SPS7-1 Oral presentation

An overview of Astronomy in Antarctica

MG Burton

University of New South Wales, Sydney, Australia

An overview of Astronomy in Antarctica will be given, highlighting the unique environment on the summits of the Antarctic plateau. These provide superlative conditions for a wide range of astronomical observations: the lowest levels of seeing in the visible of any location on our planet, the lowest sky backgrounds in the infrared, and the best atmospheric transmission across windows in the infrared and sub-millimetre. Particular attention will be given to the opportunities presented for astronomy from the high plateau sites of Dome A and Dome C.

SPS7-2 Oral presentation

A decade of observations with AST/RO at the South Pole

C. L. Martin[1], AST/RO Telescope Team[2]

[1]Oberlin College, Oberlin, OH, United States, [2]Harvard-Smithsonian Astrophysical Obs, Cambridge, MA, United States

From 1995 through 2005, the Antarctic Sub-mm Telescope/Remote Observatory (AST/RO) collected a wealth of astronomical data with its 1.7m diameter telescope at the geographic South Pole. With key projects ranging across the southern sky being observed in frequencies from 200 GHz all the way up to 2 THz, the AST/RO dataset continues to play an essential role in the understanding of galactic and extragalactic atomic and molecular clouds.

This talk will discuss the history of the telescope, the special techniques that enabled its successful operation in the Antarctic environment, the exceptional observational conditions of the site itself, and a few of the telescope's observational highlights.

SPS7-3 Oral presentation

Site Testing At Dome C: History, Present Status & Future

J Vernin, A Agabi, E Aristidi, M Azouit, M Chadid-Vernin, E Fossat, T Sadibekova, A Ziad

Nice University-CNRS, Nice, France

Here we present why we decided to undertake a site characterization at Dome C, Antarctica following a first step made at South Pole. It was clear that poor seeing measured at South Pole was mainly due to ground catabatic wind interacting with strong vertical temperature (refractive index) gradient. Thus, we though to move to Dome C where no catabatic wind is expected. We will recall the history of this long adventure. Then we will present the more recent results which concern daytime observations as well as nighttime observations, as measured by DIMM, balloons, GSM and SSS. From this database and the very special vertical distribution for the optical turbulence at Dome C, we will present some strong implications for High Angular Resolution astronomy at Dome C.

SPS7-4 Oral presentation

Latest Results on Neutrino Point Source Searches with the AMANDA Telescope

T.P.A. Castermans

University of Mons-Hainaut, Mons, Belgium

High energy neutrinos constitute highly valuable astronomical messengers. Unlike photons or protons, they can travel cosmic distances without being absorbed or deflected from their initial direction of propagation and deliver unaltered information related to the site of their emission. The Universe being transparent to photons only up to modest energies, neutrinos thus can be the indispensable partners of 'conventional' astronomy to probe the most violent astrophysical objects.

Completed in 2000 at South Pole, the AMANDA neutrino telescope, prototype instrument of the IceCube neutrino observatory, has collected data since 1997. These have been analysed in order to find evidence of a neutrino signal coming from objects such as microquasars, Active Galactic Nuclei, supernovae remnants or Gamma Ray Bursts. In this talk, we will review the different strategies developed in this quest and present the latest results and limits placed on fluxes of astrophysical neutrinos.

SPS7-5 Oral presentation

Status Of The High Energy Neutrino Observatory IceCube

A. Karle

University of Wisconsin-Madison, Madison, United States

IceCube is a large neutrino observatory being built near the geographic South Pole.

IceCube is designed to measure neutrinos of energies 10^11 eV to more than 10^{18} eV. The main goal is the detection of neutrinos originating from active galactic nuclei, gamma-ray bursts, supernova remnants and other astrophysical sources. IceCube will perform other studies such as WIMP annihilation in the Sun, neutrino oscillations and cosmic-ray composition at energies above 1 PeV.

604 Optical Sensors have been deployed to date, roughly 10% of the total. They comprise 540 sensors on 9 strings located between 1.45 km and 2.45 km beneath the South Pole surface, and 64 modules located in a 16-station surface air shower array called IceTop. IceCube's instrumented volume will eventually reach 1 km^3 in the ice and 1 km^2 on the surface. First data show that the instrument meets its performance goals.

An overview will be given of the design, construction status and the initial performance of IceCube.

SPS7-6 Oral presentation

The AST/RO Survey of the Galactic Center Region

C. L. Martin[1], AST/RO Telescope Team[2]

[1]Oberlin College, Oberlin, OH, United States, [2]Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, United States

To understand the strongly excited gas near the center of our own galaxy, detailed surveys in a variety of higher excitation states are required. To aid in this effort, the Antarctic Sub-millimeter Telescope and Remote Observatory (AST/RO, a 1.7m diameter sub-millimeter-wave telescope at the geographic South Pole) has completed a fully sampled survey of CO(7-6), CO(4-3), [CI](3P2-3P1), and [CI](3P1-3P0) in a three square degree region around the Galactic Center (Martin et al., ApJS, 150, 239 (2004)). In addition to this dataset, AST/RO has recently completed a survey area around Clump 1 and 2, thus covering the bulk of strongly excited gas near the center of the galaxy.

To fully illustrate the range of information available in this extensive dataset, a series of interactive 3D visualizations and movies will presented.

SPS7-7 Oral presentation

Submillimetre Maps Of Nearby Molecular Clouds

N.F.H. Tothill[1], A. Loehr[1], S. Parshley[2], J.I. Harnett[1], A.P. Lane[1], A.A. Stark[1]

[1]SAO, Cambridge, United States, [2]Cornell University, Ithaca, United States

Large-scale homogeneous surveys of molecular clouds allow us to measure the physical conditions under which stars are formed. We have used AST/RO to survey the southern molecular clouds in the Spitzer `Cores to Disks' programme: Lupus, Chamaeleon, and a sample of small dense cores, all nearby (< 500 pc) regions of low-mass star formation. The AST/RO millimetre-wave maps (13CO 2-1) cover

the same area as the Spitzer maps, while submillimetre (CO 4-3) maps cover areas with strong 13CO 2-1 emission. The CO 4-3 emission is subthermally excited and traces high-volume-density gas: In the large-scale maps, it shows a more clumpy structure than 13CO 2-1, highlighting the densest clumps of gas. By relating the physical conditions of the molecular gas to the census of young stars provided by Spitzer, we can track the process of star formation in dense molecular gas.

SPS7-8 Oral presentation

Single Star Scidar first light from Dome C

J. Vernin, M. Chadid-Vernin, E. Aristidi, H. Trinquet, T. Sadibekova

LUAN, Nice University, Nice, France

Here, we present the SSS first light from Dome C Antarctica. Results obtained during Chadid's expedition in the Summer Season 2005-2006 . The alpha Car observations are obtained during the day and using a 40 cm telescope. The SSS "Single Star Scidar" technique derives from the so-called Scidar (SCIntillation Detection and Ranging) technique, which analyses the scintillation, on the entrance pupil of a telescope, of a double star. The scientific goal is to measure vertical profiles of the Optical Turbulence C_N ^2 (h) and the wind speed *V*(h) at Dome C from the scintillation of a single star. From those two profiles it is possible to deduce almost all the parameters which can help to optimize all the instruments devoted to High Angular Resolution Astronomy, such as Adaptive Optics and Interferometry. The SSS at Dome C is composed of a 40 cm telescope driven by an equatorial mount. A short focal lens is used to collimate the optical beam, and the defocussed image of the telescope pupil is acquired by a CCD. Several thousands of images are analyzed in real time to deliver spatio-temporal cross correlations. Each few tens of seconds, such a correlation is stored in order be processed off line with the “simulated annealing” method. The development and construction of this instrument was made possible with help of: Air Force Office of Scientific Research and the European Office of Aerospace Research and Development (USA), Programmes Internationaux de Cooperation Scientifique, INSU and CNRS contracts, a European “ELT Design Study” contract, the IPEV infrastructure and financing, AFRL-VSBYA (USA), IAC (Spain) and ANR “CASDOA” contract.

SPS7-9 Oral presentation

AMICA – The Infrared Eye At Dome C

A Riva[1], M Dolci[2], O Straniero[2], F M Zerbi[1], F Bortoletto[3], L Corcione[4], V De Caprio[1], D Magrin[3], M Ragni[2]

[1]INAF Osservatorio Astronomico di Brera, Merate, Italy, [2]INAF Osservatorio Astronomico Collurania Teramo, Teramo, Italy, [3]INAF Osservatorio Astronomico di Padova, Padova, Italy, [4]INAF Osservatorio Astronomico di Torino, Torino, Italy

AMICA camera (Antarctic Multiband Infrared Camera) is the first light instrument of the IRAIT telescope that will be installed at DOME-C.

The main purpose of AMICA is to observe the infrared sky in the 1-28 microns band. The Antarctic site of DOME-C has an interesting atmospheric transmission in these bands.

This paper describes the design and the procurement of the instrument, with the study of particular solution to the extreme environmental conditions of the site (mean temperature -70°C mean pressure 640 mbar).

One peculiar characteristic of the instrument is the alternative use of two channels (1-5 microns and 5-28 microns) and the use of newly defined filters optimized for the Antarctica environment.

A first technical result of this camera will be the characterization of the observational condition of the site. Natural science application of AMICA are instead in the field of late stages of stellar evolution (especially AGB and post-AGB stars) and the star formation.

SPS7-10 Oral presentation

PILOT—a Pathfinder for an International Large Optical Telescope in Antarctica

M C B Ashley, M G Burton, J S Lawrence, J W V Storey

University of New South Wales, Sydney, Australia

PILOT is a proposed 2.4 metre optical/IR telescope, designed to take advantage of the extraordinarily good observing conditions on the high plateau of Antarctica. The superb seeing and low infrared backgrounds will allow PILOT to outperform telescopes of 2-3 times the diameter at a mid-latitude site.

PILOT is large enough to undertake important science, while small enough to act as a low-cost low-risk technology demonstrator for the next generation of large optical/IR telescopes in Antarctica. Future facilities could include the proposed 8.4 metre off-axis LAPCAT telescope, that would be competitive with ELTs in its ability to directly image extra-solar planets.

PILOT is envisaged as an international collaboration. It is hoped that Australia will fund the telescope, with instruments, logistics and other aspects of the project contributed by international partners.

A detailed science case for PILOT has been published, and a number of design studies for the telescope have been completed or are under way.

SPS7-11 Oral presentation

The Greenland Ice Cap As An Astronomical Site

M.I. Andersen[1], P.K. Rasmussen[2]

[1]Astrophysikalisches Institut Potsdam, Potsdam, Germany, [2]University of Copenhagen, Copenhagen, Denmark

Within recent years it has become evident that the Antarctic Plateau, and notably the domes, such as Dome-C, provide unique observing conditions, particularly in the IR part of the spectrum. One significant limitation of these sites is that they only provide access to one third of the sky. In this respect the Greenland Ice cap could potentially provide

a complementary astronomical site, giving access to another third of the sky. While it appears clear that the Greenland Ice cap does not posses the same potential and climatic stability as the Antarctic plateau, the typical winter temperatures are not more than 10 degrees warmer than on Dome-C and the altitude is very similar. We will give an overview of our current knowledge of the astroclimatology, logistics and operational issues and the current ideas for a site testing campaign at the SUMMIT station.

SPS7-12 Oral presentation

Panoramic camera systems for meteor tracking and meteorite recovery

N. Brosch, R. Nemiroff, L. Shamir

[1]Tel Aviv University, Tel Aviv, Israel, [2]Michigan Technological University, Houghton, United States

Since 1969, the Antarctic became the most fertile part of the Earth to yield meteorites. The recovered meteorites have been concentrated in specific locations by the actions of wind and snow. It is difficult, therefore to derive their history prior to their arrival onto the Antarctic ice except for an estimate of their space residence.

We propose to deploy a system of two or more panoramic cameras in the Antarctic designed to observe meteors and measure their space trajectories. The cameras are patterned after the successful CONCAM systems with the specific difference that each would be equipped with a high-precision light chopper. The CCD images collected by the continuously-operating cameras will yield the angular speed of each detected meteor.

Using two or more cameras spaced by a few km or tens of km it will be possible, using triangulation, to derive the space trajectories of these meteors. In case of meteorite-dropping meteors, the trajectory analysis will allow the determination of the approximate ground impact. This would allow recovery of the meteorite(s) in the subsequent Antarctic spring season with the full knowledge of the space history and with a very small chance of weathering.

SPS7-13 Oral presentation

Australian – New Zealand – Antarctic (ANZAC) VLBI Network

S Gulyaev[1], O Titov[2]

[1]Auckland University of Technology, Auckland, New Zealand, [2]Geoscience Australia, Canberra, Australia

The project of astronomical/geodetic VLBI network has been developed in Australia and New Zealand as a part of the international geodetic network strategy. The new VLBI network is supposed to consist of one Antarctic, three-four Australian and one-two New Zealand comparatively small (12-16 meter in diameter) fast slew rate automated dishes equipped with modern broadband receivers covering frequency range from 1 to 32 GHz. It is proposed to install Antarctic radio telescope in the Scott Base (New Zealand), which will be the utmost Southern radio telescope in the world (Lat = 78º S). The proposed network will operate together with the existing Australian Long Baseline Array. The set of E-W and S-N baselines spanning from 200 km to more than 7000 km provides an excellent uv-coverage, ideal for the Southern Sky radio sources. The results of the network simulations are presented.

Besides a wide spectrum of astrophysical and astrometrical VLBI applications, this network will allow to improve the ITRF in Australia-South Pacific region and the ICRF in the Southern Hemisphere; it will contribute to geophysical research (sea level change, Earth rotation irregularities) as well as to the monitoring of crustal deformation of the Australian continent, the New Zealand subduction zone and the Trans-Antarctic rift zone with fast crustal uplift.

SPS7-14 Oral presentation

Preparing a 20µm Water Vapour Monitor (IRMA) for Operations at Dome C

R.R. Phillips[1], D.A. Naylor[1], L.B. Knee[2], R.E. Dahl[1], D. Sirbu[1]

[1]University of Lethbridge, Lethbridge, Canada, [2]Herzberg Institute of Astrophysics, Victoria, Canada

The Infrared Radiometer for Millimetre Astronomy (IRMA) is a compact, relatively low cost, 20 µm water vapour monitor. By carefully choosing a 2 µm band that contains only water vapour molecule transitions it is possible to use a simple infrared detector chip to measure the total flux emitted by a column of atmosphere and hence, via an atmospheric model, to determine the total precipitable water vapour.

Since February 2005, an IRMA has been measuring precipitable water vapour levels in Chile at the Gemini South site on Cerro Pachon with a second unit added at the nearby Las Campanas observatories site in August 2005. In early 2006 data collection started with three new build IRMA units at three locations for the Thirty Meter Telescope (TMT) project site testing effort.

Additionally, an IRMA unit is in the process of being modified to prepare it for operations at Dome C in Antarctica as an addition to the suite of instruments on the University of New South Wales' AASTINO site monitoring facility.

We present here a description of the features of the TMT IRMA units that enable them to run in a remote, unattended location in the Chilean desert that are relevant to the similarly remote Dome C operations. In addition we describe the modifications that have been undertaken and that are currently being tested in order to enable the units to operate with minimal redesign at the extremely low Antarctic winter temperatures.

SPS7-15 Oral presentation

Wide field surveys for submm astronomy with CAMISTIC at Dome C

V. Minier, G.A. Durand, P.O. Lagage

Service d'Astrophysique/DAPNIA/DSM CEA Saclay, Gif-sur-Yvette, France

The CAMISTIC project aims to install a filled bolometer-array camera with 16x16 pixels on a small telescope (e.g. IRAIT) at Dome C and open the 200-μm (i.e. THz) windows for ground-based observations. CAMISTIC will be located at about 500 m from the base, with very reduced access. Autonomous and automated cryogenic devices specifically designed for the harsh conditions in Antarctica will therefore be needed. We plan to demonstrate the reliability of a novel cryogenic system with all static parts placed next to cryostat at outer temperature conditions and a warmed cabinet for compressors, motors and valves. Extensive tests in wintering condition will be performed before expedition. CAMISTIC will be equipped with novel bolometer technology. The filled bolometer array with a monolithic grid of 256 pixels was designed by CEA for the PACS far-IR/submm imager on the Herschel Space Observatory and similar arrays are currently developed for the ArTéMiS submm camera on ground-based telescopes. A prototype camera operating in the 450 μm atmospheric window has successfully been tested in March 2006 on the KOSMA telescope. CAMISTIC will perform site testing on the atmospheric opacity and sky noise at 200-450 μm and then open the way for future, large submm telescopes at Dome C. In the future, placed on a 12-m single-dish telescope at Dome C, a bolometer camera with ~10000 pixels at 200-450 μm will be particularly powerful to undertake wide field surveys of star-forming complexes in our Galaxy as well as deep field surveys of dust-enshrouded high-redshift galaxies in the early Universe.

SPS7-16 Oral presentation

Antarctica - A Case For 3D-Spectroscopy

A. Kelz

Astrophysikalisches Institut Potsdam, Potsdam, Germany

3D-Spectroscopy (3DS) is an observational technique, that offers several operational benefits for a location such as Antarctica, while being applicable to a wide range of astronomical programmes. Given the environmental conditions, instrumentation for Antarctica should feature a high level of reliability, operational simplicity, and broad capabilities at a minimum of required service. Integral-Field Spectroscopy (IFS) provides multiple spectra for each point of a 2-dimensional field, rather than only along a narrow 1-dimensional spectrograph slit. Therefore, IFS does not require very accurate telescope pointing, nor pre-assumptions about slit or aperture sizes. It avoids any losses due to seeing or atmospheric dispersion, eliminating the need for parallactic alignment or a dispersion compensator.

Furthermore, as all the information is gathered at the same time, 3D-spectroscopy is more efficient than any scanning technique and insensitive to changing conditions. The resulting data-cube (RA, Dec, lambda) allows both a PSF-optimized extraction of single and combined spectra, as well as the re-construction of narrow- and broad-band images, without the need for a filter wheel. The use of future, innovative integral-field units, eliminates much of the complexity, present in classical spectroscopy. It relaxes acquisition requirements and removes critical, movable parts from the system. This allows a fast and reliable 'point-and-expose' observational approach, which is ideally suited for remote or robotic observations, as needed in Antarctica.

Apart from the technological benefits, the presentation will give examples of a variety of scientific programmes that benefit from the use of IFS, ranging from stellar population studies to cosmology.

SPS7-17 Oral presentation

Prospects for Antarctic Interferometry

E. G. Fossat

LUAN, Universite de Nice, Nice, France

The prospects for conducting interferometry from the Antarctic plateau will be discussed, especially in the optical/IR.

SPS7-18 Poster

The International Concordia Explorer Telescope: a joint telescope for atmospheric and astrophysical applications at Dome C

K. G. Strassmeier[1], A. Herber[2], V. Vitale[3], G. Cutispoto[4], I. Ribasi[5], H. Korhonen[1], M. Andersen[1], T. Granzer[1]

[1]AIP, Potsdam, Germany, [2]AWI, Bremerhaven, Germany, [3]CNR-ISAC, Bologna, Italy, [4]INAF-Catania, Catania, Italy, [5]IEEC, Barcelona, Spain

ICE-T is a fully robotic telescope for astrophysics and atmospheric research in Antarctica and is based on the ``Star Photometer'' project within TAVERN, the quantification of tropospheric aerosol and thin clouds variability over the east Antarctic plateau including the radiation budget. This poster introduces the joint science case, the conceptual design, and the anticipated data handling plan. ICE-T consists of two 60cm optical ultra-wide-field Schmidt telescopes and one 18cm narrow-field Maksutov spectrophotometric telescope on a single mount for the

Antarctic station Concordia at Dome C.

SPS7-19 Poster

Astronomical Site Testing of the Antarctic Plateau

J R Mould[1], K Mighell[1], M Merrill[1], R Lynds[1], A Tokovinin[7], T Travouillon[2], A Moore[2], C Pennypacker[3], L Wang[3], G Weidner[5], M Swain[6], D York[4]

[1]NOAO, Tucson, United States, [2]Caltech, Pasadena, United States, [3]University of California, Berkeley, United States, [4]University of Chicago, Chicago, United States, [5]University of Wisconsin, Madison, United States, [6]University of Arizona, Tucson, United States, [7]NOAO, La Serena, Chile

We have assembled a team with expertise in astronomical site testing in the Antarctic and expertise in Antarctic meteorology, to answer the outstanding questions that must be answered before major facilities for optical and infrared astronomy can be deployed to the Antarctic plateau.

Previous work has shown that the Antarctic Plateau is the best site on earth for many types of astronomical observation. The dry, tenuous and extremely cold air leads to considerable gains in sensitivity for the measurement of radiation fluxes incident on the earth from space across many wavebands.

Optical turbulence in a boundary layer covering the plateau remains to be characterized, however. Understanding it is key to design of future telescopes or arrays of telescopes. Measurements should be made at a number of sites, including Dome A, Dome F, and a transantarctic mountain site.

SPS7-20 Poster

Science with the High Elevation Antarctic Terahertz Telescope

W Walsh[1], MG Burton[1], JWV Storey[1], MCB Ashley[1], C Walker[2]

[1]University of New South Wales, Sydney, Australia, [2]University of Arizona, Tucson, United States

The proposed High Elevation Antarctic Terahertz Telescope (HEAT) is an instrument designed for the measurement of sub-mm spectral lines over regions several square degrees in size toward the Milky Way and Magellanic Clouds. By mapping as a function of Galactic position the size and mass distribution and internal velocity dispersion of interstellar clouds in the Galaxy in both atomic and molecular lines, HEAT will construct the first barometric map of the Galactic Plane. HEAT will also map the gas heating rate, the star formation rate and produce the first large scale Galactic images of the dominant cooling atomic cooling lines of carbon and nitrogen. balance, and evolution of molecular clouds in the Milky Way and distant star-forming galaxies. Since the ionisation potential of nitrogen is 14.5eV, the 1461.1319 GHz = 205.176μm line of [NII] arises from regions where hydrogen is ionised, and thus serves as an extinction-free probe of the Warm Ionised Medium (WIM). There is an observed nonlinear relationship between [CII] and [NII] emission (Bennett et al. 1994) on large scales. By observing a variety of UV-illuminated giant molecular clouds, compact and diffuse HII regions, and planetary nebulae in the 1461 GHz [NII] line at 700 times the spectral and angular resolution of satellite data, the [CII]/[NII] intensity ratio can be used as a probe to determine how much of the Galaxy's [CII] emission arises in ionised gas.

SPS7-21 Poster

Romanian Robotic Telescope Project For Antarctica

P. Popescu[1], R. Popescu[1], P. Paraschiv[1], A. Nedelcu[1], O. Badescu[1], Th. Negoita[2], A Bot[3]

[1]Astronomical Institute of Romanian Academy, Bucharest, Romania, [2]S.C. Romanian Institute for Polar Researches, Bucharest, Romania, [3]INCDTIM, Cluj-Napoca, Romania

Researches, financed by Romanian Ministry of Education and Research, were initiated in 2005, having as final goal the installing of a robotic telescope in Australian – Romanian Antarctic Base, Low-Racovita. This research will be included in the plans for the International Polar Year, 2008 being the final term of mounting the telescope. The project involves three institutes and contains specific research parts concerning astroclimate conditions, building testing and installing the telescope, astronomical observations, data storage and communications.

SPS7-22 Poster

Technology for a remote automated Antarctic observatory

MCB Ashley, J Lawrence, JWV Storey, MG Burton, S Hengst, D Luong-Van

University of New South Wales, Sydney, Australia

Encouraged by recent data from Dome C station demonstrating the unique potential of the high Antarctic plateau for astronomy, a number of international groups intend to deploy telescopes and site testing instrumentation to various unmanned locations on the Antarctic plateau within the next few years. These instruments will require a reliable completely autonomous observatory to provide power, heat, control, and communications throughout the Antarctic winter. The AASTINO (Automated Astrophysical Site Testing International Observatory), which was designed with these goals, was deployed to Dome C in January 2003. It has successfully demonstrated many of the concepts essential for such operation. The second generation AASTINO, currently in development, has an extremely flexible power generation system that can consist of solar, battery, diesel, and stirling cycle systems. Power and Control Area Network (CAN) data is available to all scientific instruments via a universal connector system, simplifying the integration of instruments developed by diverse research teams and ensuring a more straightforward deployment process. System monitoring, commands, and low bandwidth experimental data transfer, is performed via a redundant Iridium satellite network up-link. Bulk data storage is achieved via a redundant array of mechanical hard disk drives in an atmospherically modified enclosure, preventing damage by low pressure and temperature. A dual redundant supervisor system controls all aspects of communication and control, and can handle individual system failures as well as many catastrophic computer failures. In the event of total communication loss, the supervisor system is designed to control all experiments autonomously including the rationing of electrical power.

SPS7-23 Poster

SNODAR: measuring the atmospheric turbulence in the lowest 100 metres in Antarctica

C. Bonner[1], M.C.B. Ashley[1], J.S. Lawrence[1], D. Luong-Van[1], J.W.V. Storey[1], S. Bradley[2]

[1]University of New South Wales, Sydney, Australia, [2]University of Auckland, Auckland, New Zealand

The Antarctic plateau has superb astronomical seeing above a turbulent boundary layer with a thickness of between tens of metres and a few hundred metres, depending on the site.

We are developing a sonic radar, SNODAR, to measure the turbulence in the boundary layer from 10 to 100 metres, and, in particular, to measure the height of the boundary layer to an accuracy of 1 metre. Commercial sonic radars typically have a lower limit of about 30 metres, and have 30 metre range gates.

The results from SNODAR should allow a confident assessment of the height at which one must mount a telescope in order to realise the superb free-atmosphere seeing from the Antarctic plateau, which has been measured at Dome C to be 0.27 arcsecs on average, and better than 0.15 arcsecs for 25% of the time.

SPS7-24 Poster

The History of Astronomy in Antarctica

B Indermuehle[1], M Burton[1], S Maddison[2]

[1]University of New South Wales, Sydney, Australia, [2]Swinburne University, Melbourne, Australia

We present the historical development of astrophysical science in Antarctica from the early 20th century until today. We find three temporally overlapping eras, each having a rather distinct beginning. These are the astrogeological era of meteorite discovery, the high energy era of particle detectors, and the photon astronomy era of microwave, submillimetre and infrared telescopes, sidelined by a few niche experiments at optical wavelengths. The favourable atmospheric and geophysical conditions are briefly examined, followed by an account of the major experiments and a summary of their results.

SPS7-25 Poster

AstroPoles – the astronomical program for the International Polar Year

M Burton

University of New South Wales, Sydney, Australia

It has long been recognised that the polar plateaus provide the best sites on the Earth's surface for the conduct of a wide range of astronomical observations, from optical to millimetre wavelengths. This is on account of the extremely cold, dry and stable air found there. The exceptional site conditions would allow observations to be made of the cosmos, with greater sensitivity and clarity, and across a wider part of the electromagnetic spectrum, than from temperate-latitude sites. AstroPoles is the international astronomy community's IPY project, which aims to quantify these conditions at four sites in the Polar regions; Summit in Greenland, Ellesmere Island in Canada, and Domes A and C on the Antarctic plateau, and then to begin the process of turning these sites into frontline observatories. Dome A is likely to be the pre-eminent location on the Earth for observational astronomy, but has only recently been visited by humans (China in 2005). Dome C is the site for a new station (France/Italy, fully operational in 2005), and already shows indications for better seeing conditions than for any existing observatory. Summit Station (Denmark/USA) and Ellesmere Island (Canada) are also extremely cold and dry. They are the best prospective observing sites in the northern polar regions and their conditions have not yet been quantified. This poster will describe the AstroPoles program and its aims for the IPY.

Given on behalf of the AstroPoles consortium.

SPS7-26 Poster

A Test for the Detection of Vegetation on Extrasolar Planets :

Detection of Vegetation in Earthshine Spectrum

D. Briot[1], E. Aristidi[2], L. Arnold[3], P. Francois[1], P. Riaud[1], P. Rocher[1], J. Schneider[1]

[1]Observatoire de Paris-Meudon, Paris, Meudon, France, [2]Université de Nice Sophia Antipolis, Nice, France, [3]Observatoire de Haute-Provence, Saint-Michel l'Observatoire, France

The search for life in extrasolar planets is to be tested first with the only planet known to shelter life. If the planet Earth is used as an example to search for a signature of life, the vegetation is one of its possible detectable signature, using the Vegetation Red Edge due to chlorophyll in the near infrared (0.725 m). We focus on a test of the detectability of vegetation in the spectrum of Earth seen as a simple dot, using the reflection of the global Earth on the lunar surface i.e. Earthshine. On the Antarctic, the Earthshine can be seen during several hours in a day (not possible at our latitudes) and so variations due to different parts of Earth, that is to say oceans and continents, facing the Moon could be detected.

SPS7-27 Poster

The Antarctic Plateau: The Ideal Terrestrial Site for Extrasolar Planet Transit Surveys?

JL Christiansen[1], MCB Ashley[1], D Caldwell[2]

[1]University of New South Wales, Sydney, Australia, [2]NASA Ames Research Center, Moffet Field, United States

Three Antarctic plateau sites - the South Pole, Dome C and Dome A - are assessed for their suitability as locations for an extrasolar planet transit survey. Predominately, the long winter night offers a unique opportunity to achieve significant phase coverage in a short period of time. This reduces the amount of time required on each target field by a factor of more than 2 over temperate sites. A South Pole site also has the advantage of almost no airmass variations for a target field, eliminating that periodic systematic from the data. Sites at Dome C and almost certainly Dome A would offer the additional advantage of extremely stable and high-quality photometric conditions for long periods of time, which are essential for detection of low-amplitude transits. The Vulcan South experiment to detect extrasolar planet transits was deployed at the South Pole to capitalise on these advantages from 2003 to 2005. The system and the survey strategy are described here.

SPS7-28 Poster

The Gattini cameras for optical sky brightness measurements in Antarctica

A Moore[1], E Arisitidi[2], MCB Ashley[3], M Busso[4], M Candidi[4], J Lawrence[3], J Storey[3], B le Roux[6], R Ragazzoni[6], P Salinari[6], G Tosti[4], T Travouillon[1], S Kenyon[3], D Luon-Van[3]

[1]CALTECH, Pasadena, United States, [2]LUAN, Nice, France, [3]University of New South Wales, Sydney, Australia, [4]University di Perguga, Perugia, Italy, [5]CNR, Roma, Italy, [6]Osservatorio Arcetri, Italy, Italy

The Gattini cameras are two site testing instruments for the measurement of optical sky brightness, large area cloud cover and auroral detection of the night sky above the high altitude Dome C site in Antarctica. The cameras have been in operation since January 2006. The cameras are transit in nature and are virtually identical, both adopting Apogee Alta ccd detectors. The camera called Gattini-SBC images a 6 degree field centred on the South Pole, an elevation of 75^{o} at the Dome C site. The camera takes repeated images of the same 6 degree field in the Sloan g' band (centred on 477nm) and, by adopting a lens with sufficiently long focal length, one can integrate the sky background photons and directly compare to the equivalent values of the stars within the field. The second camera, called Gattini-allsky, incorporates a fish-eye lens and images ~110 degree field centred on local zenith. By taking frequent images of the night sky we will obtain long term cloud cover statistics, measure the sky background intensity as a function of solar and lunar altitude and phase and directly measure the spatial extent of bright aurora if present and when they occur. An overview of the project is presented together with preliminary results from data taken since operation of the cameras in January 2006.

SPS7-29 Poster

Optical Sky Brightness at Dome C, Antarctica

S Kenyon, JWV Storey, MG Burton

University of New South Wales, Sydney, Australia

Dome C, Antarctica is a prime site for astronomical observations in terms of climate, wind speeds and turbulence. The infrared and terahertz sky backgrounds are the lowest of any inhabited place on Earth. However, at present little is known about the optical sky brightness and atmospheric extinction. Using a variety of modelling techniques together with data from the South Pole, we estimate the brightness of the night sky including the contributions from scattered sunlight, moonlight, aurorae, airglow, zodiacal light and artificial sources. We compare our results to another prime astronomical site, Mauna Kea. We find moonlight has significantly less effect at Dome C than at Mauna Kea. Aurorae are expected to have a minor impact at both sites, and zodiacal light is expected to be less at Dome C than at Mauna Kea. Airglow emissions at Dome C are expected to be similar to those at temperate sites. With proper planning, artificial sources of light pollution should be non-existent. The overall atmospheric extinction, or opacity, is expected to be the minimum possible. We conclude that Dome C is a very promising site not only for infrared and terahertz astronomy, but for optical astronomy as well..

SPS7-30 Poster

Atmospheric scintillation at Dome C, Antarctica: implications for photometry and astrometry

S Kenyon[1], J Lawrence[1], MCB Ashley[1], JWV Storey[1], A Tokovinin[2], E Fossat[3]

[1]University of New South Wales, Sydney, Australia, [2]CTIO, La Serena, Chile, [3]LUAN, Nice, France

Night-time turbulence profiles of the atmosphere above Dome C, Antarctica, were measured during 2004, using a MASS instrument. We compare this data with turbulence profiles above Cerro Tololo and Cerro Pachon, also measured with a MASS, and find, with the exception of the lowest layer, that Dome C has significantly less turbulence. In addition, the integrated at turbulence 16 km above Dome C is always less than the median values at the two Chilean sites. Using average wind speed profiles, we assess the photometric noise produced by scintillation, and the atmospheric contribution to the error budget in narrow angle differential astrometry. In comparison with the two mid-latitude sites in Chile, Dome C offers a potential gain of about 3.6 in both photometric precision (for long integrations) and narrow-angle astrometry precision. Although the data from Dome C cover a fairly limited time frame, they lend strong support to expectations that Dome C will offer significant advantages for photometric and astrometric studies.

SPS7-31 Poster

LAPCAT: the Large Antarctic Plateau Clear-Aperture Telescope

JWV Storey[1], R Angel[2], J Lawrence[1], P Linz[2], MCB Ashley[1], MG Burton[1]

[1]University of New South Wales, Sydney, Australia, [2]Steward Observatory, Tucson, United States

We present a proposal for an 8.4 metre off-axis optical/IR telescope to be located at Dome C, Antarctica. LAPCAT will use a mirror identical to the offset segment recently cast for the Giant Magellan Telescope (GMT) as a completely unobscured f/2.1 primary. With a cooled deformable Gregorian secondary in a dewar following prime focus, LAPCAT will allow for diffraction-limited imaging with only a single reflecting surface at ~ 220K, and thus the lowest possible thermal background obtainable on earth. The exceptionally low atmospheric turbulence above Dome C enables very high contrast imaging in the thermal infrared, and diffraction limited imaging extending to optical wavelengths (20 mas at 800 nm, where Strehl ratios > 60% are projected). As an example, a deep 5 mm exoplanet imaging survey to complement current radial velocity methods could take advantage of both the low background and pupil remapping methods for apodization enabled by the clear aperture. Many new, young, giant planets ($\geq 3M_{Jupiter}$ at 1 Gyr) would be detected in orbits $\geq$ 5 AU out to 20 pc. By providing a test bed for many of the GMT technologies in an Antarctic environment, LAPCAT also paves the way for the eventual construction of a second GMT at Dome C. Such a telescope would have unparalleled capabilities compared both to other ELTs in temperate sites and to JWST.

SPS7-32 Poster

PLATO - the next-generation AASTINO for robotic site-testing on the Antarctic plateau

S Hengst, J Lawrence, D Luong-Van, J Everett, MCB Ashley, JWV Storey, S Hall

University of New South Wales, Sydney, Australia

A new site-testing facility, PLATO (Plateau Observatory), is under development at UNSW for deployment to remote sites on the Antarctic Plateau including Dome A. The new facility will adopt many of the features of the AASTINO (Automated Astrophysical Site Testing InterNational Observatory) facility at Dome C. PLATO will autonomously control a flexible site testing and observing instrument suite, monitored via the Iridium satellite network. A challenging aspect of PLATO is to maximise the reliability of the power source while minimising fuel consumption. We are building a low pressure, low temperature environmental chamber to simulate operation at the highest altitudes (4,100 m at Dome A). Two types of engines will be tested: a single-cylinder diesel engine and a Stirling engine.

SPS7-33 Poster

PILOT: optical configuration and instrumentation

J Lawrence, MCB Ashley, MG Burton, JWV Storey

University of New South Wales, Sydney, Australia

PILOT, the Pathfinder for an International Large Optical Telescope, is proposed as a 2.4 m diameter optical/infrared telescope to be located at Dome C, Antarctica. PILOT will be placed on a 30 m high tower to minimise the effect of the turbulent atmospheric boundary layer, and should experience the best seeing conditions and the lowest infrared background of any telescope on earth. To take advantage of these conditions, we propose an optical configuration able to deliver diffraction-limited images in the visible, while also giving excellent wide-field performance. We also present a straw-man instrument suite for PILOT.

SPS7-34 Poster

Polar night operation at Dome C with “Star Photometer” and ICE-T

A. Herber[1], A. Gröschke[1], V. Vitale[2], K. Strassmeier[3]

[1]AWI, Bremerhaven, Germany, [2]ISAC-CNR, Bologna, Italy, [3]AIP, Potsdam, Germany

Atmospheric aerosol optical depth (AOD) data from the Antarctic plateau are very sparse. Some AOD measurements were performed during austral summer but none during winter, although some night aerosol information has been gathered from Lidar measurements in the coastal areas. Satellite measurements are very difficult as a consequence of the low AOD values, the high surface reflectivity, and the long and cold polar night. The application of an astronomical “Star Photometer”, by using stellar light as a pencil probe through the atmosphere, can close this gap. Year-round measurements based on Lidar, Sun and Star Photometers, and in-situ measurements will allow a detailed study of the inter-annual and seasonal variations of AOD over the high interior plateau, especially the effects and variability during polar night.

The combined atmospheric and astronomical German activities at Dome C are part of the international project TAVERN (quantification of tropospheric aerosol and thin clouds variability including the radiation budget over the east Antarctic plateau) under responsibility of CNR-ISAC Bologna; and also recognized by the EU network ARENA (Antarctic Research: A European Network in Astronomy). With the “Star Photometer” we intend to observe bright stars for the atmospheric AOD program in 2009 but later on, roughly in 2012, to extend the nightly observations with the help of a more ambitious astronomical experiment called ICE-T (*International Concordia Explorer Telescope*). Both systems will be installed in a specially designed 4m Radom and should enable a combined analysis to study horizontal features of nightly aerosols. This activity is planned in extension of ICE-T’s own astronomical program, i.e. planet transit search, stellar surface activity, and various miscellaneous topics.

SPS7-35 Poster

Design and Construction of the Moving Optical Systems of IRAIT

J. Colome[1], C. Abia[3], J. Isern[2], I. Dominguez[3]

[1]IEEC, Barcelona, Spain, [2]IEEC-CSIC, Barcelona, Spain, [3]UGR, Granada, Spain

The IRAIT (International Robotic Antarctic Infrared Telescope) project is based on a 80 cm aperture telescope to observe in the infrared range. It is due to start operations in spring 2008, several months after installation in Dome C (Antarctica). We present the contributions made to such project by the Institute for Space Studies of Catalonia (IEEC) and the University of Granada, whose participation is mainly focused in developing the moving optical system for the secondary (M2) and tertiary (M3) mirrors of the telescope. Moving parts of the optical system provide focusing and chopping capabilities, implemented in M2, and a rotation mechanism, implemented in M3, permits observation in either Nasmyth foci. The work package includes the design and construction of both mirrors, the mechanical supports, the electronics and the control software, all prepared to work at the low temperatures of Antarctica. A Spanish company, NTE, was contracted to carry out the design and manufacturing. Tests at low temperature and integration in the telescope is being finished during summer 2006, before sending the telescope to Antarctica, scheduled by the end of the year.