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IAU IAUGA Astronomy for All Busan 2022 THE KOREAN ASTRONOMICAL SOCIETY 한국천문학회 KASI Korea Astronomy and Space Science Institute

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#IAUGA2022 is an official hashtag of the IAUGA2022

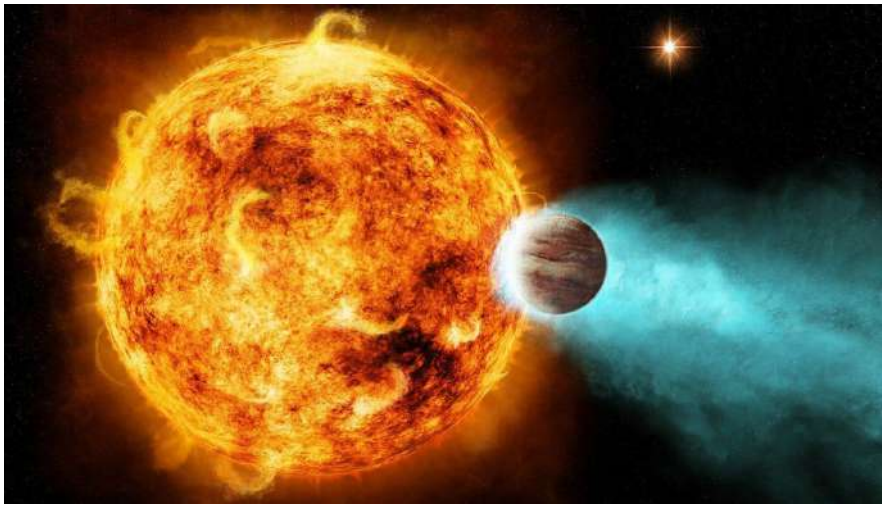
Winds and magnetospheres from stars and planets: similarities and differences

Stan Owocki, S370 plenary speaker

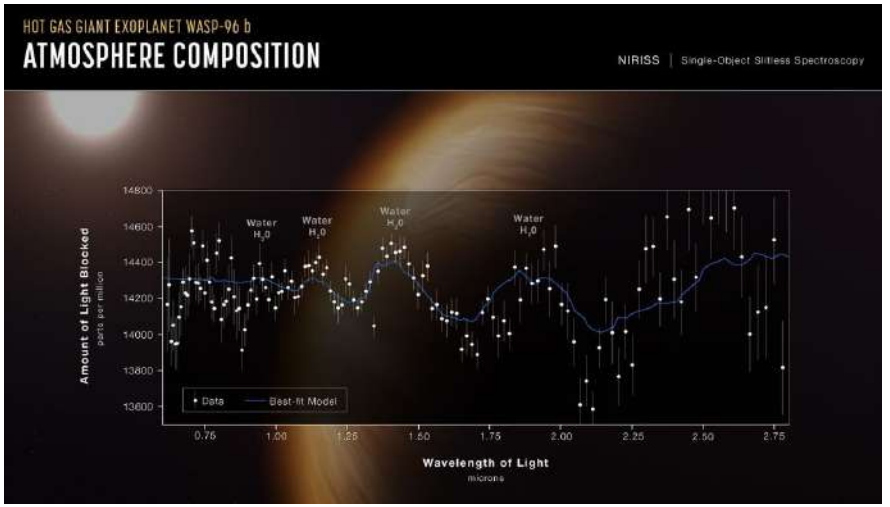
As a young boy in the 1960's, Stan Owocki became fascinated with the night sky, wondering about the swarms of stars, where they come from, what they're made of. When, for his 11th birthday, he got his first telescope, a 3-inch Newtonian reflector, he discovered that among the best targets were the bright planets: Venus with its crescent shape; reddish Mars with hints of a bright polar ice cap; Jupiter with its four shuffling moons; Saturn with its magnificent, glorious rings.

As a young man Stan went on to get a doctorate in astronomy, and since 1987 as a professor at the University of Delaware in the US he has made a career of studying stars, with a particular focus on their somewhat peculiar tendency to shed some of their mass through outflowing "stellar winds". Though following with great personal interest the many spacecraft tours that revealed in wonderous detail all the planets and moons of our solar system (including Pluto), their technical study seemed quite distinct and far afield from his work on stars.

Then in the mid-90's came the discovery of the first extra-solar planets, many of them "hot Jupiters" that orbit so close to their host star that the stellar radiation heats up their outer atmosphere to such a high temperature that some of the gas expands outward in a "planetary wind". The attached figure shows an artist's depiction of such a hot Jupiter orbiting close



An artist's depiction of a "hot Jupiter" exoplanet orbiting close to its star. (Image credit: NASA/Ames/ JPL-Caltech)



Webb's (reversed) transmission spectrum, with the "peaks" showing where water molecules have absorbed starlight. (Image credit: NASA/ESA/CSA and STScI)

to its star. Among the 5000 exo-planets detected since then are also "super-Earths", with a rocky core and a dense atmosphere, orbiting at various distances from their star. When any planet with an atmosphere passes in front of its host star, the absorption features it imparts in the star's spectrum allows one to infer information on the atmosphere's density and composition, and even if it is extended into an outflowing wind. The recent spectrum from the Webb telescope of water absorption by the exo-planet Wasp 96b is a prime example.

Thus a central issue in the study of exo-planets, and particularly whether they can have the mild temperature and dense atmosphere for the extensive liquid water that is key to life on earth, is how well they retain their atmosphere against loss to a wind, or to ablation from the star's wind.

The organizers of the IAU Symposium 370 on "Winds from Stars and Planets" thus aim for the meeting to bring together researchers on stars and exo-planets, with emphasis on exploring the overlap and distinctions in the physics underlying their wind outflows. Stan's opening plenary talk will introduce these concepts, with added emphasis on how magnetic fields of both stars and planets can influence these outflows, and their key observational signatures ranging from X-ray to radio wavelengths.

Stan Owocki (University of Delaware) during a visit to the Galapagos Islands.

Science Program for Division G: Stars and Stellar Systems

The Vera C. Rubin Observatory is located on the Cerro Pachón ridge in north-central Chile; it hosts an 8.4-m telescope that will conduct a 10-year Legacy Survey of Space and Time (LSST). The survey will focus on probing dark matter and dark energy, complete the census of the Solar system, explore the transient sky and map the Milky Way galaxy. Image courtesy of Rubin Obs/NSF/AURA.

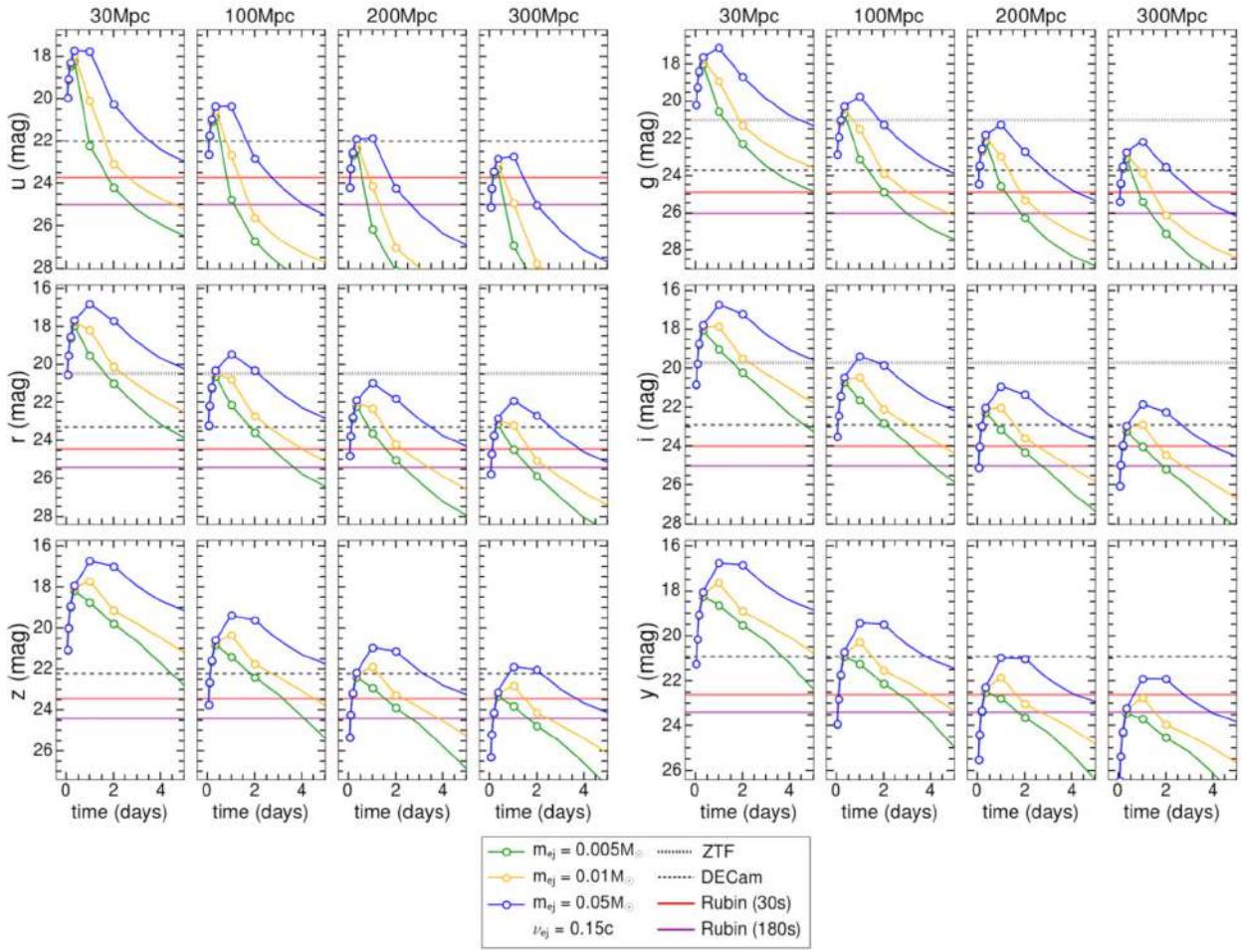
Division Meeting G: Stars and Stellar Physics	
START DATE	Friday, 5 August
END DATE	Monday, 8 August
ORAL SESSIONS	Room 106, Convention Hall, 1st Floor
POSTERS	e-Poster Zone, Convention Hall, 3rd Floor

For details on presenters, topics, and times see the online program on the GA website

Division G fosters research, sharing expertise, disseminating knowledge and public outreach related to all areas of stellar astrophysics. The topics include stars, their populations and evolution, binary and multiple systems, stellar variability and observables across the entire light spectrum.

Stellar astrophysics has seen major advancements in the last triennium, mostly thanks to the large surveys that observe large swaths of the sky and deliver aggregate petabytes of data. With the delivery of heterogeneous, high-precision data and advances in data science and computing power, we have been witnessing a substantial increase in model fidelity across stellar astrophysics: from stellar formation and evolution across the H-R diagram, to binary and multiple star physics and asteroseismology, all the way to galactic structure and evolution. Division G days provide us with an opportunity to reflect on what we have learned over the last triennium and ponder on the most pressing current challenges in the field of stellar astrophysics.

Division Days at the General Assembly take place on Friday (Aug 5) and Monday (Aug 8), where we welcome everyone interested in the latest advancements in stellar astrophysics. We will focus specifically on radiative transfer, radioactive decay and magnetic pressure in stellar atmosphere models; the roles of magnetic fields, convection, gravity waves, shear and turbulence in stellar interiors; symbiotic stars, cataclysmic variables and contact binaries; compact objects and tidal disruptions; evolved stars; and the search for transients across the sky. The scientific program comprises 5 invited talks, 16 contributed talks, and 18 e-talks and e-posters. Invited speakers include PhD prize winners Drs. Lisa Bugnet, Simon Blouin and Steven Goldman, Division vice-president Dr. Merieme Chadid, and the LSST/TVS pulsating stars chair Dr. Kelly Hambleton. The program also includes a 30-min discourse on Division G's role, scientific and collaborative impact, and worldwide support for stellar astrophysics.



Simulated kilonova light-curves in the six Rubin LSST filters for different properties of the ejecta (mass and velocity) at four representative distances (30, 100, 200, and 300 Mpc). Dotted and dash-dotted lines mark typical 5-sigma detection thresholds of ZTF and DECam, respectively, assuming 30-s exposure times. Red and purple solid lines: Rubin LSST 5 sigma detection thresholds for exposure times of 30-s and 180-s under ideal observing conditions. The superior sensitivity of the Rubin Observatory is essential to detect the multi-color emission from kilonovae. Adopted from Andreoni et al. (2022).

Dr. Andrej Prša is a Professor of Astrophysics at Villanova University in Pennsylvania, USA. He serves as president of IAU's Division G for the 2021-2024 triennium. His scientific interests straddle computational astrophysics of binary and multiple stellar systems, stellar populations and bulk analysis of large survey data.

Division Galaxies and Cosmology meets in Busan: 100 years of Extragalactic Astrophysics

The members of Division J of the International Astronomical Union will meet in Busan in August 2022 during two sessions, on August 5th and on August 8th. Division J is the Division Galaxies and Cosmology, and it focuses on the Physics of the Universe and galaxies beyond the Milky Way. All approaches, theory, simulations and panchromatic observations are considered by our Division. It is important to notice that Division J connects across many of the other Divisions and has strong overlap with Div. B, Div. D, Div. G and Div. H.

Division Meeting J: Galaxies and Cosmology	
START DATE	Friday, 5 August
END DATE	Monday, 8 August
ORAL SESSIONS	Room 205, Convention Hall, 2nd Floor
POSTERS	e-Poster Zone, Convention Hall, 3rd Floor

For details on presenters, topics, and times see the online program on the GA website

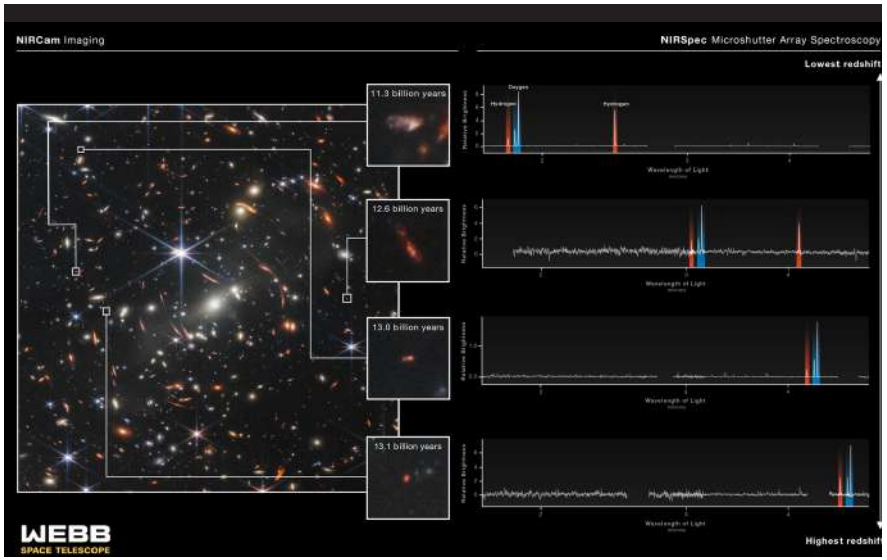
We cannot detail in this paper the rich programme of our two division days that will cover the fields studied by our division members. This is why we decided to present in this paper only the PhD prizes granted over the 4 yours since the last general assembly. The recipients of these prizes represent the youngest generation that started their career in Astrophysics and in Cosmology.

- Anna-Christina Eilers: The Growth of Supermassive Black Holes in the Early Universe, Prize 2019
- Jorryt Matthee: (Re)solving Reionization with Lyman-alpha emission, Prize 2018
- Solène Chabanier: Neutrino and dark matter cosmology with the Lyman-alpha forest, Prize 2020

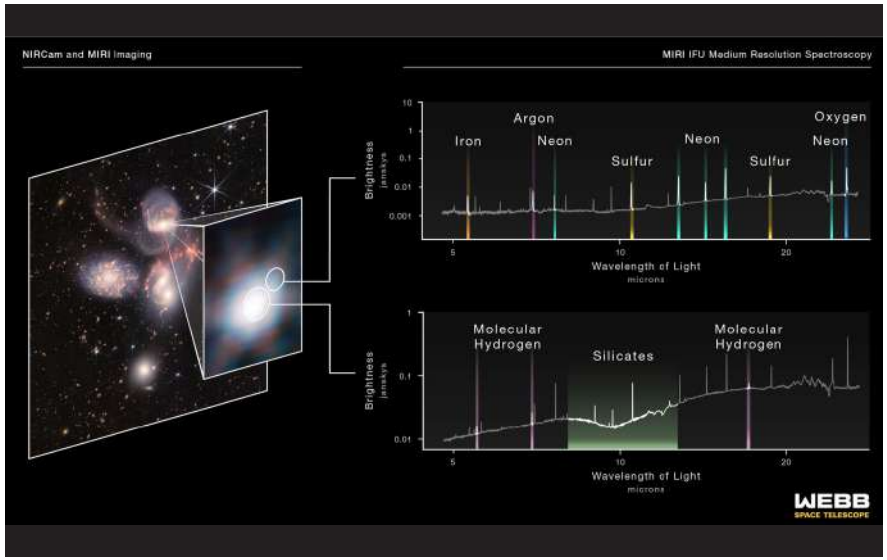
An important information about our division, that might actually be relevant to the entire Earth population, is that our understanding of the Universe is quite recent. It was in April 1920 that the Great Debate was held at the Smithsonian Museum of Natural History, between Shapley and Curtis, on the nature of spiral nebulae and the size of the Universe. From the presentations, two papers have been published by Shapley and by Curtis in the May 1921 issue of the Bulletin of the National Research Council (Shapley & Curtis 1921). Shapley supported the idea that distant nebulae were relatively small and lay within the outskirts of what is now called the Milky Way, while Curtis was convinced that these nebulae were actually other, independent objects such as our galaxy, the Milky Way. Curtis' view implies that galaxies are very large objects, at very large distances from Earth. Only in 1924, Hubble's detection of Cepheids and other variable stars in some of these nebulae (e.g., NGC 6822, M331, M32 and M31), finally allowed to estimate the distance to these nebulae and to show that they are indeed extragalactic objects. This closed the Great Debate.

The end of this debate is therefore the spiritual birthdate of the Division Galaxies and Cosmology.

The Covid-19 sanitary crisis prevented us from actually celebrating this event and even to plan for a celebration in Busan. We suggest to start planning for a celebration during the next IAU General Assembly in 2024, to mark the closing of the Great Debate.



Webb spectra identify galaxies in the very early Universe: Of the thousands of distant galaxies behind galaxy cluster SMACS 0723, NIRSpec observed 48 individually. A quick analysis made it immediately clear that several of these galaxies were observed in the early universe. These observations mark the first time these particular emission lines have been seen at such immense distances. However, there may be even more distant galaxies in this image. With Webb's data, we will now be able to measure the galaxy's distance, temperature, gas density, and chemical composition. NIRSpec was built for the European Space Agency (ESA) by a consortium of European companies led by Airbus Defence and Space (ADS) with NASA's Goddard Space Flight Center providing its detector and micro-shutter subsystems.



Composition_of_gas_around_active_black_hole_MIRI_spectra: Stephan's Quintet is a visual grouping of five galaxies located in the constellation Pegasus. Together, they are also known as the Hickson Compact Group 92 (HCG 92). Although called a "quintet," only four of the galaxies are truly close together and caught up in a cosmic dance. The fifth and leftmost galaxy, called NGC 7320, is well in the foreground compared with the other four. The topmost galaxy in the group – NGC 7319 – harbors an active galactic nucleus, a supermassive black hole 24 million times the mass of the Sun. The NASA/ESA/CSA James Webb Space Telescope studied the active galactic nucleus in great detail with the Near-Infrared Spectrograph (NIRSpec). The instrument's integral field units (IFUs) provided the Webb team with a "data cube," of the galactic core's spectral features. NIRSpec was built for the European Space Agency (ESA) by a consortium of European companies led by Airbus Defence and Space (ADS) with NASA's Goddard Space Flight Center providing its detector and micro-shutter subsystems. MIRI was contributed by ESA and NASA, with the instrument designed and built by a consortium of nationally funded European Institutes (The MIRI European Consortium) in partnership with JPL and the University of Arizona.

Denis Burgarella was the President of Division J from 2018 to 2021. He is now President of the Commission Galaxies at the Epoch of Reionization. He also coordinates a French – Japanese international network called NECO. He makes use of multi-wavelength data to study the formation and the early evolution of galaxies. Denis Burgarella developed the CIGALE code with Médéric Boquien.

Cristina Popescu is the current Vice-President of Division J. She was the President of Commission J1 - Galaxies Spectral Energy Distributions - between 2018-2021. She pioneered and developed radiative transfer methods to account for the spectral energy distribution of galaxies.

Kim-Vy Tran is currently on the faculty at the University of New South Wales and has been a professional astronomer for more than 20 years. Before becoming Division J President in 2021, she served as the Division J Vice-President in 2018-2021. Her astronomy research program advances our knowledge of how galaxies assemble over cosmic time by capitalizing on the high resolution, extreme sensitivity, and broad wavelength coverage of ground and space-based telescopes. This comprehensive approach enables us to study galaxies from the local neighborhood to the edge of the observable Universe.

IAUS 370: Winds of stars and exoplanets

Division Meeting C: Education, Outreach and Heritage	
START DATE	Monday, 8 August
END DATE	Thursday, 11 August
ORAL SESSIONS	Room 101, Convention Hall, 1st Floor
POSTERS	e-Poster Zone, Convention Hall, 3rd Floor

For details on presenters, topics, and times see the online program on the GA website

Winds form an integral part of astronomy - from regulating rotation of stars through enriching galaxies with fresh materials, outflowing winds persist during the entire lives of stars and play a key role in shaping the observed exoplanet demographics. In the case of massive stars, their winds are a vital ingredient of their evolution, from the main sequence to the pre-supernova stage, determining black hole masses as measured from gravitational waves. In the case of low-mass stars, their winds dictate rotational evolution, which affect angular momentum distribution within the stellar interior and thus affect generation of magnetic fields. Finally, in the case of planets, winds take the form of atmospheric escape, which can strongly affect their atmospheric evolution. Strong escape of highly irradiated exoplanets have now been observed in several close-in exoplanets during transits and are indirectly detected in the observed exoplanet radius distribution.

Although the only astrophysical wind that we are able to directly probe is that of the Sun, the past decades have seen great progress in observing winds of other astrophysical objects. In particular, in recent years, several observing programmes and space missions have focused on studying winds from our Sun, other stars and exoplanets.

On the solar side, two new space missions, Parker Solar Probe and Solar Orbiter, are dedicated to studying the physics of the solar wind. By traveling much closer to the Sun than any other spacecraft has ever been, these new missions allow direct measurements of the solar wind at an unprecedented close distance. Data from these missions might provide interesting implications for the variability of the plasma environment at the orbits of close-in exoplanets.

On the stellar side, winds of low-mass stars are magnetically driven, and magnetism has been either directly (through Zeeman effects) or indirectly (through activity proxies) observed in these stars. Recently, many new magnetospheres were detected around massive stars as well. In spite of similarities, there is a major difference between winds of low- and high-mass stars: their mass-loss rates are orders of magnitude different, due to different physical processes driving their winds. Even with substantially lower mass loss rates, winds of low mass-stars play a fundamental role in removing angular momentum, and thus, shaping the rotational evolution of these stars.

On the planetary side, missions like Kepler, TESS and Plato (will) provide the statistics for planet population studies and hence infer the indirect presence of outflowing planetary winds in shaping the distribution of sizes of close-in exoplanets. HST has been fundamental in detecting strong atmospheric escape of close-in giant planets through ultraviolet transmission spectroscopy. Recent observations have also opened the possibility to detect escaping planetary winds from the ground.

In order to gain insight in the physics and the modeling tools used by different communities, we wish to bring together researchers working on winds of close-in exoplanets (atmospheric escape), winds of low- and high-mass stars and the solar wind in a symposium dedicated to “winds”. Our hope is that this will foster communication between these different communities and drive advances in these fields.

Aline Vidotto (Chair) is an Associate Professor at Leiden Observatory. Her research is focused on star-exoplanet relationship — by using theory and numerical simulations, her group research the interaction of exoplanets with their host star's wind.

Luca Fossati (co-chair) is a group leader at the Space Research Institute of the Austrian Academy of Sciences, His research focuses on the observational and theoretical characterisation of exoplanetary upper atmospheres and escape, as well as of star-planet interactions, particularly at ultraviolet wavelengths.

Jorick Vink (co-chair) is a Research Astronomer at Armagh Observatory and Planetarium. His research focuses on the winds and evolution of the most massive stars. He is interested in both theory and observations, such as the UV data obtained with the HST ULLYSES project and complementary ESO-VLT X-Shooter data for massive stars at low metallicity.

IAU Executive Committee Working Group meeting: global coordination of ground and space

International collaboration has always been an important part of research in astronomy. Over the past two decades, the increasing complexity and cost of new facilities, the constrained amount of funding available from individual sources, and the rapidly increasing volume of data have made international collaboration and coordination essential to our ambitions for ever more capable facilities and more augmenting progress in moving the field forward. This Working Group Meeting will provide a forum to discuss how to improve coordination of global planning and build towards future projects. Working towards a new paradigm of global Open Data and Open Science will be a major theme of the meeting. These topics are particularly timely given the recently published planning documents by ESA (Horizon 2050) and the US National Academy Decadal report (Pathways to Discovery in Astronomy and Astrophysics for the 2020s)

IAU Executive Committee Working Group Meeting: Global Coordination of Ground and Space Astrophysics	
START DATE	Monday, 8 August
END DATE	Wednesday, 10 August
ORAL SESSIONS	Room 108, Convention Hall, 1st Floor
POSTERS	e-Poster Zone, Convention Hall, 3rd Floor

For details on presenters, topics, and times see the online program on the GA website

The first session introduces a new approach to surveying In the opening session, speakers will provide a survey of the landscape of future large facilities. We have organized tThree plenary talks on Large Space Missions, Large Ground based projects, and coordination between ground and space. In each case these will cover projects that will be coming online in the next decade giving an update on the status of planning. The speakers will address key questions, such as what are the most difficult challenges for the agencies around coordination, and how they are working towards the goal of Open Data. These three overviews will be followed by will be followed by an open discussion.

on the ground and in space that will be coming online in the next decade, and give an update on the status of planning. The speakers will address key questions, such as what are the most difficult challenges for the agencies around coordination, and how they are working towards the goal of Open Data. Three plenary talks on Large Space Missions, Large Ground projects, and coordination between ground and space will be followed by an open discussion.

The second session will be devoted to a discussion of the key questions in specific science areas and how we might improve what kind of coordination amongst and between ground and space based facilities to make faster progress. is required by different science areas. This session will feature talks on exoplanets, stellar populations, black holes, galaxies, and cosmology, followed by an open discussion. We will attempt to identify types of coordination that can benefit multiple science areas.

The third session will focus on one of the most challenging but potentially impactful areas for coordination, which is the exciting and rapidly exploding field of multi-messenger astronomy. We will hear a summary report from the Kavli-IAU Cape Ttown 2020 meeting on this topic, followed by presentations on ground and space based gravitational wave facilities, and neutrino, gamma ray and cosmic ray telescopes. This session will conclude with a panel discussion with representatives from all of the major types of facilities.

The final session will address the future role of current telescopes, and the critical topic of data archiving. This session will open with a panel discussion among representatives of current facilities. The panelists will address questions such as: how will the use of their facilities evolve over the next decade as new telescopes come online? How can we coordinate the use of the full international portfolio of new and older facilities to optimize the science? In the archive session, representatives from different archiving centers facilities will summarize how efforts are currently being undertaken to coordinate archiving of data from different facilities, agencies, and wavelengths.

All IAU members have a stake in the strategic decisions made by nations, agencies, and scientific consortia. We invite all members to attend the working group meeting and contribute towards this important effort.

Full program: https://www.iauga2022.org/program/program_06_6.asp?sMenu=abo6

Roger Davies is the Wetton Chair in Astrophysics and a student of Christ Church. He is the current president of the European Astronomical Society and the founding Director of the Oxford Hintze Centre for Astrophysical Surveys.

Rachel Somerville is a Group Leader at the Center for Computational Astrophysics at the Flatiron Institute in New York City.

Highlights of Young Astronomers Lunch (August 5)

How to get people outside their boundaries and make people aware of their work was one of the hot topics at Young Astronomers Lunch (YAL).

"I always tweet about my student's paper on Twitter," answered Xiaohui Fan from the University of Arizona, the USA, to a Ph.D. student's question, "Do you think using social media is important to get information about many things in astronomy such as conferences or new papers, and help to promote myself?"

The Young Astronomers Lunch event, first introduced at the 2006 IAU meeting, was held on Thursday, 5 August, from 12:00 to 13:30 this year. The meeting aims to provide networking opportunities between senior astronomers and young astronomers in an open and friendly atmosphere. More than 300 conference attendees participated in the event, and two mentors were matched with 3-4 mentees per table. After a 15-minute lunchtime in silence as part of coronavirus prevention measures, mentor-mentee pairs began to have a full-fledged conversation. Various topics were discussed at each table, and one of the key discussion topics was the issue of finding a job. Mentees asked their mentors for advice on promoting their research, whether using social media would be beneficial, and how to enhance their visibility in their own research field.

"I was delighted to have this precious opportunity at the conference I attended for the first time, and I got a lot of advice on the path to becoming an astronomer," said an undergraduate student at Kyung Hee University in Korea.

Women in Astronomy Lunch

Women in Astronomy Lunch meeting will take place at Hall 5A, Exhibition Center II, BEXCO on the 8th of August at 12:00-13:30.

The gender and diversity dimension of science and technology has become one of the most important and debated issues worldwide, impacting society at every level. The International Astronomical Union, through its Executive Committee Working Group on Women in Astronomy, has been a strong advocate for discussing these themes openly and for supporting initiatives that can improve a more balanced representation of diversity in our community. In this context, the Organizing Committee of the IAU EC WG on Women in Astronomy together with the NOC of the IAU-GA in Busan are proud to announce the Women in Astronomy Lunch Meeting (WL) for networking and discussions of important issues.

You can sign up for this event when you register for the GA.

We kindly acknowledge a generous donation by US National Academy of Sciences (US NAS) and the Norwegian Academy of Science and Letters (NASL) that have made the organization of this event possible.

※ To participate in this event please bring the ticket issued with your name badge

Korean Food (Busan Food) and Busan Culture

Here are top 3 Busan foods chosen by local and foreign travelers as their favorites.

Pork and Rice Soup

Wheat Noodles (Milmyeon)

Sliced Raw fish

Pork and Rice Soup

Which dish first comes to mind when you think about Busan? The list is too long, but many Koreans would pick Busan's specialty, rice and pork soup. Hot broth with pork bones, fresh chive kimchi, salted shrimp, and noodles are prepared in a set. Roll the thin noodles as the appetizers by adding a spoonful of seasoned chives and salted shrimp into the soup with an incredible amount of meat and soup for a more pleasantly surprising flavor.

Wheat Noodles (Milmyeon)

The second-best food for travelers in Busan will be wheat noodles (milmyeon).

Here is the tip recommended for you to taste mulmimyeon (soup wheat noodles). Firstly, take a sip of the broth, then add vinegar and mustard sauce to satisfy your taste! If you like to enjoy the unexpected perfect blend of spicy, sweet, and sour sauce at the tip of your tongue, you might finish a bowl of bibimyeon (spicy wheat noodles) within a minute.

Sliced Raw fish

Any trip to Busan wouldn't be complete without some sliced raw fish. Old restaurants with several layers of history are the best way to meet the people of Busan, while window seats in restaurants offer a beautiful view of the city to be enjoyed with good food. But no matter where you go, you'll surely enjoy sliced raw fish in Busan.

If you want to experience the energy of Busan, we recommend Gwanglli Beach and Nampo-dong.

Gwangalli Beach

Nampo-dong

Gwangalli Beach

Gwangalli Beach is a famous beach and one of Busan's representative hot spots together with Gwangandaegyo Bridge. It is the closest beach to the city center and also a trendy meeting place for Busan's youth.

Along with its white sandy beach, Gwangalli is filled with diverse attractions such as restaurants serving delicious foods, coffee shops with an open view of the sea and exotic stores hidden in alleyways. Gwangalli is also known for its numerous coffee shops and restaurants with a great view of the sea. If you want to enjoy the night view of the sea a bit more, the Waterside Park is the best place to go.

Nampo-dong

A major urban district, the neighborhood has a park, a department store, a traditional market, and major tourist attractions, making it a hot place for locals, tourists, and foreigners alike. As the area is large, you may have to spend an entire day or even longer to enjoy every part of Nampo-dong. Enjoying local food is the best part of a trip. Nampo-dong Food Alley, where each building is full of clothing stores and restaurants, and the center of the narrow alley is lined up with various accessories and food carts selling street food. Its street food is also popular among tourists. Cheap and delicious street food you can only taste in Busan.

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Young Astronomers Lunch