovery of very small amplitude pulsations in the Sun has raised a question concerning the concept of pulsating and non-pulsating stars. We now expect that pulsations, at least with small amplitudes, will be ubiquitous among stars in general. This opens the possibility of a seismological approach to stars, and the research field probing the internal structure of stars in general is now called "asteroseismology."

We plan to discuss the ideas which we have obtained from helio- and asteroseismology about the physical processes inside the Sun and other stars and the mechanism of solar and stellar oscillations during the JD11, on the "New Advances in Helio- and Astero-Seismology". We hope we can share the latest knowledge of that which has so far been hidden behind substantial barriers.

JUNWEI ZHAO, GUENTER HOUDEK AND HIROMOTO SHIBAHASHI

ARE WE DOING ASTRONOMY RIGHT?

This may seem like a silly question, given the exciting discoveries filling our journals. But could we do even better? Are we doing astronomy sustainably or will our "Golden Age" soon draw to an end? For example, data used by graduate students are increasingly obtained via the web. Few students starting now will get any hands-on experience at a major world-leading telescope. Does this mean that the next generation of astronomers won't know how to build telescopes? And how come the project that has arguably produced the most innovative science from HST (the Hubble Deep Fields), creating a new paradigm for astronomical discovery, was never awarded time through a peer-review system? How, actually, are discoveries made?

On Tuesday these questions will be addressed by a range of well-known speakers including three IAU Presidents (Ron Ekers, Catherine Cesarsky, and Robert Williams), controversial physicist and populariser Lawrence Krauss, pulsar discoverer Jocelyn Bell-Burnell, and astronomical futurist George Djorkovski. Other questions will include:

- Have we achieved the best way to allocate time on major telescopes?
- What will be the impact of enormously large data sets?
- How do we balance popular "bandwagons" against innovative but less popular ideas?
- Do we have the optimal system for training young astronomers?
- Is astronomical progress limited by discrimination?
- How should we optimize international collaboration, particularly on major missions?

While we should always ask such questions, the International Year of Astronomy seems a particularly appropriate time to review our progress, and see if we can do even better. SpS5, "Accelerating the rate of Astronomical Discovery", will examine a range of potential limits to progress—paradigmatic, technological, organizational, and political, and draw lessons to guide future progress. It starts on Tuesday at 11:00 in Room 2.5, and continues until Friday.

RAY NORRIS

Stellar Atmospheres: Looking Backwards and Ahead

After some 40 years in the field of stellar atmospheres and stellar spectra, I find that the technical development in the field has been fantastic. The linear detectors, in particular the CCDs, applied at modern telescopes and new efficient spectrometers, revolutionized spectrometry. The number of analysed stellar spectra increased immensely. In fact, half the number of papers ever written on stellar abundances were printed during the latest decade. But also on a theoretical level, the advances are impressive. This is not due to new fundamental and enigmatic discoveries, as in other fields of astrophysics, but to the fact that the requirement that the analysis should have a solid physical basis is finally becoming reality.

A main driver for this latter improvement is again the improvements in spectrometer technology. The abundance criteria (mainly strengths of spectral lines) can now be measured to an accuracy of a few percent in hundreds of thousands of stars, and this should in principle enable a corresponding accuracy in stellar abundances. Still, they are in general not known to better than 30% or so, and in many cases not better than a factor of two. Even worse is that the systematic errors have not been known properly. This is because the models of the light-emitting regions and the calculation of their spectra have been too primitive.

To improve the situation, the basic assumptions of the models had to be abandoned. Real stellar atmospheres are not stratified in plane-parallel layers, they are not in hydrostatic equilibrium nor in Local Thermodynamic Equilibrium (LTE). Instead, they are known to show thermal inhomogeneities due to convective motions and other hydrodynamic phenomena, and their non-local radiation fields bring the populations of different atomic and molecular states out of LTE.

In order to improve the situation, it has been necessary to invent new algorithms to model the complex radiative transfer and the hydrodynamics properly. Considerable work has also been done in order to improve all the atomic and molecular data needed in the calculation of realistic spectra and of the energy balance in the models. The effects of these improvements for late-type stars are corrections of abundances, often by 10-30%, and sometimes by an order of magnitude.

As yet, these possibilities to improve the analyses have not been applied systematically. Also, several key physical data are still missing. But at least, for the first time in history, we are starting to understand the systematic errors remaining in the analysis. And in the years to come, we can start counting on errors in abundances reduced by at least one order of magnitude. What new discoveries will that lead to in the study of the evolution of stars and galaxies?

Bengt Gustafsson

Open Issues on Chemical Abundances

Almost as ancient as the universe itself are the chemical elements that form planets and the life that dwells upon them. The fuel for the gravitationally-confined thermonuclear reactors, known as stars, came from the Big Bang, but it was only later that nuclear "processes" in those reactors turned hydrogen and helium into heavier elements.

Today, our knowledge of stellar evolution is such that, for the most part, we understand the abundances found in typical solar systems like our own, and can predict the average pattern in the sun from almost first principles. There are some important gaps in our knowledge though, especially regarding the origin of the heaviest elements like platinum and uranium. These and other r-process elements have been made by rapid neutron capture on a short time scale, about 1 second. We know how, but still don't know where.

We also know that exploding stars called supernovae are especially copious producers of heavy elements, but we still don't know, in detail, how these explosions work. Probably several mechanisms are involved. Increasingly, however, our knowledge of nucleosynthesis is used as a diagnostic. Rather than just trying to explain what we see in the sun, the pattern of abundances seen in old stars distant galaxies, and individual supernovae, inform us about the nature of the early universe, galactic evolution, and the deaths of stars. Were the stars different when the universe was young? What was the role of these stars in altering the structure of the cosmos? And how has the evolving composition of our galaxy affected the formation of planets and the evolution of life? These are some of the questions our symposium will address.

Stan Woosley

Cosmology with Stars like the Sun

The first thing that comes to mind when the subject is the chemical nature of the early Universe are high-redshift objects. But some stars, much closer to home, may come in handy to help figuring out the whole story.

Stars of mass similar to, and less than, that of the Sun live for essentially a Hubble time and thus probe the entire history of star formation in the Universe. The chemical abundances in their surface layers are largely unchanged through their lives, reflecting the gas from which they were born. Detailed elemental abundances provide significantly more information than does overall metallicity, since different elements are produced by stars of different masses, on different timescales.

Analysis of the fossil record in old stars nearby is complementary to direct observations of high-redshift systems, and has the capability of breaking degeneracies inherent in analyses limited to integrated spectra or integrated photometry of unresolved systems – such as age/metallicity or star-formation rate/Initial Mass Function.

For this to be achieved, large imaging surveys should be complemented by large spectroscopic surveys at both medium and high spectral resolution. These provide line-of-sight velocities, overall metallicities, stellar parameters and elemental abundances. From these data we can extract not only the history of the baryons, but infer much about the dark matter that dominates gravity on the scale of galaxies.

The potential scientific returns of such effort will be discussed at the Symposium 265, "Chemical Abundances in the Universe: Connecting First Stars to Planets."

Rosie Wyse

RESCUING A **FALLEN ASTEROID**

On October 6, 2008, Richard Kowalski at the Catalina Sky Survey in Arizona discovered a small asteroid now known as 2008 TC3. The coordinates of the asteroid were promptly communicated to the IAU Minor Planet Center, where Tim Spahr that morning discovered that the computer program was choking on the data. Consultation with Steve Chesley of NASA/JPL confirmed that the asteroid would become the first observed asteroid to hit Earth, only 20 hours after discovery in the early morning hours of October 7 at a remote site in the Nubian Desert of Sudan. Astronomers tracked the asteroid and measured its orbit, permitting Steve to calculate a better approach trajectory. In the hours just before impact, the rapidly tumbling asteroid became bright enough to measure its reflection properties and, from its rapid flickering, the asteroid's tumbling rates and shape. Satellites confirmed the impact, causing a bright -20 magnitude fireball and a sonic boom that was detected as far as Kenya. One airline pilot reported seeing three flashes low near the horizon.


PETER JENNISKENS SHOWS ONE OF THE RECOVERED PIECES OF THE ASTEROID

For several weeks after that, it was thought that this would be the end of the story. One satellite reported an explosion 37 km high in the atmosphere, from which meteorites had never been recovered before. Other satellites reported lower altitudes, however, and a fall site in the desert begged for a dedicated search. I received the first news out of Sudan by way of Dr. Muawia Shaddad, an astronomer at the University of Khartoum. He sent pictures taken by eye witnesses at Wadi Halfa, near the border with Egypt, of a striking dust train at twilight, bathing in the rising Sun. In fact, thousands in Sudan had seen the bright fireball, which occurred just around morning prayer. Despite earlier failed searches, Shaddad received University support to conduct a field campaign with my help. In the afternoon of December 5, I walked with 45 students and staff in the middle of the Sahara Desert, searching for a needle in a haystack, not even certain that needle would exist. After just two hours of searching, student Mohammed Alameen discovered the first small chunk of asteroid 2008 TC3. The next day, several more meteorites were found, all dark scruffy and thinly crusted, spread along the trajectory calculated by Chesley. This was the first time that meteorites were recovered from what essentially looked like a cometary fireball. The meteorite turned out to be a rare anomalous polymict ureilite achondrite, which are now firmly linked to F-class asteroids.

A small fragment of the asteroid is here at the IAU General Assembly, courtesy of the University of Khartoum and the SETI Institute. If you see Steve or me in the corridors, don't hesitate to ask us about it. As a late-scheduled addition to the program, I will talk about my incredible adventure (a personal as well as scientific journey) during the last presentation at IAU Symposium 263 (room R2.2) on Friday August 7 (17:00).

PETER JENNISKENS

THE FIRST GALAXIES: THEORETICAL **PREDICTIONS** AND OBSERVATIONAL **CLUES**

Recent observational and theoretical results show that the period between recombination and the end of the reionization era is very dynamic in terms of star and galaxy formation. At z~6 we find galaxies already in place, with stellar masses rivaling those of giant local systems. The age of the stars in these high redshift galaxies is several hundred million years, putting their formation epoch at z~9-15, well into the reionization period. Yet, these stars exhibit characteristics similar to those found in lower redshift galaxies.

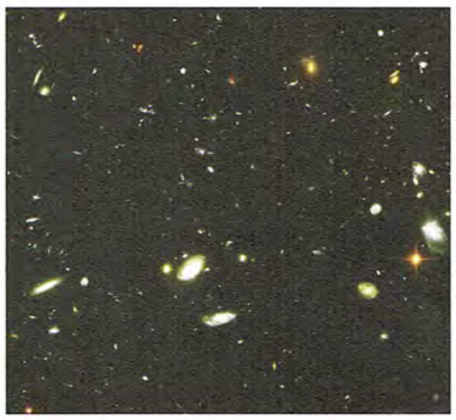
Furthermore, QSOs at z~6 imply an extremely efficient fueling mechanism during the first few hundred million years after the recombination epoch. These new observations are raising questions about where the first generations of stars were formed, how the first galaxies were assembled, can their low redshift counterparts be identified and what role did the early galaxies play in the reionization process?

These recent results have become available through multiwavelength observations, extending from the observed UV to infrared wavelengths. Large datasets, combining both ground- and space-based telescopes, and covering sufficiently large areas to counteract cosmic variance, have only recently become available.

The formation of galaxies through hierarchical merging is a fundamental paradigm in LCDM models. While the theory can successfully account for and model the evolution of dark matter halos, inclusion of the star formation process still presents a problem. Hence, a better understanding of how the first stars formed and interacted with their environment is fundamental to understand the reionization process.

This Joint Discussion will bring together observers and theorists for a discussion of where we stand today and what progress can be made in the near future with improved models and new observational facilities such as ALMA, JWST, ELTs and others.

TOMMY WIKLIND


THE HUBBLE SPACE TELESCOPE ULTRA-DEEP FIELD

REMINDER: ASTRONOMY EDUCATION LUNCHEON

As reported in the Estrela D'Alva 4th issue, there will be an Astronomy Education Luncheon at 12:15 today on the Mezzanine Level. The Luncheon will be devoted to a discussion of education strategies for the IAU for different regions of the world. Members interested in discussing or participating in future IAU education and outreach activities are invited to attend.

ESTRELA D'ALVA
The Morning Star
IAU XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL

DAY 08 WEDNESDAY, AUGUST 12th, 2009

DIM STARS ARE COOL

The study of low luminosity stars was hampered in the past by the perception that stellar astronomy did not require the use of large aperture telescopes; as a consequence, telescope time allocation committees were very reluctant to assign time in large modern telescopes to stellar programs. The situation changed in the late 80s and 90s when 4 m class telescopes and the Hubble space telescope were used to obtain good quality data on faint stars. CCD trigonometric parallaxes for M dwarfs and cool white dwarfs (WDs), as well as high S/N optical and near IR spectra and photometry, provided strong constraints to evolutionary and atmosphere models for them. The availability of new models and excellent data prompted a renewed interest in the determination of the theoretical and observational WD and M dwarf luminosity functions (LF), which hides information regarding the mass function of a given population and its star forming history. During the 90s the search for sub stellar objects or brown dwarfs (BDs), with masses below the minimum mass for stable hydrogen burning ($M_{BD} \leq 0.07\ M_{\odot}$), became a hot topic.

Recently, deep wide sky surveys like 2MASS, SDSS, UKIDSS, SCSS, etc. have changed again the way we look at low luminosity stars. For instance, they revealed the existence of large numbers of cool WDs. Today for the first time, we may have statistically significant samples of these dim stars, enough to attempt to understand their evolution by comparing the observed and theoretical mass and luminosity functions, which depend on properties of the progenitor populations and can be used to constrain galactic evolutionary models and determine the age of a given stellar population. At present the debate is still ongoing over issues regarding the completeness of the samples of cool and ultra-cool WDs, the effect of metallicity and mass on WDs' age determinations and other assumptions used to feed the different models.

The results of the MACHO and EROS microlensing experiments, favor the idea that about 20% of the galactic dark halo is formed of 0.5 $M_{\odot}$ compact stellar objects. Several authors attempted to identify this population with old WDs. However, at present less than a handful of cool WDs remain as candidates to be members of the halo population. Most cool WDs have turned out to be too young or to have a thick disk kinematics rather than halo. The observed local density of halo WDs, as determined by different authors, suggest a value of ~ $10^{-5}\ M_{\odot}\ pc^{-3}$, which is only 1 % of the local density of dark matter halo. We seem to be at a similar spot as when in the mid 90s the existence of BDs was an issue. Now that we know they exist, we face other challenges. Maybe we will need to wait for surveys with 8 m class telescopes and follow-ups with future 30 m ones in order to detect today's elusive halo white dwarfs.

The low mass siblings of disk and halo white dwarfs are the low mass ($\leq 0.2\ M_{\odot}$) stars in the dwarf and subdwarf sequence, all the way to planet mass BDs. Several deep wide near IR surveys have turned up hundreds of new BDs with accurate photometry and spectroscopy, good enough to constrain evolutionary models. The old spectral type classification had to be extended towards lower luminosities to accommodate BDs with temperatures as low as 550 K, giving rise to the new spectral types L and T (and maybe soon Y). Model atmospheres of these extremely cold objects have to deal with many complicated processes like dust condensation, which affect the emerging flux. One of the most interesting developments in the area of sub stellar mass research has been the discovery of ultracool sub dwarfs with masses well into the BD's regime. Most of these low metallicity BDs have halo kinematics typical of an old stellar population. Good quality IR spectra of these low metallicity BDs show the effect of metals in the emergent flux and constrain the models with varying metal contents.

ARTIST'S IMPRESSION OF THE SCR 1845-6357 STELLAR SYSTEM. THE SMALL RED STAR IS SHOWN IN THE BACKGROUND WHILE THE NEWLY DISCOVERED BROWN DWARF IS AT FRONT. | ESO

Although BDs have masses as low as a few Jupiter masses, they are different from the observed giant Jupiters found in many planet search programs. This difference originates at birth, BDs form just like any star, by accretion in the core of a molecular cloud while planets condense from gas depleted debris in a disk around a star. This difference translates in that a 20 M_J exoplanet will have more metals than its host star, while a 20 M_J BD will have typical stellar abundances. Photospheric pressures are also quite different. In any case some of the model atmosphere treatments developed for BDs may become useful in the future in the interpretation of exoplanet spectra.

Low luminosity star are now a very active field of research, pushing the development of new large telescopes and instruments. Who knows where this will lead the field but I am sure we are bound to be surprised. In 6×10^{12} yrs from now, these 0.1$M_{\odot}$ stars will have surface temperatures similar to the present day Sun and will be the last refuge for life in a very dark universe.

MARIA TERESA RUIZ

A CASINO CALLED URCA

RODRIGO SOLDON / CREATIVE COMMONS

Mário Schenberg (1914-1990) was a well known Brazilian theoretical physicist, with well over one hundred papers published, mostly in Field Theory; he was professor at the University of São Paulo. At the age of 26, he published two papers (both in the Physical Review) with George Gamow in which they explained the cause of the stellar collapse associated to the supernova phenomenon, called the URCA process. One year later he published another paper with Chandrasekhar about stellar evolution, known as the Schenberg-Chandrasekhar limit. In that paper they show that there is an upper limit (of ~10%) on the mass of hydrogen that can be exhausted before the star leaves the main sequence. Both are classic (and his only) works in astrophysics. He was also a politician, being elected for the São Paulo State House of Representatives in 1947.

After entering the university in 1970, I became a friend of Schenberg, visiting him many times and talking about his work in astrophysics. Why the name of URCA for the stellar collapse theory, I asked him? Well, he said, there is some speculation about it; some people say that it means "Ultra-Rapid CAtastrophe". "But this is not true", he said. "We named it after a Casino in Rio de Janeiro, which was at the Urca mountain, near the Sugarloaf". In the language of the native Indians, Urca means a "small boat". This Casino was very famous, at that time, because money used to disappear very quickly in its roulettes. Schenberg and Gamow proposed that the reason for the stellar collapse was that neutrinos escaped the center of a collapsing star, stealing a large amount of energy and allowing further collapse. They proposed that this was the cause of the explosion of supernovae (correctly) and novae (incorrectly).

In 1969 the military government forced Schenberg to a premature retirement, for his independent opinions and intellectual influence. For many years he was not allowed to even enter the university campus. He, then, became a well known critic of art. In January 1978 I invited him to deliver an opening talk in a summer course in Astronomy I had organized. That was the first time he returned to the university campus in 9 years. I remember driving him in my small VW Beetle on the way to the university and wondering about what might happen to both of us if the army would discover our adventure.

Although published in 1941, the URCA theory was only confirmed experimentally 46 years later, by the detection of a burst of neutrinos from the collapse of Supernova 1987A in the Large Magellanic Cloud. A journalist called me immediately after this detection, asking about its meaning. I suggested interviewing Schenberg, communicating him the news. Next day the journalist called me back saying that he talked to Schenberg but that he could not understand the meaning of the neutrino detection. Later I, sadly, realized that this was the sign of a long-lasting illness.

Nowadays casinos are forbidden in Brazil. The building of the Urca Casino will become an institute of design. The IAU-GA closing banquet, tonight, will be on a restaurant on top of the Urca hill.

JOÃO STEINER

JOURNALS ACCESS FOR DEVELOPING NATIONS

In science, access to peer-reviewed journals is a critical enabler for researchers. Because the process of publishing peer-reviewed articles has costs and most publishing is done in the developed world, access to the peer-reviewed literature can be unaffordable for institutions and individuals in many nations. Institutional subscription rates for astronomy journals range from a few hundred to several thousand dollars, while individual subscriptions can be a significant fraction of a monthly salary.

The American Astronomical Society and other publishers participate in a program called the Program for the Enhancement of Research Information (PERii) organized by an organization based in the United Kingdom, the Information Network for the Availability of Scientific Publications (INASP).

Although a central activity of PERii is to provide affordable access to journals, the program also helps scientists in developing countries write, publish and communicate their research.

Through partnerships with publishers and other organizations and with intellectual and financial contributions from the UK's Department for International Development (DFID), the Swedish International Development Cooperation Agency (Sida), the Norwegian Agency for Development Cooperation (NORAD), the Royal Danish Ministry of Foreign Affairs (RDMFA) and various foundations, PERii's goal is to allow countries to build up research capability through training, access to information and infrastructure development.

The Information Delivery component of PERii enables library consortia to select multidisciplinary resources from over 50 publishers and aggregators at very low rates. The negotiated content available includes:

- Over 25,000 online journals
- Over 11,000 ebooks
- Citation and bibliographic databases
- Document delivery from the British Library

Among the astronomy journals currently available are the Astrophysical Journal (including Letters), Astronomical Journal, Monthly Notices of the Royal Astronomical Society, Annual Reviews, many journals from Springer (such as the Astronomy and Astrophysics Review and Astrophysics and Space Science) and many others.

INASP supports and negotiates access to online resources in developing and emerging countries for a range of institutions, including university departments, university libraries, not-for-profit research institutions and centers, higher education institutions, colleges, polytechnics, non-government organisations (NGOs) as well as parliamentary libraries and government offices.

If you want to see the list of resources that eligible institutions in your country may access or are not sure whether you are eligible to access a resource please visit the INASP web page (http://www.inasp.info) and contact the designated Country Coordinator for your country. Alternatively you can contact INASP by e-mail at inasp@inasp.info.

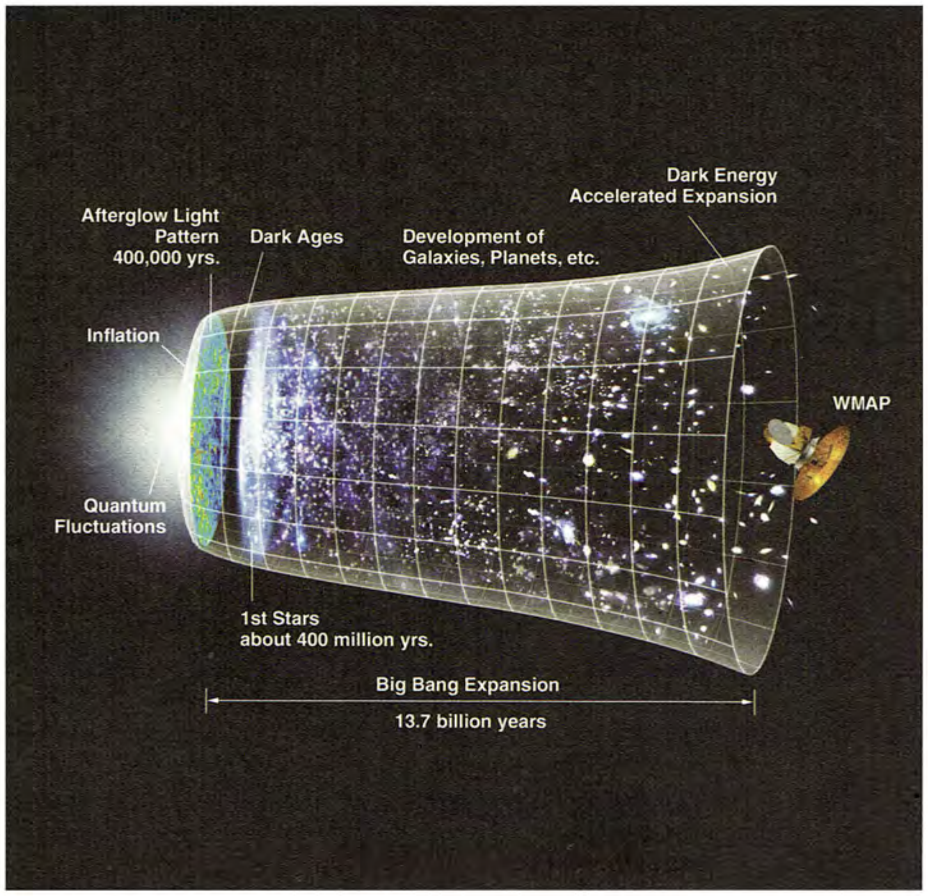
KEVIN B. MARVEL

Look what **happened** when I played with an **Equation!** That there was **no Big Bang?**

I was a student at the Yerkes Observatory in the 1950s where Chandrasekhar was a great teacher. In his course, he came to an equation in stellar structure, the derivation had taken seven pages, and there was something special about him and that equation, some feeling of *awe*. Frank Shu referred to it in his famous textbook as "... one of the most beautiful and important formulae in all of theoretical astrophysics...".

But no one *did* anything with it. The time was not ripe; we had to wait for large telescopes and powerful spacecraft to deliver essential information about our universe, which began in 1989 with the Cosmic Background Explorer COBE, and was followed by the Wilkinson Microwave Anisotropy Probe WMAP in 2001.

While there is a non-specific literature regarding parallel or many universes, one can quickly recognize that the multiverse is controlled by Chandra's equation. Their masses are all the same, and their physics is the same unified quantum, relativity, gravity, and atomic physics of our universe. It functions as a system of Darwinian *evolution* having the relatively long periods and statistics that Darwin had for his finches and people, but that are lacking in the Big-Bang modeling because of the rapidly changing conditions due to the expansion of intergalactic space.



NASA/WMAP Science Team

How did our universe originate from that system? The second part of this discussion is based on observations of star formation and the interstellar medium (ISM), scaled up by a factor of 10^{19} for consideration of the inter-universal medium (IUM). This history of our universe relies on observations. Everything ages and decays in our environment; even the proton may have a limited half-life. The decay debris of all universes travels on the *accelerated expansion* of their intergalactic space into the IUM, such that new universes will have uniform material, with small variations due to galactic clustering. The uniformity and galactic clustering appear in 3-K-background observations. This indicates that the temperature of the proto-universe was kept down enough so that earlier galaxy and particle characteristics were not melted away. And that in turn is explained by the gravitational compression energy being used for re-energizing and re-combining the debris. There is a supply, which the Big Bang did not have, and with the crucial difference that it is no longer the young and active material of hydrogen and other atoms, but it is the totally different old and cold debris; it is inert material.

This is therefore energy seeking material. Energy that would normally heat the material in star formation is now being absorbed and used. The proto-universe can therefore grow in mass without getting as hot as a proto-star would, and this is possible because the gravitational energy is used to re-energize and to re-constitute the debris into regular photons, protons, and neutrons.

Our universe originated at a much later and further developed stage than that of the Big Bang. It began with photons, protons, and neutrons some 10^{37} Planck times later than the Big Bang would have, that is at $t \sim 10^{-6}$ s on the standard clock, the time when the space density was that of the proton, 10^{18} kg m^{-3}.

A detailed paper is linked to www.lpl.arizona.edu/faculty/gehrels.html.

Tom Gehrels

Brazil and the **IAU** (1919-1931)

If it is true that scientists are internationalists by heart, and due to their practical needs, astronomers played a unique role in the creation of the first international agency for continuous scientific cooperation. The International Research Council (IRC) was formed in July 1919, although its preliminary meetings started even before the end of the First World War. And not by chance one of the first disciplinary Unions resulting from this initiative was the IAU.

Brazil was among the first countries to be admitted in the IRC and the IAU, on account of its participation in the war alongside the Allied Powers. By that time the general concern of Brazilian diplomacy was the country's positioning within the new geopolitical order, which diplomats and statesmen believed could be strengthened by means of the involvement in the League of Nations and its various agencies. Indeed, the government sent Henrique Morize, then Director of the National Observatory and President of the National Academy of Sciences, as the Brazilian delegate in two decisive meetings, respectively the First General Assembly of the IAU, held in May 1922, and the Extraordinary Assembly of the IRC, held in 1926.

But the more significant contribution of Brazil to the international cooperation in Astronomy during the years between the wars was given in the realm of science, not politics. From 1924 to 1931 Lelio Gama, a young Brazilian astronomer working at the National Observatory, conducted regular observations of 96 pairs of stars. The observations aimed at contributing to the IAU Commission n. 19, at the time called "Variation of Latitude" and now updated to "Rotation of the Earth", and despite their early unintentional interruption they were highly praised by Hisashi Kimura, President of the Commission.

Christina Helena Barboza and Raquel dos Santos Oliveira

PROPOSALS FOR RESOLUTIONS TO BE SUBMITTED TO THE **IAU XXVII GENERAL ASSEMBLY**

The Executive Committee has received the following Resolutions to be submitted to the vote of the Individual Members of the International Astronomical Union in the Second Session of the IAU XXVII General Assembly in Rio de Janeiro, Brazil, 13 August 2009.
Karel A. van der Hucht, General Secretary
International Astronomical Union – Union Astronomique Internationale
98bis bd Arago, F-75014 Paris, France

RESOLUTION B1
on

IAU Strategic Plan:
Astronomy for the Developing World

Proposed by: the IAU Executive Committee

The XXVII General Assembly of the International Astronomical Union,

recognizing

1. the goal of the IAU to encourage the development of astronomy and facilitate better understanding of the universe,

2. that the current activities of the International Year of Astronomy 2009 have made great strides in advancing knowledge of astronomy among citizens of all nations and awareness of its value to society,

3. that science education and research is an essential component of modern technological and economic development,

therefore resolves that the IAU should

1. place increasing emphasis on programs that advance astronomy education in developing countries,

2. approve the goals specified in the Strategic Plan "Astronomy for the Developing World" as objectives for the IAU in the coming decade.

3. assess programs undertaken during the IYA to determine which activities are most effective in advancing astronomy.

***

RESOLUTION A1
on

Implementing the IAU Strategic Plan

Proposed by: the IAU Executive Committee

The XXVII General Assembly of the International Astronomical Union,

recognizing

1. the goal of the IAU to encourage the development of astronomy and facilitate better understanding of the universe,

2. that the current activities of the International Year of Astronomy 2009 have made great strides in advancing knowledge of astronomy among citizens of all nations and awareness of its value to society,

3. that science education and research is an essential component of modern technological and economic development,

4. Resolution B1 adopting the IAU Strategic Plan passed by the XXVII General Assembly,

therefore resolves that the IAU should

1. give high priority to supporting the development of astronomy infrastructure in emerging nations,

2. proceed with the implementation of the IAU Strategic Plan through the creation of a Global Development Office and seek additional resources for implementing the plan.

***

RESOLUTION B2
on

IAU 2009 astronomical constants

Proposed by:
IAU Division I WG Numerical Standards of Fundamental Astronomy
Supported by: Division I

Proposer:
Brian J. Luzum <brian.luzum@usno.navy.mil>
Seconder:
Nicole Capitaine <nicole.capitaine@obspm.fr>
Seconder:
Dennis McCarthy <dmc@usno.navy.mil>

1. The XXVII General Assembly of International Astronomical Union,

considering

1. the need for a self-consistent set of accurate numerical standards for use in astronomy,

2. that improved values of astronomical constants have been derived from recent observations and published in refereed journals, and

3. that conventional values have been adopted by IAU GA 2000 and IAU GA 2006 resolutions for a number of astronomical quantities,

recognizing

1. the continuing need for a set of Current Best Estimates (CBEs) of astronomical numerical constants, and

2. the need for an operational service to the astronomical community to maintain the CBEs

recommends

1. that the list of previously published constants compiled in the report of the Working Group on Numerical Standards of Fundamental Astronomy (see http://maia.usno.navy.mil/NSFA/CBE.html) be adopted as the IAU (2009) System of Astronomical Constants.

2. that Current Best Estimates of Astronomical Constants be permanently maintained as an electronic document,

3. that, in order to ensure the integrity of the CBEs, IAU Division I develop a formal procedure to adopt new values and archive older versions of the CBEs, and

4. that the IAU establish within IAU Division I a permanent body to maintain the CBEs for fundamental astronomy.

***

RESOLUTION B3
on

the Second Realization of the International Celestial Reference Frame

Proposed by: IAU Division I WG on the Second Realization of the International Celestial Reference Frame

Supported by: IAU Division I

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Ralph A. Gaume <rgaume@usno.navy.mil >
Seconder:
Chopo Ma <chopo.ma@nasa.gov>

The International Astronomical Union XXVII General Assembly,

noting

1. that Resolution B2 of the XXIII General Assembly (1997) resolved "That, as from 1 January 1998, the IAU celestial reference system shall be the International Celestial Reference System (ICRS)",

2. that Resolution B2 of the XXIII General Assembly (1997) resolved that the "fundamental reference frame shall be the International Celestial Reference Frame (ICRF) constructed by the IAU Working Group on Reference Frames",

3. that Resolution B2 of the XXIII General Assembly (1997) resolved "That IERS should take appropriate measures, in conjunction with the IAU Working Group on reference frames, to maintain the ICRF and its ties to the reference frames at other wavelengths",

4. that Resolution B7 of the XXIII General Assembly (1997) recommended "that high-precision astronomical observing programs be organized in such a way that astronomical reference systems can be maintained at the highest possible accuracy for both northern and southern hemispheres",

5. that Resolution B1.1 of the XXIV General Assembly (2000) recognized "the importance of continuing operational observations made with Very Long Baseline Interferometry (VLBI) to maintain the ICRF",

recognizing

1. that since the establishment of the ICRF, continued VLBI observations of ICRF sources have more than tripled the number of source observations,

2. that since the establishment of the

ICRF, continued VLBI observations of extragalactic sources have significantly increased the number of sources whose positions are known with a high degree of accuracy,

3. that since the establishment of the ICRF, improved instrumentation, observation strategies, and application of state-of-the-art astrophysical and geophysical models have significantly improved both the data quality and analysis of the entire relevant astrometric and geodetic VLBI data set,

4. that a working group on the ICRF formed by the International Earth Rotation and Reference Systems Service (IERS) and the International VLBI Service for Geodesy and Astrometry (IVS), in conjunction with the IAU Division I Working Group on the Second Realization of the International Celestial Reference Frame has finalized a prospective second realization of the ICRF in a coordinate frame aligned to that of the ICRF to within the tolerance of the errors in the latter (see note 1),

5. that the prospective second realization of the ICRF as presented by the IAU Working Group on the Second Realization of the International Celestial Reference Frame represents a significant improvement in terms of source selection, coordinate accuracy, and total number of sources, and thus represents a significant improvement in the fundamental reference frame realization of the ICRS beyond the ICRF adopted by the XXIII General Assembly (1997),

resolves

1. that from 01 January 2010 the fundamental astrometric realization of the International Celestial Reference System (ICRS) shall be the Second Realization of the International Celestial Reference Frame (ICRF2) as constructed by the IERS/IVS working group on the ICRF in conjunction with the IAU Division I Working Group on the Second Realization of the International Celestial Reference Frame (see note 1),

2. that the organizations responsible for astrometric and geodetic VLBI observing programs (e.g. IERS, IVS) take appropriate measures to continue existing and develop improved VLBI observing and analysis programs to both maintain and improve ICRF2,

3. that the IERS, together with other relevant organizations continue efforts to improve and densify high accuracy reference frames defined at other wavelengths and continue to improve ties between these reference frames and ICRF2.

Note 1: The Second Realization of the International Celestial Reference Frame by Very Long Baseline Interferometry, presented on behalf of the IERS / IVS Working Group, Alan Fey and David Gordon (eds.). (IERS Technical Note; 35) Frankfurt am Main: Verlag des Bundesamts für Kartographie und Geodäsie, 2009. See <www.iers.org/MainDisp.csl?pid=46-25772> or <hpiers.obspm.fr/icrs-pc/> .

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RESOLUTION B4
on

Supporting Women in Astronomy

Proposed by: the EC WG IYA Task Group *She is an Astronomer*
Supported by: the EC WG *Women in Astronomy*

The following persons will be available for consultation and, if necessary to speak on the above resolution at the General Assembly on 13 August 2009:

Proposer:
Helen J. Walker <helen.walker@stfc.ac.uk>
Seconder:
Sarah T. Maddison <smaddison@swin.edu.au>

The International Astronomical Union XXVII General Assembly,

recalling

1. the UN Millennium Development Goal 3: promote gender equality and empower women,

2. the IAU/UNESCO International Year of Astronomy 2009 goal 7: improve the gender-balanced representation of scientists at all levels and promote greater involvement by underrepresented minorities in scientific and engineering careers,

recognizing

1. that individual excellence in science and astronomy is independent of gender,

2. that gender equality is a fundamental principle of human rights,

considering

1. the role of the IAU Working Group for Women in Astronomy,

2. the role of the IYA2009 Cornerstone Project She is an Astronomer,

resolves

1. that IAU members should encourage and support the female astronomers in their communities,

2. that IAU members and National Representatives should encourage national organisations to break down barriers and ensure that men and women are given equal opportunities to pursue a successful career in astronomy at all levels and career steps.

***

RESOLUTION B5
in

Defence of the night sky and the right to starlight

Proposed by: IAU EC WG IYA2009 Cornerstone Project Dark Skies Awareness and the members of the Starlight Declaration
Supported by: IAU Division XII/ Commission 50 WG Controlling Light Pollution

The following persons will be available for consultation and, if necessary to speak on the following resolution at the General Assembly on 13 August 2009:

Proposer:
Richard J. Wainscoat <rjw@ifa.hawaii.edu>
Seconder:
Malcolm G. Smith <msmith@noao.edu>

The International Astronomical Union XXVII General Assembly,

recalling

1. the IAU/UNESCO International Year of Astronomy 2009 goal 8: facilitate the preservation and protection of the world's cultural and natural heritage of dark skies in places such as urban oases, national parks and astronomical sites,

2. the Declaration approved during the International Conference in Defence of the Quality of the Night Sky and the Right to Observe Stars (La Palma, Canary Islands, 2007),

recognising that

1. the night sky has been and continues to be an inspiration of mankind, and that its contemplation represents an essential element in the development of scientific thought in all civilisations,

2. the dissemination of astronomy and associated scientific and cultural values should be considered as basic content to be included in educational activities,

the view of the night sky over most of the populated areas of the Earth is already compromised by light pollution, and is under further threat in this respect,

3. the intelligent use of unobtrusive artificial lighting that minimises sky glow involves a more efficient use of energy, thus meeting the wider commitments made on climate change, and for the protection of the environment,

4. tourism, among other players, can become a major instrument for a new alliance in defence of the quality of the nocturnal skyscape,

considering

1. the role of the IAU Division XII Commission 50 and its WG Controlling Light Pollution,

2. the role of the IYA2009 Cornerstone Project Dark Skies Awareness,

resolves that

1. An unpolluted night sky that allows the enjoyment and contemplation of the firmament should be considered a fundamental socio-cultural and environmental right, and that the progressive degradation of the night sky should be regarded as a fundamental loss,

2. Control of obtrusive and sky glow-enhancing lighting should be a basic element of nature conservation policies since it has adverse impacts on humans and wildlife, habitats, ecosystems, and landscapes,

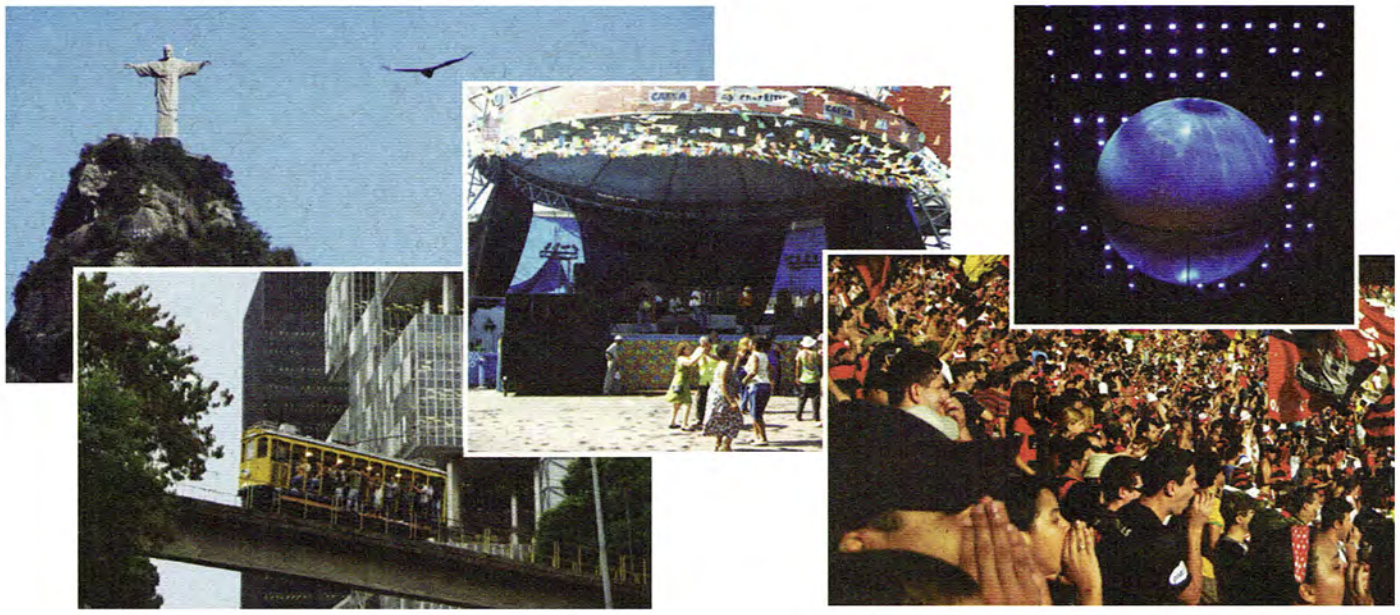
3. Responsible tourism, in its many forms, should be encouraged to take on board the night sky as a resource to protect and value in all destinations,

4. IAU members be encouraged to take all necessary measures to involve the parties related to skyscape protection in raising public awareness – be it at local, regional, national, or international level – about the contents and objectives of the International Conference in Defence of the Quality of the Night Sky and the Right to Observe Stars [http://www.starlight2007.net/], in particular the educational, scientific, cultural, health and recreational importance of preserving access to an unpolluted night sky for all mankind,

further resolves that

Protection of the astronomical quality of areas suitable for scientific observation of the Universe should be taken into account when developing and evaluating national and international scientific and environmental policies, with due regard to local cultural and natural values.

WHAT DID ASTRONOMERS DO OVER THE WEEKEND?



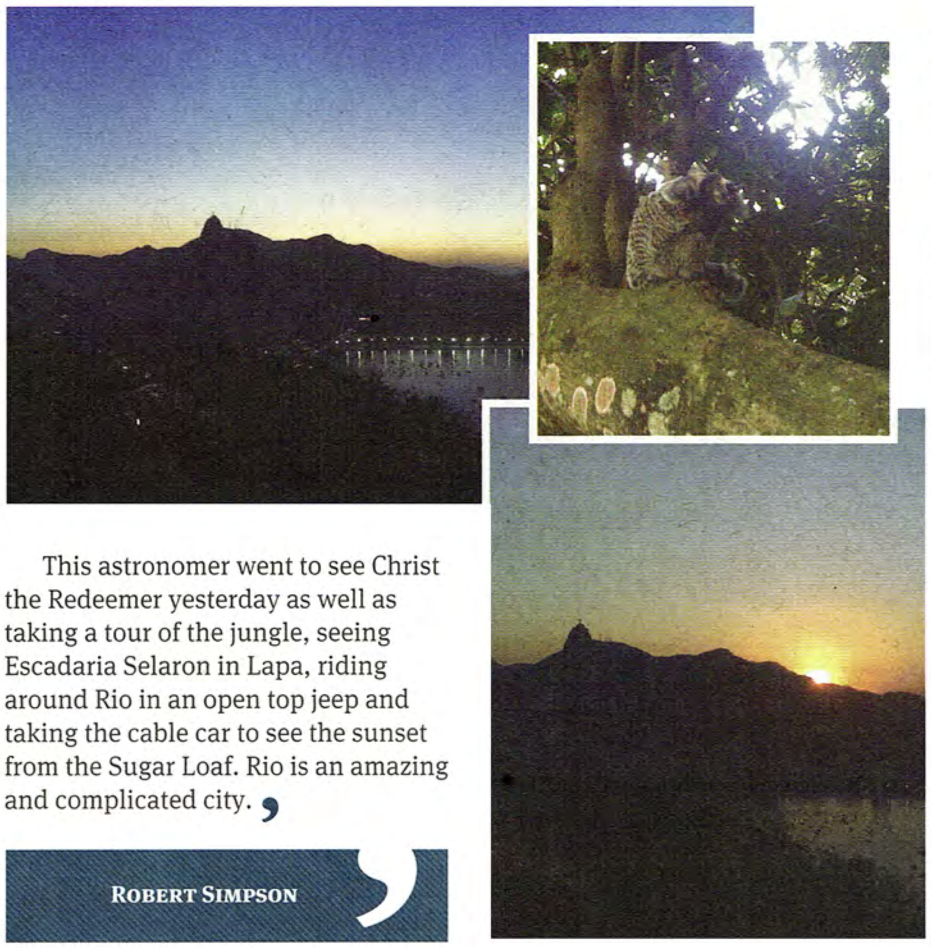
Some views of my weekend in Rio. (1) Learning to fly from Corcovado, first lesson... (2) The "bondinho" (affectionately "little tram") is the last existing tramway. Seated tickets are very cheap. Standing up on the footboard was permitted, and free, though slightly more risky... (3) Nordeste went south at Sao Cristovao market, with music and dance. (4) The "Oi Futura" exhibition should rather be renamed "Eyed Futura". (5) But, this weekend, THE real event was at Maracana: Flamengo against Corinthians. Rio won!

FRÉDÉRIC ARENOU

My activity this past weekend may have been unique. I did Nothing. After the hectic preparations involved in getting away, I needed relief from pressure. The overload of information acquired during the first GA week needed time to digest, much as does a large meal. I took no camera with me on this negative expedition to Nothingness, but in my imagination it was just like a black hole, only rectangular. A certain amount of energy went towards it but nothing emanated from it, so there is nothing to show what Nothingness was like. Only its effects were felt, and my conclusion is that I should do Nothing much more often.

Yet I was not idle; that would have been boring. I shopped for food, did the laundry and several other tasks which the working mother absorbs in her daily round as naturally as breathing, I read a non-astronomical book and I sauntered around part of Rio in order to absorb the atmosphere, but all in a re-creative mood. Doing Nothing was inscribed into the basic Law for Life, and it is a fallacy to think that we can disregard it and still grow and flourish. Observance of the Sabbath made sense by building an obligatory pause into our otherwise endless cycles. Nothingness is warmly recommended.

ELIZABETH GRIFFIN



This astronomer went to see Christ the Redeemer yesterday as well as taking a tour of the jungle, seeing Escadaria Selaron in Lapa, riding around Rio in an open top jeep and taking the cable car to see the sunset from the Sugar Loaf. Rio is an amazing and complicated city.

ROBERT SIMPSON

What I did in Rio? I took the morning bus to Teresópolis, got off at the entrance to the National Park Serra dos Órgãos, paid the fees, and started a gentle but steady ascend. The trail, except for the upper part, led through a dense forest. After five hours of walking, I finally reached the top of Pedra do Sino, the highest mountain of this rugged range (2,263 meters above sea level). The effort was rewarded by beautiful views on monumental rocky towers, deep green valleys, and, in the distance, the Guanabara Bay, Corcovado, and Rio de Janeiro. Some Brazilian tourists brought tents with them, but I had to go back. When I was leaving the park, the Southern Cross was already shining above the trees.

JIRI BOROVICKA

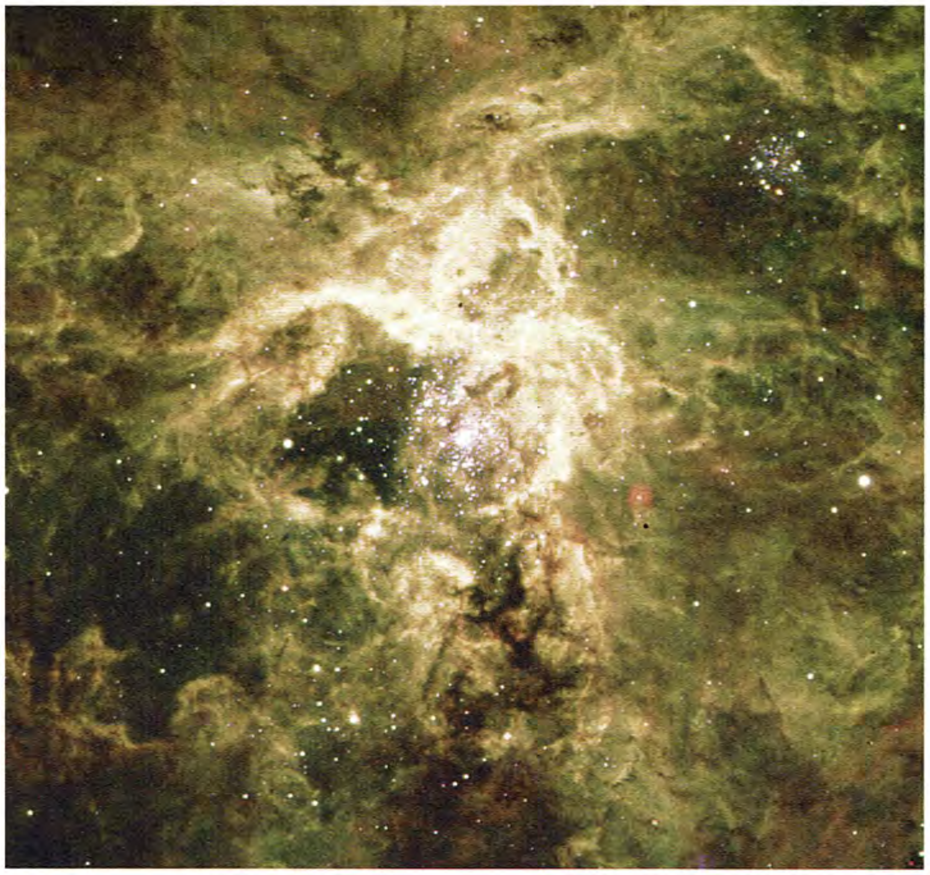
Dissecting the Tarantula

The dramatic Tarantula Nebula in the Large Magellanic Cloud (LMC) is a dense stellar nursery, with hundreds of massive stars in the central 100pc, giving us our closest view of a small-scale starburst in the local Universe. An international consortium, led by Dr. Christopher Evans from the Royal Observatory in Edinburgh, has been using the Very Large Telescope (VLT) in northern Chile to study the massive star population in the Tarantula.

With a total of 160 hours of VLT observations, the team has used the multi-object FLAMES instrument to obtain high-quality spectroscopy of over 1,000 massive stars in the Tarantula region. The resulting spectra will be compared with state-of-the-art theoretical calculations to obtain the physical parameters and chemical compositions of each star. One of the most novel aspects of the survey is that each star is observed with FLAMES at six separate epochs to provide a thorough check for binary companions. The VLT spectra will also be complemented by photometric monitoring from the Faulkes Telescope South as part of their schools education programme in the coming year, enabling rigorous analysis of the identified binary systems and characterisation of emission-line stars.

Armed with such an extensive and unprecedented sample of the most massive stars, the Tarantula Survey will provide answers to some of the most fundamental questions in stellar astrophysics, such as the role of stellar rotation in chemical enrichment, the binary fraction of massive stars, the plausibility of long-duration gamma-ray bursts in the reduced metallicity of the LMC, and the dynamical evolution of this intricate and beautiful cluster, while also providing us with an ideal template with which to investigate dense regions of star formation in distant galaxies.

Christopher Evans



A new era for globular clusters in M31

Since the Hubble's heroic work in 1932, numerous studies on the survey of the globular clusters in M31, the great spiral galaxy in Andromeda, came out. Yet these surveys were based on photographs or small-field CCD images, and many globular clusters in M31 remain to be discovered.

Recently we finished a wide field survey of the globular clusters covering the 3° x 3° field of M31, using CCD images obtained at the KPNO 0.9 m and the spectra taken with the Hydra multi-fiber spectrograph at the WIYN 3.5 m.

We found 113 new globular clusters and 258 probable globular clusters, and confirmed 383 globular clusters known in previous studies.

Combining our results with those in the literature we produced a master catalog of 504 globular clusters with velocity data. This is the first survey of the entire M31 based on CCD imaging, opening a new era for the field.

The existence of a halo in M31 has been controversial. From the analysis of the kinematic data we showed that there is indeed a dynamically hot halo, rotating but primarily pressure-supported. We derived a dynamical mass of 2 x $10^{12}\ M_\odot$ for a radius of 100 kpc. We also found that not only the metal-rich globular clusters but also the metal-poor globular clusters show strong rotation in the inner region. In addition, we have identified 50 friendless globular clusters, which have probably a different origin from the other globular clusters.

The existence of the rotating metal-rich central bulge, the radial metallicity gradient, and the extended smooth metal-poor halo in M31 can be explained by a rapid dissipative collapse of a proto-Galactic cloud, while the extended bulge, substructures and friendless globular clusters are evidence for accretion and merging of small scale filaments.

Myung Gyoon Lee, Hong Soo Park, Ho Seong Hwang, Sang Chul Kim, Doug Geisler, Ata Sarajedini, and William Harris

The Lithium History of NGC 6397

The WMAP+SBBN-inferred primordial Li abundance is a factor of three higher than the plateau value measured in old metal-poor PopII stars, suggesting that these stars have undergone photospheric depletion. In order to constrain the physics responsible for such depletion one needs to establish the behaviour of surface Li abundance with stellar effective temperature and evolutionary phase. Globular clusters are ideal objects as relative stellar parameters can be precisely determined.

We conducted a homogeneous analysis of a large sample of stars (~300) in the metal-poor globular cluster NGC 6397, covering all evolutionary phases. NLTE Li abundances (or upper limits) are obtained for all stars, and for a size-able subset we also infer Na abundances. The Na data are used to discriminate between stars formed out of pristine and polluted material.

In our results, hot dwarfs appear slightly more Li-poor than cool dwarfs, which may indicate the presence of the so-called Li dip. Although weak, this feature, common to PopI stars, is seen here for the first time in a globular cluster.

A considerably large spread in Na abundance confirms that NGC 6397 has suffered from intra-cluster pollution in its infancy and a limited number of Na-rich and Li-poor stars contributes to form a significant Na-Li anti-correlation. It is nevertheless seen that the Li abundances are unaffected by relatively large degrees of pollution. By comparing our Li abundance trends to predictions from stellar structure models including atomic diffusion and ad-hoc turbulence below the convection zone, we confirm i) that some turbulence, with strict limits to its efficiency, is necessary to explain the observations; and ii) the onset of thermohaline mixing in globular cluster stars at the luminosity bump.

F. Primas, K. Lind, C. Charbonnel, F. Grundahl, M. Asplund

COMPARING SOLAR ACTIVITY MINIMA TO CHARACTERIZE THE HELIOPHYSICAL "GROUND STATE"

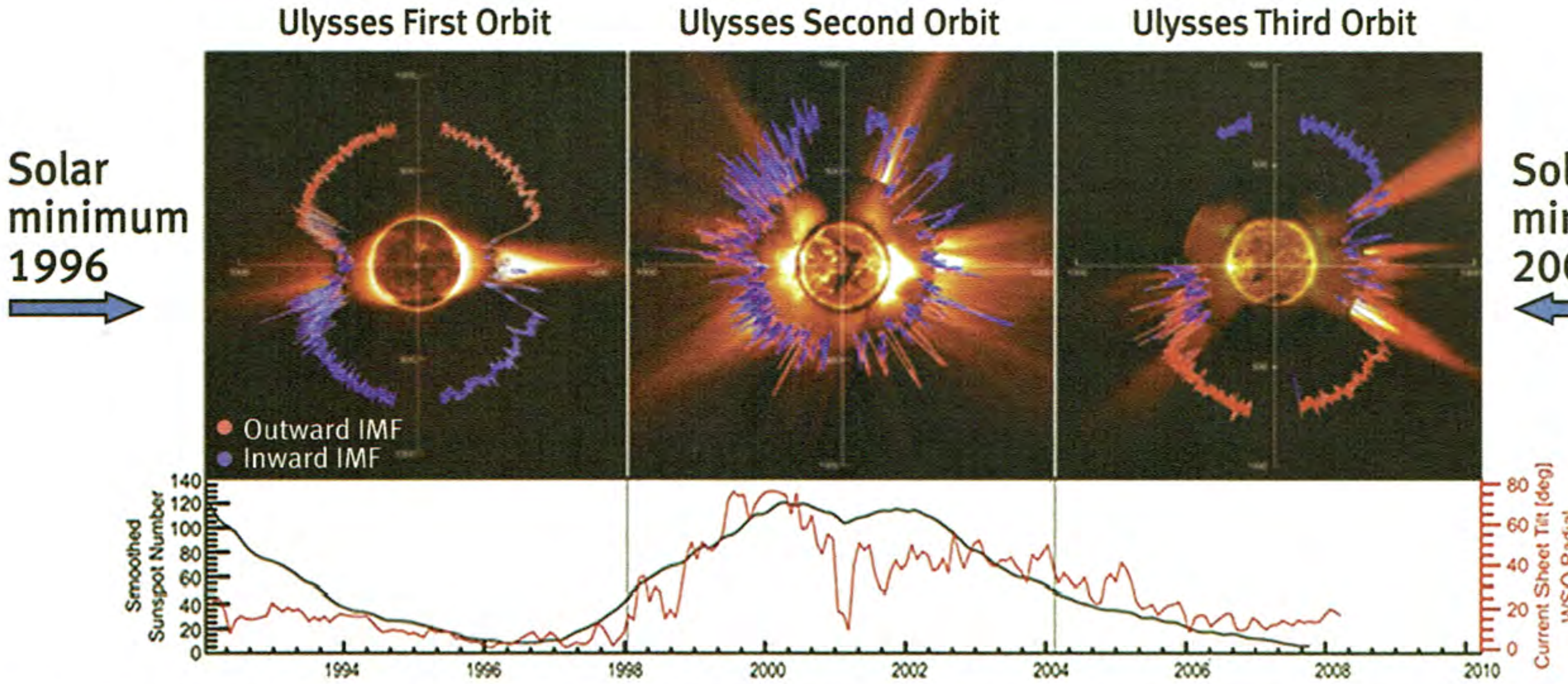
The solar activity cycle, manifested by repeated increases then decreases in the number of sunspots visible on the Sun, has been observed and studied for centuries. However, only for the past two to three ~11-year activity cycles have new capabilities in satellite and ground-based observations allowed us to study how a broad range of solar, heliospheric, and geospace observables vary within and between cycles. Solar minimum represents the time of lowest solar activity and simplest heliospheric structure, and as such is a good place to begin putting together such a system-wide understanding. However, the current solar cycle minimum is very quiet and extended, with the sunspot number dropping to its lowest values in at least 75 years. Also, the current total solar output (irradiance) is lower than the value of the past two solar minima, and the solar wind density and magnetic field strength are at the lowest values observed since the dawn of the space age. Determining the solar origins and net impacts at the Earth of solar minimum differences will require coordinated, interdisciplinary modeling efforts to bring the pieces together.

The current and last cycle minima were well-studied via international observational and modeling campaigns known as the Whole Sun Month (WSM - 1996) and the Whole Heliosphere Interval (WHI – 2008; http://ihy2007.org/WHI/). The goals of these campaigns have been to characterize the 3-D solar minimum heliosphere and to trace the effects of solar structures and activity through the solar wind to the Earth and other planetary systems. The modus operandi of both WHI and WSM has been to coordinate comprehensive observations of the global heliosphere near solar minimum, including focused, quantitative observations designed to provide constraints on models of the Sun-Earth coupled system.

We are forming a new IAU Working Group within Division II (Solar and Heliosphere) to coordinate international and interdisciplinary research of variations within and between solar minima, how these originate at the Sun and extend through the heliosphere, and how they impact the Earth. The goals of the WG are to archive and make accessible data and publications from these periods, coordinate research, and provide an infrastructure that can be extended to include observations and models from past and future solar cycles.

These topics will be discussed in the context of the WHI Campaign in Joint Discussion 16 here at the GA from Wed., August 10 to Friday, August 12 in Room 4. Results from the WHI period will be discussed, compared and contrasted with those from WSM and other solar cycles. One focus will be on variations between solar minima, and how we can improve understanding of how such variations arise. Come to JD16 to learn about the solar activity variations of our nearest star – the Sun!

DAVID WEBB



THREE IMAGES SUMMARIZING THE SOLAR WIND SPEED VS LATITUDE OBSERVED BY ULYSSES IN ITS SOLAR POLAR ORBIT OVER 2 SOLAR MINIMA AND THE LAST MAXIMUM (MIDDLE). BOTTOM PLOTS SHOW THE SUNSPOT NUMBER (BLACK) AND HELIOSPHERIC CURRENT SHEET TILT (RED) OVER THIS TIME. NOTE THE DIFFERENCES BETWEEN THE 2 MINIMA.

THE ISM OF GALAXIES IN THE FAR-INFRARED AND SUB-MILLIMETRE

JD14, Far Infrared 2009, aims to bring together astronomers who are interested in the great new facilities becoming available in the submillimetre and far-infrared, and what they can tell us about the interstellar medium in galaxies. Some, such as the Spitzer Space Telescope, are already working. Some, such as Herschel and ALMA, are soon to be working, but all bring the promise of transforming our understanding of the ISM in galaxies, and its relationship to star formation.

JD14 is being held in the second week, between 12th to 14th August. We aim to have a vigorous discussion, where we review the state of our knowledge of the ISM in galaxies now, and plan how best to proceed from the point of view of both observations and theory, to exploit the new instruments. JD14-FIR2009 covers topics ranging from interstellar chemistry, the role of turbulence, triggering, feedback and magnetic fields in regulating star formation to the properties of star forming galaxies at high redshift. This meeting is the third in a series to discuss far-infrared and submillimeter emission of the interstellar medium from the Milky Way and other galaxies. FIR2007 was held in Bad Honef, Germany, while FIR2005 took place in Onsala, Sweden. Check out our website:

http://www.phys.unsw.edu.au/IAUJD14/programme.html

MARIA CUNNINGHAN

ESTRELA D'ALVA
The Morning Star
IAU XXVII GENERAL ASSEMBLY
AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 09
THURSDAY, AUGUST 13th, 2009

A FUTURE OF MULTIPLE EARTHS

ARTIST'S CONCEPT OF A PLANET AROUND GLIESE 581, A RED DWARF. ORBITING INSIDE THE SO-CALLED HABITABLE ZONE, IT IS POSSIBLY THE EXTRASOLAR BODY MOST SIMILAR TO EARTH DISCOVERED UNTIL NOW.

Since the first extrasolar planet was discovered, the greatest challenge was to improve detection techniques in order to find lower mass bodies – Earth analogues, so to speak. It appears the technology is reaching that critical mass, and in two years time we may be finding out about the first Earth-mass planets, using the most traditional planet hunting method, radial velocities measurements.

This perspective was presented at the IAU General Assembly by Michel Mayor, the Geneva Observatory astronomer who was responsible for the detection of the first exoplanet ever found, around 51 Pegasi, in 1995.

Since then, he and his collaborators have claimed the discovery of over 150 planets orbiting other stars, many of them composing multiplanet systems. Last Monday, in a crowd-packed auditorium, Mayor highlighted the fact that, in spite of some still existing observational biases, it is becoming increasingly clear that planets with masses much lower than Jupiter's are quite common in the Universe.

That's good news for astrobiology, of course, and that's why his talk was part of Special Session 6, "Planetary Systems as Potential Sites for Life." Chaired by Régis Courtin, the event was a two-day effort in allowing the diverse community currently studying the possibilities of extraterrestrial life a chance to catch up on what is going on. Mayor, for instance, revealed a newly began project to look for low mass planets around some of the closest stars to our Sun, including alfa Centauri B.

But that's just about radial velocity research. As pointed out by David Bennett, from University of Notre Dame, when it comes to microlensing – a gravitational effect predicted by Einstein's General Relativity that can be used as a way of finding planets – the bias is to the opposite side of that of radial velocities. According to Bennett, it is much easier to find planets positioned farther away from the parent star, with much larger periods, than the ones closer to it, which show up more clearly in radial velocity measurements.

Only a handful of planets have been detected using this method so far, but the expectations for the future are high, especially when a space platform becomes available. Bennett and collaborators are pushing now for the Microlensing Planet Finder (MPF), a Discovery-class space mission that they hope could be done under NASA's auspices. They could very well detect Earth-like planets, in Earth-like orbits.

There's also high expectations for the two current space planet finders, that are using transit observing techniques. The French/European/Brazilian CoRoT mission and the American Kepler satellite can in principle pinpoint many low-mass planets in the coming years. In fact, the CoRot team has reported success in detecting its first 'Super-Earth' planet – an intermediate class of objects, between terrestrial and giant planets, that has no analogue in the Solar System.

The Kepler group, on the other hand, has just presented a gorgeous measurement that allows for the detection not only of a planet's transit, but for its phases as well. A very good beginning for those who wish to spectroscopically study the atmospheres of extrasolar planets – and, eventually, looking for signatures of life in them.

So, all in all, we're looking for very promising years in the field of extrasolar planets and, of course, the search for the answer of the mother of all questions: are we alone in the Universe?

SALVADOR NOGUEIRA

Message from the Incoming IAU President

The IAU is currently involved in two important initiatives that have long-term implications for the Union: the International Year of Astronomy, and the new strategic plan for the Union that deals with the worldwide development of astronomy. The IYA 2009 has been a great success in many countries, and it is now time to plan on how best to follow up IYA programs so increased awareness of astronomy results in a greater role for science in society.

The IAU Executive Committee is committed to policies and programs that serve the interests of members and the public. For example, we are currently debating the possibility of allowing Union-wide electronic voting on some issues, and also expanding the activities of the Union by establishing a global development office to coordinate activity associated with the strategic plan that has been presented at this General Assembly. These activities include some of the present Commission 46 outreach and education programs of visiting lectures, short course schools for graduate students, teacher training, and visits to government officials and university presidents to advocate astronomy programs. We plan to seek funds from private foundations as the world economy improves in order to expand these initiatives. At the same time, of course, we will continue our current activities in support of IAU symposia, regional meetings, and travel grants.

In all of these endeavors we seek the active involvement of you, the individual members. If you have ideas about, opinions on, or interest in any of the above efforts please approach members of the Executive Committee to let us know of your desire to participate or simply to point us in the right direction on any of these issues. We hope you have found the program and flow of ideas at this Rio General Assembly to be stimulating, and we look forward to seeing you in Beijing in three years.

Robert Williams

Eta Carinae seen by the Hubble Space Telescope

Flower arrangement inspired on Eta Carinae. The flower arrangements in the Convention Center, during the General Assembly, were made by Verônica Huziwara, who has a bachelor degree in Astronomy from the Federal University of Rio de Janeiro and a master degree in Astrophysics from the Observatório Nacional. Presently, she runs Tamar Flores at the Rio de Janeiro International Airport. For the GA, she designed several special arrangements inspired on popular images from the HST.

What we learned from Eta Carinae last January

Eta Carinae is one of the most luminous stars known. Based on its mass and high rotation, it is believed to be a Gamma-Ray progenitor. It is a great opportunity to study such an object in the local universe (at a mere 2.25 kpc from us!) and any effort to know its physical parameters is worthwhile.

The discovery that eta Car is a binary system opened an opportunity to measure the stellar masses. However, we don't know very much about the orbital and stellar parameters. We know that the secondary star is hotter and less evolved than the primary and their winds collide with great violence. The wind-wind collision zone collapses every 5.54-yr, during the periastron passage.

The prediction of a spectroscopic event for January 9, 2009 was a golden opportunity to measure the parameters of the wind-wind interaction and, maybe, to detect the secondary star. There where 10 ground based telescopes in the Southern Hemisphere, and all the spatial based telescopes monitoring the event at all wavelength ranges.

The data brought many new features, not yet reported before. All the spectral lines in the optical repeated the expected behavior through the minimum. In particular the HeII4686 emission line repeated the steep rise and fall in the month before the minimum, in fine agreement with the past cycle, including the sub-peaks. The local maximum, a month after the minimum, also seems to have repeated as before, what is puzzling when compared with the X-ray emission.

The X-ray light-curve passed through the minimum, following the previous cycles. The recovery phase, however, brought a big surprise. The minimum was expected to last for 3 months, but, was suddenly interrupted at the mid-point.

The light-curve returned to the normal post-minimum level. Did the wind-wind collision zone re-arranged earlier than expected? Is this because of a decrease in the primary star mass loss rate?

A huge amount of data, including spectra with high spatial and spectral resolution, is under analysis and may bring answers and unsuspected news. This will be the main subject of the JD13 meeting, "Eta Carinae in the Context of Most Massive Stars", scheduled for days 13th and 14th August.

Augusto Damineli

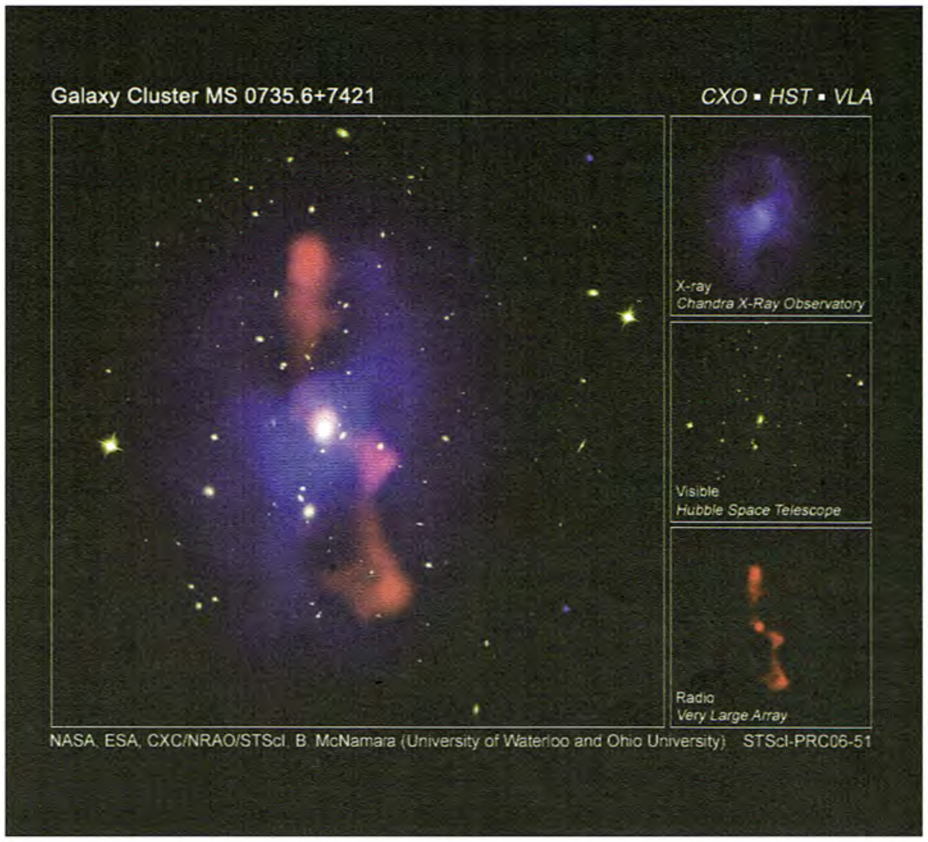
THE ROLE OF BLACK HOLES IN GALAXY FORMATION

The galaxy population in the nearby Universe seems to be governed by a "critical mass" which manifests itself in several different ways. For example, the number density of galaxies drops sharply above a stellar mass of a few x 10^{10} solar masses. At the present day, this mass also marks the transition between predominantly star-forming galaxies, disk-like, and massive red-and-dead galaxies, spheroidal. However, at high redshift, we observe star forming, disk-like galaxies above this mass scale.

Why are galaxies unable to grow much larger than this special mass today, and what process is responsible for quenching star formation in red-and-dead spheroids? A new picture is developing in which the supermassive black holes (BH) that dwell within galactic spheroids play a key role. In this picture, galaxy-galaxy mergers transform disks into spheroids, and also trigger accretion onto a central BH. The energy produced by the accreting BH eventually halts further accretion, limiting the growth of the BH itself, and drives large-scale winds that quench star formation. Once a massive BH has formed, low-level accretion produces giant radio jets, which heat any surrounding hot gas. Thus, star formation is shut off for galaxies that both have a massive BH and are accreting gas from a relatively diffuse hot halo.

At high redshift, gas tends to flow into galaxies along cold, dense filaments that are immune to heating by these jets, and a massive BH may not yet be in place. This may explain the apparent decrease of the galaxy critical mass over time (sometimes called "downsizing").

RACHEL SOMERVILLE



STAR FORMATION AND ACTIVE GALACTIC NUCLEI

Feedback from active galactic nuclei (AGN) is a key process in regulating star formation and generating the galaxies we see. Thanks to the combination of adaptive optics and integral field spectroscopy, we now realise that the converse is also true: star formation plays an important role in fuelling the AGN.

In nearby AGN, there is a young, kinematically distinct, stellar population in the central tens of parsecs. In the same region the molecular gas disk thickens and its column density increases. The implication is that we are seeing a star forming torus. Hydrodynamical simulations confirm our suggestion that fast and slow stellar outflows plays a crucial role in the evolution of the torus; they also show that gas streams in to form a compact turbulent disk on smaller scales, which one can perhaps identify with the structures detected by VLTI.

We have proposed a scenario in which the nuclear region passes through several phases, determined by the external mass accretion rate. After an initial starburst, supernovae expel the intercloud medium, leaving a disk dominated by dense cloud cores. Detailed analysis of several objects supports the predictions made by our model. We believe that we are now beginning to understand some of the key processes at work in these Seyfert galaxies: the importance of star formation and its role in the structure and evolution of the torus, and in fuelling the AGN.

RICHARD DAVIES

OBSERVING FEEDING AND FEEDBACK IN NEARBY AGN

Current observations suggest that most galaxies which possess a stellar bulge also harbor a supermassive black hole (SMBH) at their centers, which strongly affects the evolution of the galaxy. When the SMBH is fed with enough mass, we say that the galaxy has become "active", or that it harbors an Active Galactic Nucleus (AGN). The accretion flow also produces feedback observed as jets or winds. I have been studying these feeding and feedback processes via observations of nearby AGN using Integral Field Units (IFU) of the Gemini Telescopes.

Feedback - We have observed ionized gas outflowing at velocities of a few hundreds of km/s in the inner few hundred parsecs of nearby AGN, with typical outflow rates of 0.01 solar masses per year, which is 10 times the estimated nuclear accretion rate, implying that we are not directly observing the nuclear outflow, but entrainment of the ISM gas by this outflow. A new result, derived from channel maps extracted along the emission-line profiles, is the finding of high velocity gas close to the nucleus, which can explain the apparent acceleration observed outwards along the NLR in previous long-slit studies. This high velocity gas can be observed in channel map movies (see www.if.ufrgs.br/~thaisa/ifu_movies).

Feeding - We have mapped also an inflowing component along nuclear spirals and filaments in the galaxy plane. In the near-IR, the molecular gas kinematics is dominated by these inflows or by circular rotation in the plane, while the ionized gas kinematics is dominated by outflows along the NLR, suggesting that the molecular gas emission traces the AGN feeding and the ionized gas emission traces its feedback.

THAISA STORCHI BERGMANN

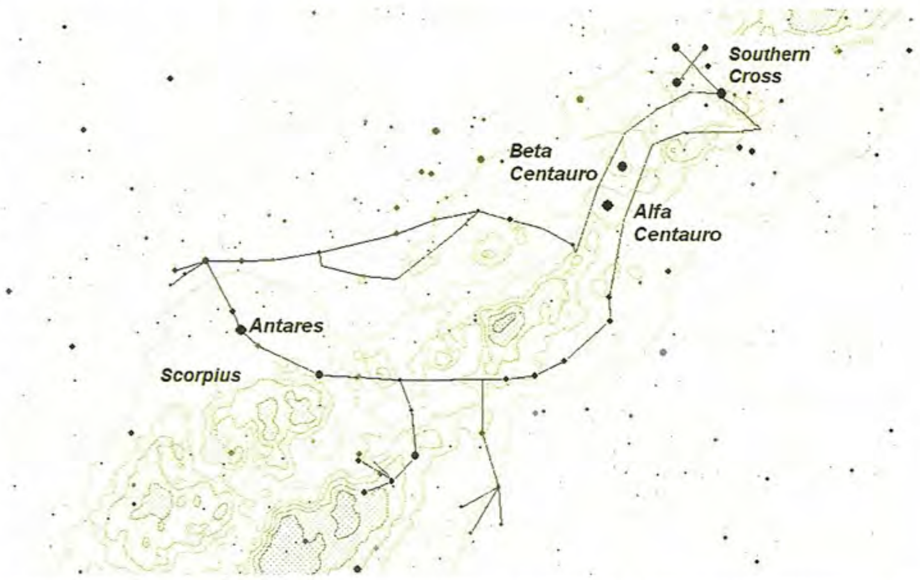
THE ASTRONOMY OF BRAZILIAN INDIANS

As in many ancient cultures, the main purpose of Brazilian indians' astronomy was the geographical orientation and the building of a calendar. According to father Claude d'Abbeville, who spent 4 months among the Tupinambá indians during 1612, "they attribute the influx and reflux of the sea to the Moon and recognize well the two high tides appearing after the full and new Moon". D'Abbeville published his findings 18 years before Galileo's "Dialogue of the two chief world systems" where the tides were atributed to the motion of the Earth disregarding the Moon effect.

The Brazilian indians also used the gnomon to study the apparent motion of the Sun, and were able to count the years with high precision by following the Sun's path between the tropics. At variance with the main western constellations, that are located along the ecliptic, the main indian constellations are distributed along the Milky Way. Indian constellations are formed not only by linking single stars but also some other features like dark clouds or star clusters. For example, the Large and Small Magellanic Clouds are considered contellations themselves, representing watering troughs where the Tapir and the Peccary drink.

The Brazilian indians identify more than 100 constellations (compared to the 88 officially recognized by the IAU), and believe that the sky is an imperfect copy of the Earth, so each animal here has its celestial counterpart. The two main constellations used by the Brazilian indians are the Southern Cross and the Pleiades. The first is used to measure the time during the night and to determine the location of the South Pole. The second helps to determine the beginning of the seasons. Other important constellations are the Hummingbird, the Old Man, the Pantanal Deer, and the Rhea.

GERMANO B. AFONSO



THE CONSTELLATION OF RHEA, THE AMERICAN OSTRICH. IT TRIES TO EAT TWO EGGS, REPRESENTED BY ALPHA AND BETA MUSCAE. ALPHA AND BETA CENTAURI REPRESENT TWO OTHER EGGS ALREADY EATEN.

WOMEN IN ASTRONOMY LUNCH

The Women in Astronomy Working Group held its third working lunch this week and over 240 people attended. The event was gratefully sponsored by the IAU and the US National Committee for Astronomy. Thank you to the local organisers for creating such a successful event, particularly Miriani Pastoriza. Two invited speakers, Duilia de Mello and Thaisa Storchi Bergmann, shared their experiences as Brazilian astronomers. The breakout discussions were vibrant and included the present, past and incoming Presidents of the IAU and many younger astronomers. A short Plenary session completed the event and all table notes were collected for a future report. Many participants were interested in presenting reports, which we could not include in the time available and a proposal for a 1-day Special Session at the next GA has been suggested.

Prior to the lunch, the business meeting of the WG was held. A report on the activities of the WG and an update on the She-is-an-Astronomer project of IYA were presented. Action was agreed to promote better gender balance at all IAU-sponsored meetings through stronger guidelines for the constituents of SOCs, invited speakers and session chairs, and to initiate arrangements for affordable child care. A closer connection with the IAU Executive Committee is envisaged to achieve these objectives.

ANNE GREEN AND SARAH MADDISON

MESSAGE FROM THE INCOMING IAU GENERAL SECRETARY

It is a great honour to be elected as General Secretary of the IAU, and I thank you most sincerely. I enjoyed my time as Assistant General Secretary and I thank everyone who helped during my term of office. I welcome the new AGS, Thierry Montemerle.

I must start by thanking Karel, whose tireless dedication has ensured that the Union has emerged in a strong position. We owe him a great debt of gratitude. I inherit a healthy state of affairs and an extremely competent Executive Assistant in Vivien Reuter with her assistant Jana. I thank Karel for being such a diligent mentor over the past three years.

Catherine Cesarsky has been the driving force behind the International Year of Astronomy. This is an outstanding world-wide success, more than we could have hoped, due to the hard work of many people all over the world, and particularly the IYA Secretariat hosted by ESO. Catherine led from the front in shaping the IYA, and it could never have been the same without her.

Three – or possibly four – known challenges now face us.

First of all, we must implement the Strategic Plan. Secondly, we must ensure that the International Year leaves a deep and lasting legacy. We have seen original and creative activities all over the world and witnessed the profound effect on public awareness. We must follow this up through the continuing work of the IYA Secretariat and nationally through the initiatives and structures established during the IYA.

The third challenge is more open ended – the IAU must continue to develop and reflect the needs and aspirations of its community. Ron Ekers said in Prague that "the IAU really works in the background to provide the lubrication for the wheels of the international machinery and international science". We depend on our Divisions and Commissions because these are the arteries and the nervous system of the Union and we need the active support and input of our National Members, because we add value to what they are doing.

The fourth challenge may not be such a challenge after all. We will have to match the very high standard set by our Brazilian hosts and Karel in organising this Rio General Assembly at the 2012 Beijing GA. We can all look forward to meeting again in Beijing in 2012 after a further three years of success and progress.

This has been a tremendous General Assembly and 2009 will be a momentous year in the history of the IAU. I thank you all, and I look forward to seeing you in Beijing.

IAN CORBETT

ESTRELA D'ALVA
The Morning Star
IAU XXVII GENERAL ASSEMBLY AUGUST, 2009 • RIO DE JANEIRO • BRAZIL
DAY 10
FRIDAY, AUGUST 14th, 2009

THE FINAL SESSION OF THE GENERAL ASSEMBLY

The second and final session of the XXVII IAU General Assembly, conducted yesterday, began with an upbeat note: the information that the Union has passed the impressive 10,000 individual members mark.

All six resolutions to be voted during the session were smoothly approved, including the ones regarding the IAU Strategic Plan, aimed at promoting Astronomy education, with special attention for developing countries. (More about it can be found in issue 2 of **Estrela D'Alva**, and also in an interview with the new IAU President, Robert Williams, on page 2 of this issue.)

Among the resolutions, one established new current best estimates for astronomical constants (for a look at them, go to http://maia.usno.navy.mil/NSFA/CBE.html). IAU members also approved the accounts for the last three years, as well as the budget for the next three. They were informed that, from now on, IAU will adopt euros, and not swiss francs, as its official currency.

Other perspectives for the future were presented, with the announcement of new teams for several Committees, including the Resolutions Committtee, which will have Daniela Lazzaro, currently chair of the National Organizing Committee for the General Assembly in Rio, as its chair for the next General Assembly, to be held in Beijing, 2012.

The Executive Committee of the IAU was also appointed and duly approved by the General Assembly yesterday (full list on page 3). With them falls the responsibility of advancing the new IAU Strategic Plan and preparing, along with the Chinese National Organizing Committee, the XXVIII GA.

Looking even farther, the Session also announced the country and city chosen to host the XXIX GA, in 2015: the honor will go to Honolulu, in the U.S.A.

SALVADOR NOGUEIRA

PLUTO, THREE YEARS LATER

Three years after the last IAU General Assembly, Pluto, whatever it is called now, remains under the spotlight and continues to fascinate astronomers. The little world and its moons have slowly been yielding at least some of their secrets.

In March 2009, ESO's Very Large Telescope revealed unexpected amounts of methane in Pluto's lower atmosphere. Prior to this, astronomers could study only Pluto's upper atmosphere, a tenuous layer composed mostly of nitrogen plus trace amounts of methane and carbon monoxide. The new observations reveal a lower atmosphere significantly warmer than Pluto's surface, with an average temperature of −180° Celsius.

Unlike Earth, where temperature decreases at higher atmospheric levels, Pluto has an inverted or "upside down" atmosphere, where temperatures increase at higher levels by 3-15 degrees per kilometer. And, according to a paper by Hussman et al., Pluto may even harbor a subsurface ocean, which could drive a weak magnetic field.

Equally fascinating is Charon, which may also have a subsurface ocean and shows evidence of cryovolcanism. The Gemini Observatory's Adaptive Optics System, in conjunction with its Near Infrared Imager and Spectrometer (NIRI), revealed ice deposits on Charon. High resolution spectra identify these as ammonia hydrates and water crystals in patches on the surface. A combination of liquid water and ammonia from deep within Charon could be spewing through cracks in its crust as geysers, with crystalline water ice possibly falling back to recoat Charon's surface. Spectral data strongly indicates cryovolcanism, which would mean Charon's interior possesses liquid water.

The New Horizons mission, which will study these bodies' atmospheres and geology in its 2015 flyby, took its first images of Pluto from a distance of 4.2 billion km in September 2006. The fastest spacecraft ever launched, it flew by Jupiter in January 2007 and crossed Saturn's orbit in June 2008.

LAUREL KORNFELD

FOSTERING ASTRONOMY AROUND THE WORLD: AN INTERVIEW WITH THE IAU PRESIDENT

Dr. Robert Williams is taking office as President of IAU with clear goals: to continue the efforts of helping organize astronomy internationally and, furthermore, to assist countries into developing regionally their scientific potential. But there's much more to it than just that.

In the following interview, Williams speaks of how he sees the interaction between public interest and astronomy, the promise of exoplanet research and the development of astronomy in developing countries, in face of a spreading "misguided" view of science as a purely utilitarian endeavor. More of his thoughts below.

So, what are the main objectives for the IAU in the upcoming years?

Robert Williams - Historically the IAU has done a fine job of supporting international meetings and helping in the organization of astronomy, and it should continue to do so. In the coming decade it would be good for the IAU to also place increasing emphasis on the global development of astronomy. The new Strategic Plan discussed at this GA advocates this and proposes a number of initiatives that will assist countries in strengthening their astronomy infrastructures, education and outreach efforts.

There has been recently a great emphasis in innovation, patent-seeking research, coming especially from policy-makers. Is that damaging basic science?

Williams - I wouldn't say damaging so much as misguided. Astronomy is a pure science; it exists to satisfy human curiosity. Yes, there is great pressure in governments to justify programs that can address basic human needs. One cannot argue against this, but satisfaction of curiosity and the creative spirit have fallen out of favor. My response is: if you seek the ideal society where the basic needs are all satisfied, visit your local prison! The pursuit of knowledge has a far greater effect on the human spirit than it is given credit for.

In which areas of astronomy do you feel will come the most exciting discoveries in the immediate future?

Williams - Exoplanets. Dark energy and matter will certainly be great discoveries when they have been understood, but I suspect that is likely to require a few more years. As someone who has devoted so many years to trying to understand the many aspects of the nova outburst, I would like to answer your question: novae! But, let's be realistic.

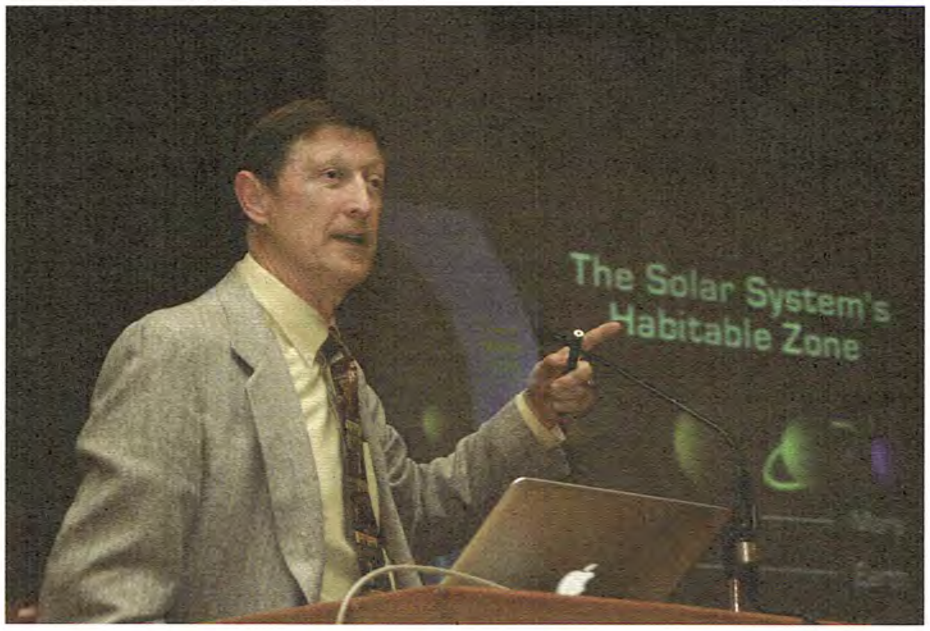
Having spent a significant fraction of your professional life in a developing country, how do you see astronomical research in South America?

Williams - It has been a source of real satisfaction to see astronomy developing so well in South America. There is still much to be done, especially in some of the countries with smaller economies. My impression of astronomical research in this continent is that, while appreciated and valued by the public, it may be considered more of a luxury, i.e., less essential, than it is in developed countries.

How do you see the importance of astronomy as part of the educational system?

Williams - Education is one of astronomy's greatest strengths. The public is fascinated with astronomy, the universe, life on other worlds, and we should place high priority on making astronomy a key part of early childhood education. It is said that images from the Hubble Space Telescope have overtaken dinosaurs as the most common classroom poster in U.S. schools!

Today, it is undeniable that astrobiology is what captures the public's attention. Do you feel that is good or bad for astronomy in general?



Williams - Frankly, I share that same interest in astrobiology. Any interest the public has that is related to astronomy is good. We should encourage it. Astronomy is funded largely by the public, through taxes, so we should take their interest into account. At the same time, we should try to influence public thinking with our discoveries.

Some astronomers, especially in the U.S., have been critical of IAU's authority to establish which celestial bodies are or aren't planets. Do you feel that, behind that, there's a deeper challenge for the organization, that is, to keep all astronomers united?

Williams - The Statutes and Bye-Laws allow for the introduction of resolutions, some of which are controversial. Do I feel that there is a challenge for the IAU to 'keep all astronomers united'? NO. Inconceivable. The IAU has the responsibility to encourage every individual who has the good fortune to be able to look up at the sky to try to understand what they see. Honest differences are inevitable and healthy.

SALVADOR NOGUEIRA

PULSAR PLANETS

The IAU Working Definition of "exoplanet" currently describes any and every planetary-mass type object found beyond our Solar System. The term necessarily covers pulsar planets too (they are listed in Comission 53's working list).

Yesterday, **Estrela D'Alva** reported that the first exoplanet ever found was that of 51 Pegasi (in 1995). However, Alex Wolczcan and Dale Frail discovered the first exoplanets of any kind known to mankind in 1992. These orbit a pulsar. They were found from timing observations made at Arecibo, and then confirmed, by reobserving them at the VLA.

Attendees at the IAU General Assembly in Buenos Aires in 1992 may remember that an earlier claim had been made for a similar discovery by Andrew Lyne. That system had a period very close to an Earth year. It had in the fullness of time to be retracted.

B. M. LEWIS

MESSAGE FROM THE OUTGOING IAU PRESIDENT

For the 90th anniversary of IAU, the Secretary General has collected the memories of six past Presidents of the IAU in the Information Bulletin 104. Like them, I can state with confidence that being an IAU President is a light job: the entire burden of running IAU falls upon the General Secretary. I was fortunate in that "my" General Secretary was Karel van der Hucht, whose dedication to the union has been total. We suffered a bad blow when IAU Executive Assistant Monique Orine died in January 2008, leaving the office in a difficult situation. Luckily, we hired almost immediately Vivien Reuter to replace Monique, and Karel and Vivien together have orchestrated a fantastic recovery.

Like Karel and Ian, I can rejoice retrospectively at the excellent working atmosphere prevailing in our little group of Officers, as well as in the Executive Committee and also with the experienced Chair of the Finance sub-Committee, Paul Murdin, who has really been there for us in the hour of need. The Vice Presidents have each agreed to carry out a specific task for the Union. George Miley spearheaded the IAU Decadal Plan for Astronomy for the developing world; it remains for Bob and Ian, and then Norio and Thierry, to bring it to fruition: in particular to undertake the difficult task of raising the necessary funds, and, if possible, generate a generous host for the Global development office. Note that this plan covers only one subset of IAU activities, so there is more strategic thinking ahead; in fact, strategic plans always need to be reconsidered and adapted, but they remain an excellent method to trigger meaningful changes.

Like Karel, I have learnt a lot about the IAU these three years, and the more I know, the more I find the Union interesting and useful. I had a number of new experiences: I have taken part in a teaching venture in Kathmandu, and found it extremely gratifying. I advise all of you to try, as we have a great need for volunteers. I have also helped setting up the first MEARIM, in Egypt, and for this I am very pleased, as it was successful and will soon become a tradition at IAU.

But of course the highpoint of my presidency was the preparations and the launch of the International Year of Astronomy 2009 (IYA 2009). One of my early tasks was to lead the IAU delegation that went to New York, at the end of 2007, to lobby in favour of IYA at the United Nations. It was a momentous time. We were delighted to see that our proposal was extremely well received, and indeed the UN endorsement soon followed. In 2006 the Executive Committee established an IYA Working Group. I felt that this task was so important, in the years of my presidency, that I held the Chair of the Working Group, with the IAU Press Officer, Lars Christensen, as super efficient secretary. We soon agreed on the necessity of establishing an IYA Secretariat in charge of the global coordination of the activities. I was at ESO at the time, and we decided to put it at ESO, managed by Lars. We hired Pedro Russo, and later Mariana Barrosa, and, I am tempted to say, the rest is history. I have enjoyed working on a regular basis with Lars, Pedro and Mariana. I am proud of the work accomplished and of the results obtained. I will continue chairing the Working Group till the end of next year, which will be devoted to an evaluation of IYA activities and impact. The exchanges and feedback with Single Points of Contact, chairs of Cornerstones and of Special projects, astronomers and amateurs, have been an incredibly rewarding personal experience which I will never forget.

One of the goals of IYA is:" Provide a modern image of science and scientists", and I'll end this farewell as IAU President with a quote from the Guardian, on its editorial page on IYA2009, Saturday 25 July 2009: "Astronomers around the world compete, co-operate and confer; they are a global community, in the richest sense of the term, and we owe to them our understanding of space and time, and light, and mass, and gravity: in a word, everything."

CATHERINE CESARSKY

MILLIMAGNITUDE PHOTOMETRY AT EVERY OBSERVATORY

Would you like to produce high precision light curves that when analyzed could provide fundamental data of unprecedented precision? If so, consider doing infrared photometry with the passbands designed by the Infrared Working Group (IRWG) of Commission 25.

But, you say, we have never done any IR photometry at my observatory; it is located at a site with modest elevation, not high in the mountains. Not to worry: the IRWG suite of near-IR passbands is designed so that you too can use these passbands and potentially get good results — provided the sky is photometric (in other words, good enough to do high-precision optical photometry).

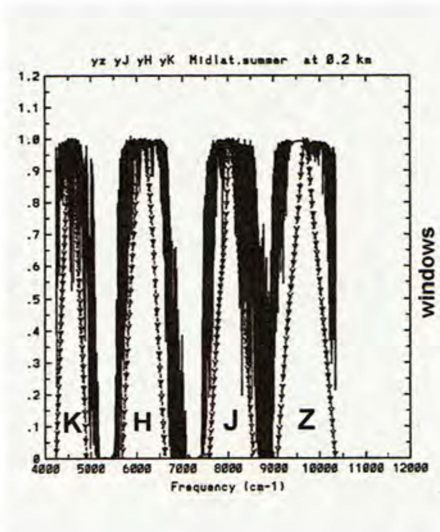
The IRWG passbands are specifically shaped and placed within the spectral windows of the Earth's atmosphere to avoid the worst effects of water vapor, and for all models. They have lower atmospheric extinction, better S/N, and less sensitivity to water vapor, than the existing JHK... passbands — new or old.

An IAU Joint Commission Meeting (9 & 25) met at the 1988 GA to discuss why JHKL photometry, although capable of producing excellent photometric light curves (Raleigh scattering is weak in the IR), suffered unexpected extinction variations.

The JCM identified the cause of the problem and recommended solutions. These, described in Milone (Springer Lecture Notes in Physics, 341,1, 1989), involved a recommendation that the Johnson JHKLMNQ filters then in use be examined and, if needed, new filters designed that would be better located within the windows.

In 1991 the IRWG was formally established by Commission 25 at the Buenos Aires GA. The tools to do this, the plan of attack, and recommendations were published in Young et al. (A&AS 105, 259, 1994). In the late '90s Custom Scientific of Phoenix, Arizona produced the near-IR suite of filters (iZ, iJ, iH, iK).

Testing and results are described in Milone & Young (PASP 117, 485, 2005). News: Custom Scientific now offers low prices for the IRWG filters if ordered in bulk. If you are interested in getting a set of IRWG filters, contact Eugene F. Milone (milone@ucalgary.ca).



EUGENE F. MILONE

THE NEW IAU EXECUTIVE COMMITTEE

The IAU Secretariat has the pleasure to announce the constitution of the IAU Executive Committee 2009 – 2012.

Officers:

President
Robert Williams (USA)
President-Elect
Norio Kaifu (Japan)
General Secretary
Ian F. Corbett (UK)
Assistant General Secretary
Thierry Montmerle (France)

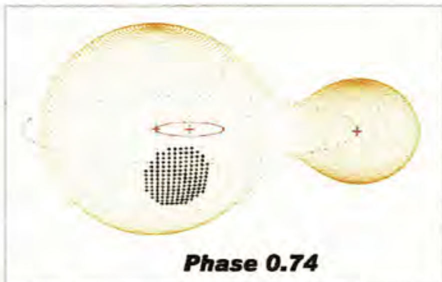
Vice-Presidents:
Matthew Colless (Australia)
Martha P. Haynes (USA)
George K. Miley (Netherlands)
Jan Palouš (Czech Republic)
Marta G. Rovira (Argentina)
Giancarlo Setti(Italia)

Advisers:
Catherine J. Cesarsky (France)
Karel A. van der Hucht (Netherlands)

AW UMa is not an AW UMa-type Binary!

Often, variable star astronomers name binaries after prototypes. Of particular note are the Algols (EA), Beta Lyrae (EB) and WUMa (EW) binaries. Two other major types are the V1010 Oph and the AW UMa Binaries. V1010 Ophiuchi objects are solar type near contact binaries. However AW UMa's are thought to be the final stage in binary star evolution. After this stage the stars coalesce and become fast single rotating FK Comae stars or fast rotating A-type stars. In clusters, these are known as 'Blue Stragglers'.

The AW UMa's are over contact, high fill-out binaries usually with wide total eclipses but shallow amplitudes. This betrays the fact that they have extreme mass ratios, on the order of 0.2 or less. These stars are thought to be billions of years old and are heavily spotted solar type binaries. The driving mechanism for their slow coalescence is the torque supplied by out flowing winds along 'stiff' magnetic field lines originating from the solar-type stars. Their periods steadily decrease as they lose angular momentum. However, recent precision photometry by T. Pribulla and S.M. Rucinski (MNRAS 386, 2008, 377) has called into question this whole scenario. They have found that AW UMa is not even in contact! It is a detached binary with gas streams that simulate contact. AW UMa is not an AW UMa-type Binary!



GSC 1283 0053. The Surface Geometry of a "AW UMa" Binary.

Thus, it joins Beta Lyra, which is not a Beta Lyra system either! (It is a W Serpentis Binary!) So much for prototypes! This system was discussed at the commission 42 science session on Wednesday. Dr. Ron Samec (Bob Jones University) discussed the characteristics of this group. This opened up to a discussion by Dr. Slavek Rucinski of the prototype—which is no longer an AW UMa So much for prototypes!

Ronald G. Samec

Invitation to Beijing

With great pleasure, we invite you to attend the IAU 28th General Assembly (GA), which will be held in Beijing, China, August 20-31, 2012.

Beijing, the capital of China, is situated in the northeastern part of the country with more than 3,000 years of history and a population over 17 million people. Many historical places of interest including the Great Wall, Summer Palace, Temple of Heaven and Forbidden City are located in Beijing. The successful hosting of the 2008 Olympic Games has improved the city's infrastructure vastly.

Chinese astronomy has over 4,000 years of history with great development over the past 30 years. During the IAU 26th GA in Prague 2006, Beijing was appointed to host the IAU 28th GA. The formal agreement between the IAU and the Chinese Astronomical Society (CAS) was signed on April 18, 2007.

The IAU 28th GA will be held at China National Convention Center (CNCC). Opened on the July 26th 2009, CNCC is China's latest and largest conference center, with superior geographical location and full facilities. It is ideally located in the heart of Olympic Park, with the Bird Nest (China National Stadium) and Water Cube (National Aquatics Center) on either side.

There are around 30 hotels ranging from budget to 5-star within 3 kilometers with ample restaurants and food courts nearby. Related information is available at http://www.astronomy2012.com.

We will do our utmost to organize a successful and unforgettable IAU GA in Beijing for you. As we always say, China loves IAU and IAU needs China! Looking forward to seeing you in Beijing 2012!

Chinese Astronomical Society
NOC and LOC of the IAU 28th GA

Message from outgoing IAU General Secretary

The International Astronomical Union was founded in Brussels 90 years ago, with the mission of fostering collaboration among scientists in the world. Young in comparison to the world's oldest science, the IAU is still sufficiently long-lived to have a rich tradition. I am pleased to be part of this venerable heritage.

Trained as a research astronomer and specializing in the astrophysics of Wolf-Rayet stars, I focused my research mostly on that field, observing at all wavelengths from the ground and from space. Between 1990 and 2002 I helped to organize, among other things, four IAU Symposia and edited the proceedings. That may have been why I was suggested for the position of IAU General Secretary - a role which I have strived to fill these past three years.

I give you 3 good reasons why I have enjoyed being your General Secretary.

1. Working for the IAU as General Secretary brought me in touch with colleagues working in all fields of astronomy. That enriched my life.

2. I had the privilege to work with very motivated and dedicated fellow Officers and fellow EC members. That made my job as General Secretary very gratifying.

3. Working for the IAU Secretariat as General Secretary means working for three years part-time in Paris: a rare opportunity to become familiar with a beautiful and fascinating city. Due to circumstances beyond my control, I saw mostly the walls of my office at the IAU Secretariat. My wife got to see Paris. That's fine too.

It would be exaggerated to claim that I now know all about the IAU. In a Union with 63 National Members, over 10000 Individual Members organized in 12 Divisions, 40 Commissions and 75 Working Groups & Program Groups, there is always more to learn. The best way to get to know the IAU is doing the editing of the General Secretary's trilogy: the Highlights of Astronomy, the Proceedings of the General Assembly (Transactions B), and the Reports of Astronomy (Transactions A). These volumes may be described by some of you as the books which nobody reads, but editing them was for me an extremely useful and revealing exercise to become informed about the activities of the IAU membership.

Three years may seem a long period in the beginning, but they feel like a short stretch at the end. The triennium from August 2006 to August 2009 was marked by continuous series of important activities and developments, both anticipated and unexpected. There is much to be grateful for and there are many to be grateful to. My sincere thanks go to:

• my home institute SRON in Utrecht, the Netherlands, for giving me leave of absence for effectively 4.5 years, to work as AGS and as GS for the IAU;

• my fellow Officers Catherine Cesarsky, Bob Williams and Ian Corbett. In the past three years we have shared much of our work for the IAU, leading to a fruitful and effective cooperation;

• all preceding General Secretaries, who were always there to give advice in a most constructive way;

• the staff of the IAU Secretariat in Paris, in particular my Executive Assistant Mme Vivien Reuter. Mme Reuter joined the Secretariat at a very difficult time. Together we had to re-invent the Secretariat, often hanging on by our fingernails, but surviving. Vivien, without you the IAU Secretariat would not be in as good shape as it is today;

• and our very motivated National Organizing Committee for this IAU XXVII General Assembly, co-chaired by Daniela Lazzaro and Beatriz Barbuy, who have invited us to this beautiful city, Rio de Janeiro, and who made this General Assembly happen. We would not be here without their intense efforts.

But most of all I want to thank my wife Riëtte. Riëtte, I could not have done this job without you. I am here because of you. Thank you.

Karel A. van der Hucht