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monthly notes of the astronomical society of southern africa

Vol 70 Nos 7 & 8 August 2011

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Articles in *MNASSA* appear in the NASA/ADS data system.

Project SOLARIS ... met eish ja, met eish!

In less than two weeks and despite the firm grip of winter, two new clamshell domes recently mushroomed onto the Sutherland skyline as part of the Polish *Project Solaris*, a southern hemisphere network of four robotic telescopes. Seen here on an icy morning, is Solaris-1 showing off its newly installed 0.5-m photometric telescope. See article on p. 131. Image credit: Stanislaw Kozlowski

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Astronomical Society of Southern Africa

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Monthly Notes of the Astronomical Society of Southern Africa
Vol 70 Nos 7 & 8 August 2011

assa news

New Members

During Council Meetings held on the respective dates indicated below, the following new members were ratified:

2 April 2011

Dr GJ Begemann, Komatipoort
Mr M Coqui, Mowbray
Mr V Ellis, Boksburg
Mr EV Flattery, Lobatse, Botswana
Mr R Fourie, Pomona
Mr EJF Forster, Brackenfell
Mr NJS Grobler, Randburg
Mr C Hardon, Newlands
Mrs C Ives, Bryanston
Mr WF Prinsloo, Hekpoort
Mr P Strauss, Kloof
Mr ZJ van Orel Bronte, Edleen

14 May 2011

Miss G. Brown, Featherbrook Estate
Mr G. Eva, Benoni Small Farms
Mr C. Ganten-Bein, Randpark Ridge
Mr P.N. Grobler, Scottsville
Mr L. Leeuw, Mill Street Post Office
Mr G.A. Myburgh, Emmarentia Ext
Mr R. Rath, Richmond Hill
Mr M.F. Stroebel, Claremont
Mr P.J. Tosen, Vanderbijlpark

28 June 2011

Mr VA Dhlamini, Tembisa
Mr DR Lyddell, Somerset West
Mr V Pather, Umzinto
Mr PJ Powers, Kempton Park ☆

news notes

Changes in the Administration of Astronomy in South Africa

The repercussions of the unjust suspension of Prof Phil Charles as the director of the South African Astronomical Observatory (SAAO) in January 2010 (see *MNASSA* **69**, 48, 2010) and his complete exoneration are at last coming to a head (the charges against him were never made public). Following a report by Prof Belinda Bozzoli, chairperson of the board of the National Research Foundation (NRF), under which the SAAO falls (see *MNASSA* **69**, 202, 2010), Prof Manfred Hellberg of University of KwaZulu-Natal was appointed for 6 months from October 2010 to head an 'Astronomy Desk' at the Department of Science and Technology (DST). His report and recommendations were handed in on 16 April, following which there has been a deafening silence.

Signs of movement were perceived following an article in the *Mail and Guardian* of 8 July 2011 by Marion Shinn, DA shadow minister of Science and Technology. She pointed out that Prof Charles's second term ends at the end of August and that a successor has not yet been selected. Charles will return to a post at the University of Southampton from which he has been on leave for the last seven years.

Prof Nithaya Chetty, who has been appointed interim manager of the astronomical interests of the NRF.

On 14 July NRF staff were informed that the Board had decided to put in place another interim management system for its astronomical interests. A 'suitably qualified and experienced Astronomer/Physicist' would be appointed to head these entities pending recommendations by the Minister of Science and Technology, the Hon Naledi Pandor, regarding the future governance of astronomy in SA.

Dr Gatsha Mazithulela, the vice-president of the NRF, under whom the SAAO fell at the time of Prof Charles' suspension, has been given a package to leave the organisation. The cost of this has not been revealed.

Prof Nithaya Chetty of the University of Pretoria, a theoretician and computational solid-state physicist, has been appointed to the new temporary post. Prof Chetty comes with excellent credentials in defending academic freedom.

The directorship of SAAO was advertised in October last year with closing date 30 January, but because of a lack of suitable applicants it was extended to 31 March. A search committee under Prof Renée Kraan-Korteweg (UCT) was appointed at the time of the original advertisement but could not function satisfactorily until the question of the management structure was resolved. Similar urgent considerations applied to the directorship of the MeerKAT project and it is thought that this is what was responsible for the latest developments. ☆

Two giant extra-solar planets found orbiting a magnetic CV

Stephen Potter and Encarni Romero-Colmenero from the South African Astronomical Observatory (SAAO) and collaborators have found evidence for the existence of an extraordinary planetary system where two giant planets are orbiting the magnetic Cataclysmic Variable (UZ Fornacis).

Figure 1 An artist's impression of what the system could look like.

UZ Fornacis is one of 15 known eclipsing magnetic Cataclysmic Variables (CVs). It is orientated in such a way that the stars appear to eclipse each other once every orbit as viewed from Earth. The red dwarf blocks our view of the much brighter white dwarf. The system is too far away to make a direct image, however during eclipse it is possible to measure a dramatic decrease in brightness that lasts for a few minutes. Fig 2. shows one such eclipse measurement using the SALTICAM and BVIT high speed cameras on SALT. The almost vertical ingress and egress only takes about 1-2 seconds which permits very accurate mid-eclipse times to be calculated. When combined with published eclipse times and archival data spanning ∼27 years, significant departures from a simple linear and/or quadratic trend were detected. Furthermore the deviations could be mathemati-

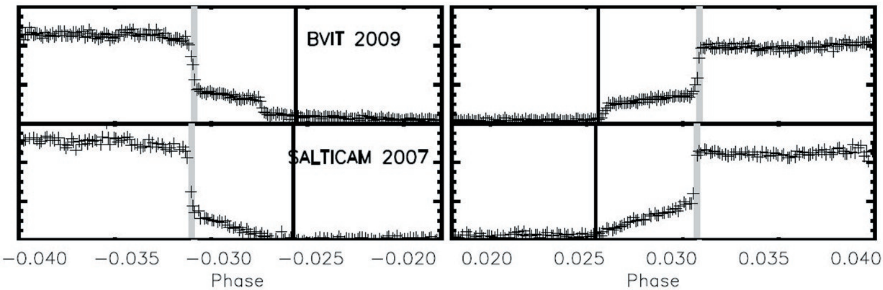


Figure 2 A sample of our new eclipse observations. Vertical grey bars indicate ingress and egress of the main accretion spot. Solid vertical bars indicate times of white dwarf ingress and egress assuming a duration of 40s.

cally described by two elliptical functions with periods of ~16 and ~5 years. Fig. 3 shows the eclipse time measurements with the two elliptical functions. This led them to hypothesise the presence of two giant planets whose gravitational effect would cause the stars' orbit to wobble and consequently slightly alter the measured time between eclipses due to the light-time effect. From the amplitudes of the time variations they were able to infer that the masses of the two planets must be at least six and eight times that of Jupiter.

UZ Fornacis would be an extremely inhospitable environment for planets to exist. Due to their close proximity, the gravity of the white dwarf is constantly stealing material from the surface of the red dwarf in a continuous stream. In addition to a strong gravitational field, the white dwarf also has an extremely high magnetic field. Consequently the stream is accelerated to hyper-sonic velocities by the gravity and is funnelled by the magnetic field. The stream then crashes onto the white dwarf, near its magnetic poles, where it gets super-

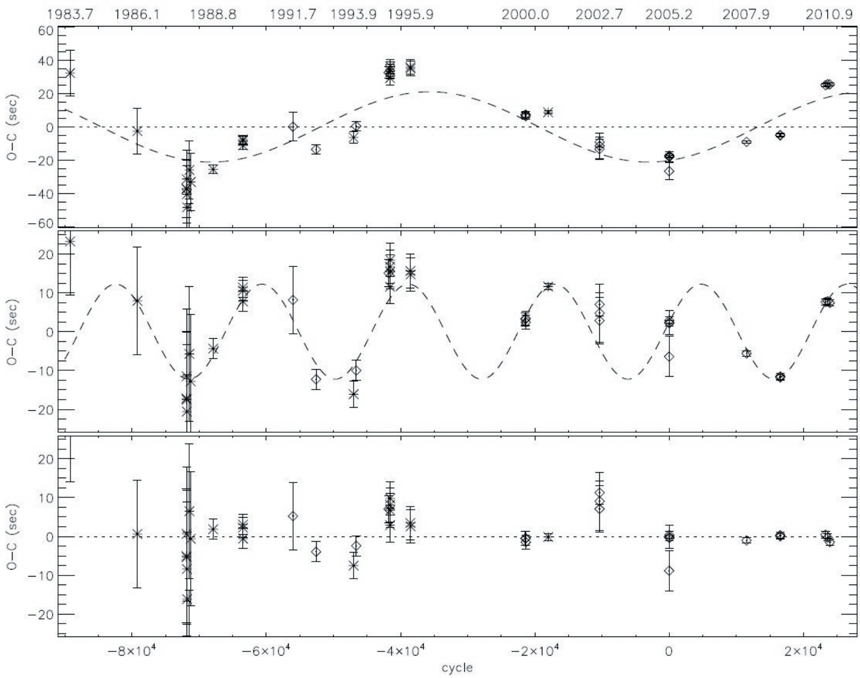


Figure 3 Top: The O-C (Observed-calculated) Middle: O-C after subtraction of the first elliptical term with the second elliptical term over-plotted (dashed curve). Bottom: The final O-C residuals after subtraction of the second elliptical term. Diamonds are our new data or data that we have reduced from archives. Crosses are eclipse times from the literature and converted (by us) to BJD.

heated to millions of degrees. This relatively small 'crash site' would be about the size of Iceland; however the amount of radiation it emits is greater than the combined brightness of both stars (see Fig. 3). Not only is it optically bright, it also floods the entire planetary system with enormous amounts of X-ray radiation. In fact it was their bright X-ray emissions that led to the discovery of this type of binary star system by the first X-ray satellites about 30 years ago.

These so called extra-solar planets are currently a hot area of astronomical research and a few hundred have now been discovered over the past few years. This new discovery of planets orbiting UZ Fornacis shows that planets can also exist in very peculiar environments. Indeed how planets could have formed in UZ Fornacis is problematic. Two possible theories are that they either formed a lot further out in a pre-common envelope circumbinary protoplanetary disc (first generation) and were subsequently dragged in to their current orbits or they formed in a disc that resulted from the common envelope phase (second generation). The latter would mean that they are very young planets. In either case this will undoubtedly prompt further searches for planets in other binary systems of this type.

This discovery was made possible by new SAAO and Southern African Large Telescope (SALT) observations combined with archival data spanning 27 years, gathered from multiple observatories and satellites including the HST (Hubble Space Telescope), EUVE (Extreme UltraViolet Explorer) , SWIFT (The Swift Gamma-Ray Burst Mission), XMM-Newton (is ESA's X-ray space observatory), ROSAT (ROentgen SATellite, was an X-ray observatory) and EXOSAT (was the ESA's X-ray Observatory). The work is currently in press with the *Monthly Notices of the Royal Astronomical Society*. ☆

Kevin Govender wins prestigious NSTF Award

At the annual National Science and Technology Forum, NSTF, awards Kevindran Govender won an award for his contributions to Science Communication for Outreach and Public Awareness over the last five years. He was presented with his award by the minister of Science and Technology, Mrs Naledi Pandor, during a gala dinner held at the Emperor's Palace, Kempton Park in May this year.

Mrs Naledi Pandor Minister of Science and Technology, Mr Kevindran Govender and Mr Lorenzo Raynard, Manager: Science Communication.

These prestigious NSTF Awards were established in 1998 to celebrate, acknowledge and promote excellence in the South African Research and Development (R&D) community by cross-cutting sectors, levels, gender, and race while recognising both individuals and teams.

The NSTF-BHP Billiton Awards recognize and celebrate excellence in scientific research that is professional, innovative, forward looking and relevant to both South Africa and the rest of the world, in order to encourage the involvement and participation of SETI organisations in research while raising awareness in the general public about local research and its relevance. The Awards have been addressing government R&D targets and policy by involving business, drawing attention to scarce skills, profiling role models and facilitating knowledge transfer for learners and students to pursue careers in SETI.

Kevin was recognized for using a variety of media in innovative and exciting ways to show that astronomy is a powerful tool for science education, communication and development. His passion for his work is reflected by his involvement in many major projects in South Africa and internationally, which include his enormous contributions to the SALT Collateral Benefits Plan and the International Year of Astronomy in 2009. In addition he has enriched and expanded the SAAO's (South African Astronomical Observatory) outreach programme considerably. He also played a significant role in bringing the IAU's Global Office for Astronomy Development, GOAD, to South Africa, of which he is now the Director. ☆

Project Solaris – a Southern Hemisphere robotic telescope network

P. Sybilski and S.K. Kozłowski

Project Solaris is a Polish scientific initiative to open a new frontier in the hunt for extrasolar planets. With the Kepler Space Telescope discovering hundreds of systems with planets, some of them harbouring as many as six exoplanets, it was time for a new method and new targets. A few years ago professor Konacki with the experience on radio pulsars timing and radial velocity measurements started to formulate the idea of a search for circumbinary planets utilising a new method – eclipse timing. This method is different to the one where one looks for planets crossing the surface of the star. In our case we look for the eclipses of stars, not the star and the planet.

We would like to report the end of main works in SAAO Observatory, located near Sutherland, South Africa. This is the first complete site, out of three.

Why *Solaris*?

Solaris was a novel by an outstanding Polish writer Stanislaw Lem (1921-2006). The novel is about a circumbinary planet which was covered with a supposedly conscious ocean. The ocean is studied by humans from a station hovering above its surface. Since the novel was first published in 1961, it precedes Star Wars' Tatooine planet (1977) in terms of the first case of a circumbinary planet in pop culture. *Solaris* was turned into a movie twice: first by a great Russian filmmaker, Andrei Tarkovsky (1932-1986) and more recently by a Hollywood's Steven Soderbergh.

Scientific Introduction

Until 1676 light was thought to have an infinite speed when Olaus Roemer carried out precise measurements of the times of eclipses of Jovian moons. Roemer's scrupulous observations led him to a qualitative conclusion that light travels at a finite speed, at the same time providing scientists with the basics of the Light-Time Effect (LTE). LTE is observed whenever the distance between the observer and any kind of periodic event changes with time. The usual cause of this distance change is the reflex motion about the system's barycentre due to the gravitational influence of one or more additional bodies. We aim to analyse one hundred eclipsing binaries from the All Sky Automated Survey (ASAS) catalogue for variations in the times of their eclipses, which can possibly be due to the LTE.

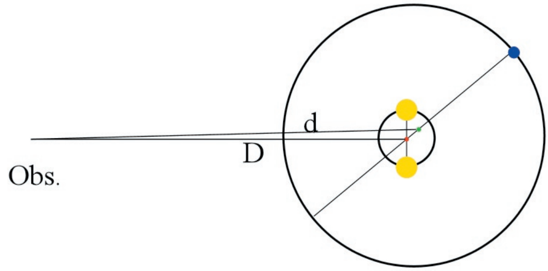


Figure 1: Yellow dots represent stars revolving around red dot – binary star's centre of mass. Blue dot is a third body revolving around green dot – centre of mass for the binary star and the planet. Distance to the observer D of common centre of the mass for the whole system remains constant, but d – distance to the binary's centre changes periodically. This is the source of Light Time Effect we measure.

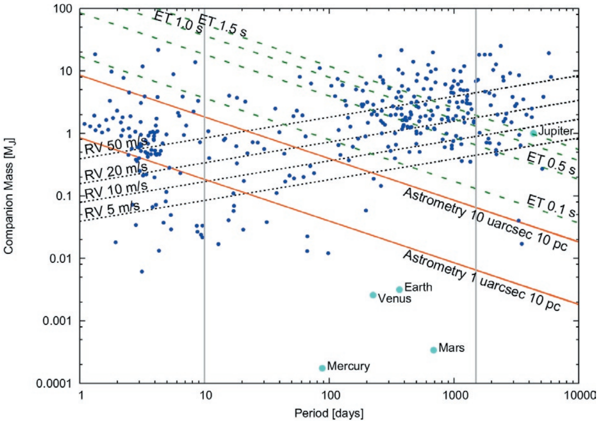


Figure 2: Discovery space for circumbinary planets around a binary star composed of two Sun-like stars. Known exoplanets and Solar System planets are marked with dots. The two vertical lines correspond to the shortest stable orbit for this case and 4 years, the assumed limit of the project.

We use an approach known from the radio pulsar timing where a template radio pulse of a pulsar is used as a reference to measure the times of arrivals of the collected pulses. The variations we will detect in O-Cs (observed – computed) may correspond to the influence of the third body. Our results will be confirmed by spectroscopic follow-up. In our recent publications we demonstrated that the timing analysis employed in radio pulsar timing can be effectively used to study photometric surveys and photometric precision available for 0.5-m telescopes is sufficient to discover extrasolar planets.

Aims

The project main goals are to:

- detect circumbinary planets around a sample of up to 350 eclipsing binary stars using eclipse timing and precision radial velocities.
- characterise the binary stars with an unprecedented precision to test the stellar structure and evolution models.

In order to achieve these goals we will establish a global network of four 0.5-meter robotic telescopes (Australia, South Africa and South America) to collect high precision, high cadence light curves of the binaries. The target for timing precision is one second per eclipse.

Maciej Konacki | Krzysztof Hełminiak | Stanisław Kozłowski | Milena Ratajczak | Piotr Sybilski

Funding and the Team

Construction of the first telescope was thanks to the "FOCUS" grant from the Foundation for Polish Science. The additional three telescopes and the overall costs of the project for the next 5 years will be covered from the highly competitive and prestigious "Ideas" Starting Grant of the European Research Council (1.5 million Euro).

The main Project Solaris team consists of: Maciej Konacki (Primary Investigator), Krzysztof Hełminiak (post doc), and PhD students Stanisław Kozłowski, Milena Ratajczak and Piotr Sybilski.

Hardware

Each of the sites will be equipped with a similar suite of equipment. The telescopes are supplied and manufactured by Astrosysteme, Austria. All four have a 0.5 m diameter main mirror. The South African and Argentinian sites will be fitted with f/15 Ritchey–Chrétien systems (see cover picture), whereas the Australian site will have an f/9 Cassegrain. The optical tube assemblies (OTA's) are mounted on the DDM160 direct drive German equatorial mounts. The high torque motors on both RA and DEC axes offer superior performance: 3 arcsec RMS pointing, 0.15 arcsec RMS tracking (over 5 minutes) and 15

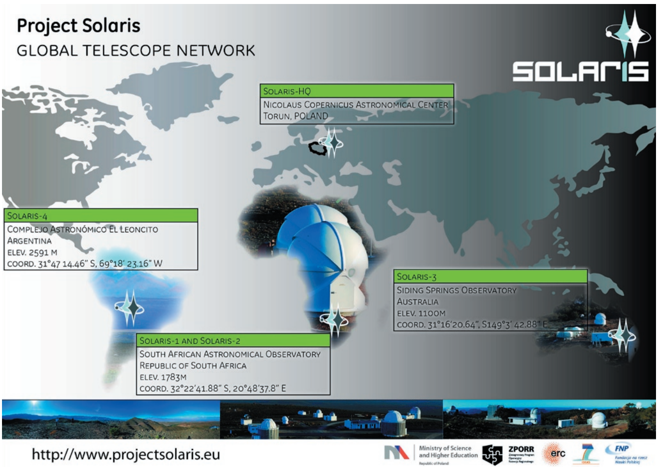


Figure 3: Localisation of Project Solaris' sites around the world.

Figure 4: (above) During their short life on the Sutherland plateau, the two Solaris domes experienced quite a bit of snow already, as seen here in a webcam view.
Figure 5: (right) The two robotic observatories Solaris-1 (on the left) and Solaris-2 (right) snuggling up on SALT's dome in the distance. Picture credit: Anthony Koeslag.

deg/s slewing speed. The mounts do not have any gears and are therefore practically maintenance free.

The imaging train consists of a field derotator, a Fingerlakes Instruments (FLI) filter wheel and an Andor iKon-L 936 CCD camera. The camera uses an e2V 2048x2048 chip with 13.5 μm pixels, cooled down to -100°C using a 5-stage thermoelectric cooler. A control and data acquisition computer, along with UPSs (uninterrupted power supplies) and networking devices are installed in an IP54 rack cabinet. All equipment is powered via network enabled power distribution units allowing remote operation.

The telescope, together with all the equipment, is housed in a Baader Planetarium AllSky fibreglass dome. The 3.5m clamshell is operated robotically and includes its own independent UPS system with a hard-wired weather station reporting on cloud and rain status. An additional high grade Vaisala WXT-520 weather transmitter is mounted on a pole near the domes and monitors the weather conditions (temperature, pressure, relative humidity, wind speed & direction and precipitation).

Software and data

The software running the network is an in-house project, currently under development. All the scientific, weather and environmental data, as well as logging, security and scheduling, are stored on Windows 2008 SQL Servers. The communication between sites relies on the Windows Communication Foundation and partially on the cloud technology, Azure. Because of the extensive use of services the interoperability between operating systems (OS) is assured. It would be easy to consume the functionality of our network from different OS. The programming language of choice is C and its variations, mainly C++ and C#. By taking advantage of .NET technology, we can achieve very quick application development, relative to the size of our team. Initially MaximDL and APC (Astronomer's Control Panel) software will be used to get the project going. These will then systematically be replaced by our own software, utilizing ASCOM standards.

Data reduction will be done by our pipeline, which is partially ready. The main goal now is to explore the power of GPU processing for the on-the-fly data reduction. ☆

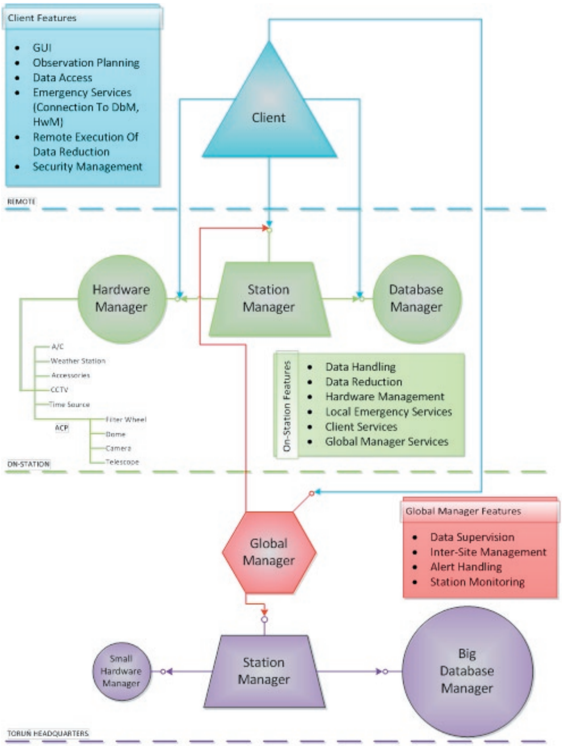


Figure 6: **Software design for the global network of telescopes.**

Figure 7: **The two new clamshell domes bring the number of telescopes on the Sutherland hilltop to 15 and add a interesting new flavour to the variety of different dome designs. Picture credit: Anthony Koeslag.**

MEARIM II

Edited by Case Rijsdijk

The last decade has seen revolutionary advances in astronomical capabilities within the Middle-East and Africa. In particular, the completion of the High Energy Stereoscopic System (HESS) in Namibia and the Southern African Large Telescope (SALT) in South Africa, together with the construction of the Karoo Array Telescope (KAT), also in South Africa and the bid by South Africa to host the SKA, has transformed African astronomy. The Southern African region will soon be able to offer world-class observational capability from ultra-high energy gamma-rays, through optical/near-IR to radio wavelengths.

This was recognised in 2008, when the region came together in Cairo for MEARIM I, which attracted attendees from a wide cross-section of the MEA countries. At the conclusion of that meeting, it was agreed that the second meeting in this series should be based in Africa, and South Africa offered to host it in Cape Town. With HESS producing outstanding results, CTA discussions gathering pace, SALT about to begin normal operations and MeerKAT under construction, the timing is thus ideal for MEARIM II. The region needs to build on these developments and to exploit them for the benefit of their wider communities. This is particularly timely given the recently announced IAU plan "Astronomy for the Developing World", which aims to bring astronomy to the entire continent. This will require a huge effort on the education and outreach front, and it is intended that this will be a significant topic at the meeting.

The second conference, MEARIM II, was held at the Cape Town Ritz Hotel in South Africa, 10 - 15 April 2011. And as with the first conference, it was well attended with a significant number of the South African astronomical community present as well as astronomers from the entire African continent and the diaspora.

During the conference the African Astronomical Society, AfAS, was launched (see *MNASSA* Vol 70 No's 5 & 6, June 2011) and marks a significant point in the history of astronomy in Africa. Another very pleasing aspect of MEARIM II was the number of presentations, both oral and poster, by masters and doctoral students, which bodes well for the future of African astronomy.

During the conference the following scientific sessions were held. These are an evolution from the science sessions of MEARIM I, taking account of new African facilities, MEA contributions and recent developments. Each session was planned as a "mini-symposium", as follows:

Image Source: http://mearim2.saao.ac.za

- S1: Galaxies and Large-Scale Structure
- S2: Space Astronomy & High Energy Astrophysics (focus on HESS results/ science)
- S3: Sun, Stellar Interiors & Heliosphere
- S4: Virtual Observatory & Data Handling (Interactive workshop)
- S5: Optical/NIR Telescopes & Instrumentation (including SALT, robotic facilities)
- S6: Astronomy for the Developing World (linked to the IAU plan)
  - A - Astronomy Research/Education in Africa
  - B - Training for MEA young astronomers
  - C - MEA cooperation in astronomy & space
- S7: Radio Telescopes & Instrumentation (SKA, MeerKAT, HartRAO, C-BASS, PAPER)
- S8: Stellar Astrophysics & Galactic Structure:
  - A - stellar evolution
  - B - interacting binaries
  - C - star formation
- S9: Planetary Astronomy & Exoplanets
- S10: Theoretical Cosmology
- S11: Observational Cosmology

The programme was full with several parallel sessions each day and it is not possible to even give a summary of it, but below is a list of the plenary sessions, and it is hoped that this well give those who weren't able to attend at least a feeling for what was a most successful conference, due mainly through the hard work of both the SOC and the LOC:

Scientific Organizing Committee
Phil Charles (chair), Sudhanshu Barway, Bruce Bassett, Roy Booth, David Buckley, Claude Carignan, Chris Clarkson, Steven Crawford, Peter Dunsby, George Ellis, Chris Engelbrecht, Michael Feast, Stefan Ferreira, Kevin Govender, Amanda Gulbis, Ahmed Hady, Justin Jonas, Renee Kraan-Korteweg, Thebe Medupe, Piet Meintjes, John Menzies, Kavi Moodley, Darragh O'Donoghue, Stephen Potter, Anja Schroeder, Ramotholo Sefako, Johan van der Walt, Brian Warner, Patricia Whitelock, Hartmut Winkler and Patrick Woudt.

Local Organizing Committee
Sudhanshu Barway, Phil Charles, Shireen Davis (chair), Bonita de Swardt, Ed Elson, Andreas Faltenbacher, Simon Fishley, Christian Hettlage, Marissa Kotze, Rudi Kuhn, Thembela Mantungwa, Nazli Mohamed, Enrico Olivier and Glenda Snowball.

MEARIM II – Plenary Lectures

1 Khalid Al-Subai (Qatar Foundation, Qatar)

The search for exoplanets

Abstract: Recent discoveries of extra-solar planets have brought excitement to the field of Astronomy and Astrophysics. They have revolutionized our view about the universe, how our solar system could be formed, and they hint at the possibility of life existing elsewhere in the universe. We will survey aspects of different detection methods, and what the advantages of each method are. We will also discuss a Qatari contribution to this field.

2 Roy Booth & Justin Jonas (SKA/MeerKAT, South Africa)

MeerKAT update - the Telescope and its Survey Science

Abstract: Two major milestones towards the South African SKA project were completed in 2010: a CoDR on the specification of the MeerKAT precursor Array and the submission and adjudication of proposals for Large Survey Projects with the instrument. The main change, following the CoDR, was a new specification for the antennae and their size from 80 x 12m conventional centre-fed paraboloids to 64 x 13.5m Gregorian-offset antennae. The offset antennae have a larger collecting area, low blockage and a lower sidelobe response with good polarisation characteristics, and should improve the overall imaging dynamic range of the instrument. The new design will be discussed. More than 500 scientists, worldwide, applied for a total of 10 years observing time in the form

of large survey proposals with MeerKAT. They were reviewed by an international committee in September, 2010, with the result that some 5 years of time were awarded to ten proposals covering a range of science from Pulsars and transients, through a high frequency Galactic survey to observations of external galaxies and clusters in the 21 cm hydrogen line, out to deep observations for the highest redshifts in hydrogen and CO to a deep continuum survey. Furthermore, it was agreed that MeerKAT would be furnished with a VLBI capability and be used with the world arrays for the highest resolution measurements in astronomy. These scientific programmes will be described.

3 Jorgen Christensen-Dalsgaard (Aarhus University, Denmark)
Asteroseismology with Kepler and SONG

The study of stellar interiors is undergoing a revolution with the availability of extensive observations of stellar oscillations and the resulting detailed inferences of stellar properties. A major step has been taken with the observations from the NASA Kepler mission which is providing observations of a large number of stars at unprecedented sensitivity and accuracy. This has resulted in the characterization of large ensembles of stars, both on the main sequence and in more advanced 20 stages of evolution, and detailed investigations of a number of stars, with much more to come as the analysis progresses. The next leap in the study of stellar interiors, with a potentially important African contribution, will result from the development of the SONG (Stellar Observations Network Group) network, which will carry out groundbased asteroseismic observations at the highest possible level of detail and precision.

4 Andrew Drake (Caltech, USA)
Catalina Real-time Transient Survey

The Catalina Real-time Transient Survey (CRTS) is an optical transient survey that covers 30 000 square degrees of sky in search for transient astrophysical phenomena occurring on timescales from minutes to years. Observations are derived from the three dedicated telescopes which cover up to 2 500 square degrees of sky each night, to a depth of between V=19 and 21.5. To enable rapid automated event follow-up, all CRTS data is processed in real-time and detections are distributed within minutes using VOEvent, SkyAlert and iPhone technologies. New transients are classified utilizing virtual observatory archives, machine learning techniques, and collaborative Citizen science projects. CRTS has so far discovered more than 500 new CVs and 700 supernovae from amongst approximately 3 000 transients. All CRTS discoveries are posted on public web pages to encourage collaboration and maximize scientific output.

5 Ken Ganga (APC, France)
The Planck Satellite: Status and Early Results
The Planck Satellite was launched on 14 May 2009 and both her scientific instruments have been working well since. A set of over 20 "early" papers, addressing science ancillary to the Cosmic Microwave Background, was released on 11 January 2010. I will briefly present these papers, as well as the performance of Planck to date, and will present Planck's future outlook and plans.

6 Kevindran Govender (Global Office of Astronomy for Development, South Africa)
IAU Global Office of Astronomy for Development
The International Astronomical Union (IAU), in recognition of the immense use of astronomy to stimulate development, has developed a decadal strategic plan entitled "Astronomy for the Developing World". At the heart of the implementation of this plan is the Global Office of Astronomy for Development. South Africa bid in 2010 to host this office and was selected as the host country, with the South African Astronomical Observatory, a facility of the National Research Foundation, being selected as the host institute. With strong support from the Department of Science and Technology and the IAU, the Office began its work on 1st March 2011. The history and implications of this Office will be discussed, as well as its implementation plan moving into the future.

7 Matt Jarvis (UWC, South Africa & University of Hertfordshire, UK)
A multi-wavelength view on galaxy formation and evolution
I will present the latest results from the VISTA Deep Extragalactic Observations survey and it's companion survey the Spitzer Extragalactic Representative Volume Survey, along with the science that can be done by combining these deep near infrared data sets with radio, X-ray and far-infrared data sets.

8 Birgitta Nordström (Niels Bohr Institute, Denmark)
Our Galactic Neighbourhood – a Melting Pot of Migration
Spiral galaxies are an important part of the visible Universe. In the prototype, our own Milky Way, we can observe the most important component of a spiral galaxy – the disk – in unprecedented detail. In the Solar neighbourhood we can determine the numbers, ages, detailed chemical compositions, and galactic orbits of stars from the entire history of the disk with a completeness and accuracy not available anywhere else in the Universe. Therefore, the solar neighbourhood is a fundamental benchmark for all models of the evolution of galaxy disks. The Geneva-Copenhagen Survey (Nordström et al. 2004 and Holmberg, Nordström et al. 2007, 2009) has full spatial, kinematic, metallicity and age information for

14 000 long-lived stars and provides a rich source of data for tests of models of evolution and formation of the Galaxy. We find that classical evolution paradigm of gradual enrichment and dynamical heating of the Galactic disk seem to fail several of the standard tests related to the stellar metallicity distribution, age-metallicity relation, and age-velocity relation. Both dynamical and kinematic evolution need to be taken into account in sufficient detail by the models to match the best data. A search for signatures of past accretion events in the Milky Way (Helmi et al. 2006) has yielded evidence of ancient substructure in the Galactic Disk and a project to study possible chemical signatures is ongoing (Stonkute et al. 2009, 2010).

9 Stephen Brian Potter (SAAO, South Africa)
Photo-polarimetry now, Spectro-polarimetry soon - unique SA capabilities
I present the current and future unique optical polarimetry capabilities in South Africa, both by showcasing recent scientifi c results and by discussing imminent instrument developments and upgrades at the SAAO and SALT.

10 Bassem Sabra (Notre Dame University - Louaize, Lebanon)
Accretion in LINERs?
The database of IR/optical/UV emission lines from low-ionization nuclear emission regions (LINERs) is very extensive and advanced. What is not advanced, however, is the understanding of how the accretion mode affects the observed emission lines. This project aims to study this connection through photoionization simulations. A particular accretion mode leads to a characteristic ionizing continuum which, in turn, leads to characteristic IR/optical/UV emission lines. We present theoretical emission-line diagnostics from CLOUDY simulations in which we a irradiate a grid of clouds having a range of densities and ionization parameters with two different spectral energy distributions (SEDs): a) SED resulting from thin disk accretion, believed to be operating in Seyferts and quasars, and b) and SED resulting from an advection dominated accretion flow (ADAF), suspected of operating in LINERs. We study the simulated IR/optical/UV emission lines ratios commonly observed in LINERs to uncover any trends that might hint at the accretion mode. We will then use these emission-line diagnostics to identify the accretion mode in several representative LINERs.

11 Ramotholo Sefako (SAAO, S. Africa) & Adrian Tiplady (SKA/MeerKAT, S. Africa)
Astronomy Geographic Advantage Act – Protecting SA astronomy
South Africa intends to exploit its strategic advantages of geography and infrastructure by encouraging the development of large telescopes operating at

radio and optical wavelengths. This is strongly motivated by the dark and clear skies in Sutherland for optical astronomy, the vast desolate plains of the Karoo for frequency interference-less radio astronomy, and the urge to develop world class astronomical facilities in order to maintain South African astronomy as world class. To ensure that conditions remain optimal for doing astronomy the Astronomy Geographic Advantage (AGA) Act (2007) has been formally declared. In this two-part talk we focus on the development and implementation of the Act and its regulations that are meant to protect our astronomy advantage areas against mainly light pollution (for optical astronomy) and radio frequency interferences (for radio astronomy), as well as the implications of all these in our quest to make Southern Africa an international hub for multiwavelength astronomy.

12 Jean-Philippe Uzan (IAP, France & UCT, South Africa)
Fundamental constants and the equivalence principle: recent astrophysical developments
Testing for the constancy of the fundamental constants has proven to be an efficient test of Einstein equivalence principle that can be performed on astrophysical scales. The past decade has witnessed a lot of progresses both from a theoretical and an observational point of view. In this talk, I will summarize the link between the constants and the equivalence principle. I will then focus on the recent astrophysical progresses and in particular quasar absorption spectra, stellar and primordial nucleosynthesis.

13 Christo Venter (North-West University, South Africa)
Status of H.E.S.S. and CTA
The High Energy Stereoscopic System (H.E.S.S.) is a world-class experiment locatedin Namibia, and consists of an array of four 13-metre telescopes which investigates the non-thermal universe in the energy range 100 GeV to 100 TeV via the Cerenkov technique. The instrument is sensitive to fl uxes of a few thousands of that of the Crab nebula, has a wide fi eld of view (5 deg), sub-degree angular resolution (< 0.1deg), accurate pointing (< 10”), and good spectral resolution (10-20%). Its excellent location affords a clear view of the Galactic Centre as well as many galactic sources. The combination of its superior location and experimental capabilities led to a long list of exciting discoveries of several very high energy (VHE) gamma ray sources over the past few years, including supernova remnants, the source at the Galactic Centre, compact binary systems, microquasars, pulsar wind nebulae, gamma rays from cosmic-ray interactions with dense molecular clouds, a starburst galaxy, stellar and galaxy clusters, active galactic nuclei, and

"dark sources" with no obvious counterparts, in addition to conducting the first VHE survey of the sky, measuring the local cosmic-ray electron and iron nuclei spectra, constraining the level of extragalactic background light, and providing upper limits to dark matter annihilation. These feats have been recognized internationally: H.E.S.S. shared the €1million EU Descartes Prize for Research in 2006, and won the 2010 Rossi Prize of the High Energy Astrophysics Division (HEAD) of the American Astronomical Society (AAS) for revolutionizing the field of gamma-ray astronomy. H.E.S.S. phase II, entailing the addition of a 28-metre central telescope to the existing four, is already underway. This will result in increased energy coverage (with an expected threshold of ~20 GeV), sensitivity, and angular resolution of the instrument. Efforts for the design and construction of a next-generation gamma-ray observatory called CTA (Cherenkov Telescope Array) are gaining momentum. CTA will consist of a northern and southern component, unifying the global gamma-ray astronomy community, and will boast an order-of-magnitude increase in sensitivity. The status of the South African site proposal bid for hosting CTA South will be discussed. It is lastly important to view our knowledge of the VHE sky within the greater multiwavelength context, it being complementary to observations at lower energies (e.g. high-energy gamma rays, X-rays, optical and radio). The rich opportunities created by such a synergy will enable continued study of some of the most violent and energetic phenomena in the universe.

14 Robert Williams (Space Telescope Science Institute, USA)
The Nova Outburst: Evidence for a New Paradigm

Spectroscopic observations of novae date back a century and the fundamental nature of the outburst has been understood for 50 years. Yet, recent observations suggest a possible significant modification to the standard nova paradigm. A high resolution spectroscopic survey of novae has revealed short-lived heavy element absorption systems near maximum light consisting of Fe-peak and s-process elements. The spectroscopic evolution of novae gives evidence for two distinct interacting gas systems in which the bright continuum is produced by the outburst ejecta but absorption and emission lines originate in gas ejected by the secondary star in a way that could explain dust formation and X-ray emission from novae. The absorbing gas is circumbinary and it pre-exists the outburst. Its origin appears to be mass ejection from the accretion disk or secondary star, and it might initiate the nova outburst. ☆

In the footsteps of La Caille, Everest and Maclear on the Kapokberg

Ian Glass (SAAO)

Summary: A visit to the top of the Kapokberg on 11 July 2011 to examine the present condition of the beacons used by La Caille in the 18th century and Maclear in the 19th is described.

La Caille

In 1751-3 the famous French astronomer Nicolas-Louis de La Caille visited the Cape to survey the southern sky and make several other measurements. On finishing his astronomical programme, he turned his attention to finding the radius of the earth in the southern hemisphere. This had already been done at various northern latitudes and the data were consistent with a flattened spheroidal or ellipsoidal shape for the planet. The question was whether the southern hemisphere had the same shape.

To measure the radius, it was necessary to measure the latitude by astronomical means at two places about a degree apart along a north-south line. The distance between them on the earth's surface was then measured by precision survey techniques.

The latitudes were found from stars near the zenith whose positions were measured by means of an instrument called a "zenith sector", and referred to the local vertical through the use of a plumb line. A set of stars was measured at La Caille's temporary observatory in Cape Town and at a beacon he chose near the Piketberg.

To make the land survey he laid out a precision baseline in the Swartland and triangulated to get the distance between two of the highest nearby peaks. One of these was on the Kasteelberg, near Riebeeck Kasteel, and the other was on the Kapokberg, near Darling.

The line between these two peaks was then used as the base of two much larger triangles, one with his observatory in Cape Town at the apex and the other with the Piketberg beacon at the apex. He could then work out the land distance between these two stations with high accuracy (See Fig. 1).

To his surprise he found that the earth seemed to be more flattened in the southern hemisphere than in the northern one. In other words, it appeared to be somewhat pear- shaped! Though puzzled, he took the attitude that he had made his measurements with all due care and this was simply what the data indicated, like it or not.

Everest

In 1820 George Everest (after whom Mt Everest was named) visited La Caille's various sites while recuperating from an illness at the Cape and became convinced that La Caille's measurements of latitude

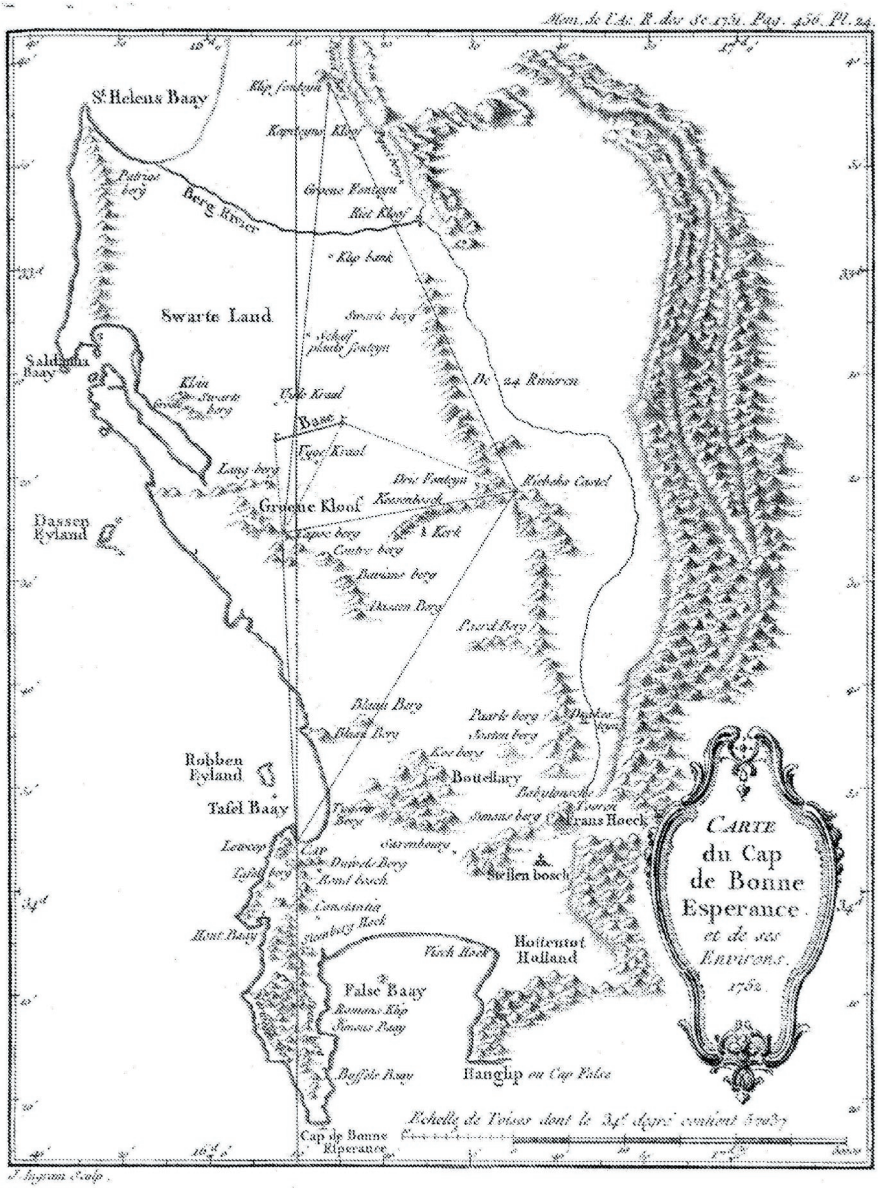


Fig. 1. La Caille's map of the Western Cape. The vertical line is his "Arc of the Meridian". The triangles show how he surveyed this length. The "Groene Kloof" is the present-day Darling area. From La Caille, 1751.

were incorrect. He asserted that the plumb lines of his instrument had been affected by the gravitational attraction of Table Mountain at the southern end and the Piketberg at the northern (Everest 1821).

Maclear

About 20 years later, Thomas Maclear repeated La Caille's work but extended the survey to well beyond the mountains at each end. He was able to show that Everest had been right – the plumb lines had indeed been deflected from the true verticals.

Today, very few relics of these important observations remain. La Caille's Observatory, which was between the present Strand and Waterkant Streets, has long since been demolished. His northern terminal at Piketberg was never more than a temporary marker. His baseline was simply laid out between two small mounds in the Swartland. A cairn he built as a marker on the Kasteelberg was removed early in the 20th century. Only his Kapokberg marker was still likely to be in existence.

Maclear's southern terminal for the repeat of La Caille's work was the centre of the Transit instrument at the Royal Observatory and his northern terminal was a threshing floor that still exists and is marked by a plaque on a farm in the Piketberg. The two pyramids that defined his baseline still exist and are fenced off. His beacons on the Kasteelberg and the Kapokberg were removed or built over by the South African Trigonometrical Survey in the twentieth century.

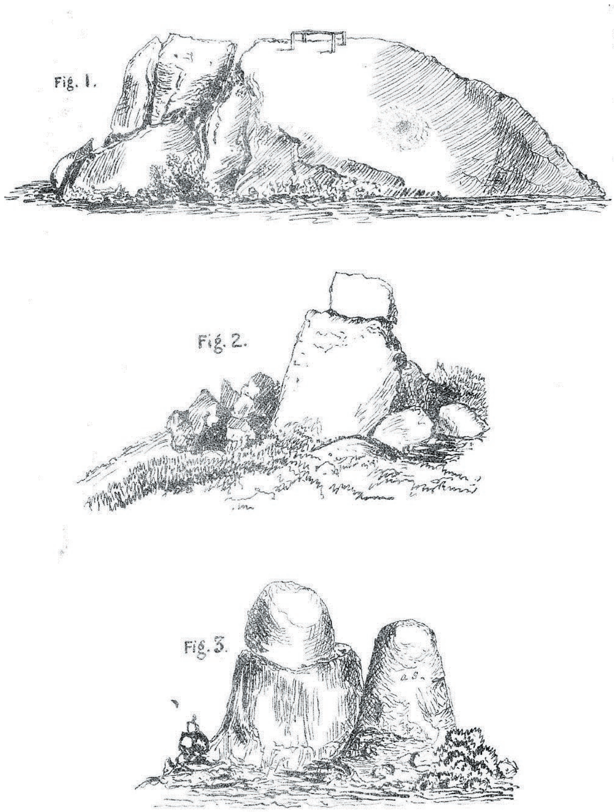


Fig. 2. The Kapokberg rock beacons, from Maclear (1866).

The Kapokberg Beacons

Maclear (1866) in his massive tomes on the Verification of La Caille's Arc of the Meridian presented sketches of the two rocks that formed his and La Caille's beacons (Fig. 2).

The upper sketch is the "signal rock" on which Maclear placed his beacon and where the present-day Trigonometrical Survey beacon rests on a platform of stones. The temporary frame on top supported his instruments. The lower two sketches are of the rock that La Caille used as a beacon, from the south and from the east respectively. Maclear says "La Caille's rock is referred to as the *cylindrical* rock, though the resemblance to this figure is rather remote". The bottom sketch shows the smaller rock to the north.

La Caille (1776) described his beacon as "a large rock supported by a smaller one towards the north. This rock is towards the western extremity of the summit of this mountain, which is very flat. It faces Cape Town and there is another one, larger and less high, at several paces away towards the north-north-west." In another place (La Caille 1751) he describes the rock as being "nearly cylindrical and the easternmost of those that are on the western extremity of the mountain ... called Kapokberg"

Everest was able to locate the rock in question without too much difficulty.

Maclear at first wrongly identified the north-north-western rock as being La Caille's but found that the angles he measured did not agree with the latter's results. He duly realized his mistake and determined the relative positions of La Caille's rock and his one. He made a mark on his rock.

The Beacons Today

Before climbing the mountain, I looked at the area on Google Earth. From the co-ordinates given by Maclear relative to the Royal Observatory, Cape of Good Hope, it was possible to locate his "signal rock". Using his bearing and distance (Maclear 1866, p. 447) the top of La Caille's rock could be seen nearby, just jutting out above the bushes.

The Kapokberg summit is 459m above sea level. To get to it one must cross private farmland and we obtained permission from Mr John Duckitt of "Waylands", on its eastern side. The walk started across a gentle grassy slope used for grazing. Much of the middle part was covered with scratchy and sometimes prickly bush about 1m high. The last part was along a jeep track Altogether it took us about 1½ hours, about half of the time "bundu bashing", to get to the summit.

Today the summit is festooned with communications gear, located within a small square fenced-off compound belonging to the SA Railways. With the right contacts it should be possible to get there using a 4 x 4 vehicle.

Just outside the middle of the southeastern side of the telecommunications compound is a rock almost submerged in bushy vegetation (Fig. 3). On it is a horizontal platform with the Trigonometrical Survey beacon in its centre. There are so many bushes around the rock that it cannot be recognized from Maclear's sketch, but standing on it the outlines can be made out.

When standing next to the Trigonometrical beacon and looking towards the SSE, the top of La Caille's rock can be just be seen (Fig. 4), surrounded by a thicket of bushes. It is about 2 to 2½ m high and the capstone is about 1m across.

To get to the rock involved half-crawling about 10m into the thicket from the northern side, breaking branches and clearing away decayed vegetation. It was only too obvious that this monument is rarely visited.

Fig. 5 is a view of the rock from close up on its east side. The vegetation was slightly less dense to the south-east (Fig. 6).

Climbing onto the rock, one has a magnificent view across Table Bay to Cape Town. To the east is the Kasteelberg, on the 2nd peak from the northern end of which La

Fig. 3. **Maclear's rock, called by him the "signal rock", with the modern Trigonometrical Beacon on it, viewed from La Caille's rock to the south-south-east.**

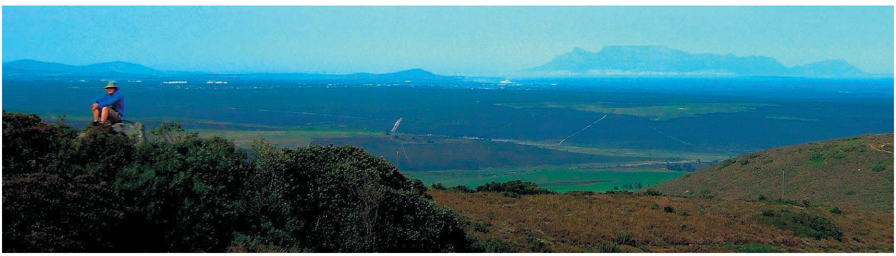
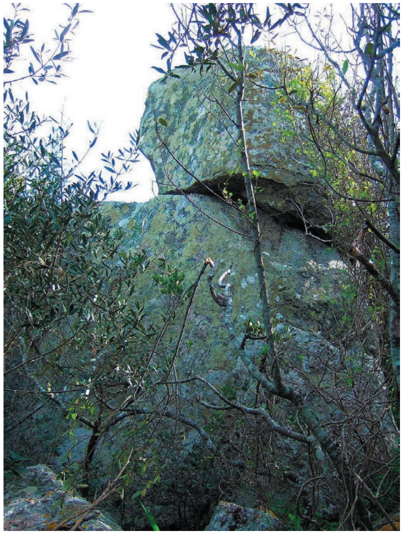


Fig. 4. **La Caille's rock (left), just visible above the bushes, viewed from Maclear's rock. Table Mountain is in the distance at the top-right (Photo: Hettie Glass).**

Fig. 5. **(above) La Caille's rock from the east, close-up. The small rock is to the right in this view (Photo: ISG).**

Fig 6. **(right) the same rock from the south-east (Photo: ISG).**



Caille's beacon once stood. To the north is the Piketberg, the northern terminal of the Arc of Meridian.

In view of their historical importance, it would be nice for the bush to be cleared and a small area around each beacon to be fenced off.

Acknowledgments

I would like to thank my wife Hettie for accompanying me and enduring a myriad scratches in the cause of science history. Also, Mr John Duckitt for allowing us to traverse his farm.

References

Everest, G., 1822. On the Triangulation of the Cape of Good Hope. *Memoirs of the Royal Astronomical Society*, **I, pt. II**, pp. 255-270.

La Caille, N.-L. de, 1751. Diverses Observations Astronomiques et Physiques Faites au Cap de Bonne-Espérance Pendant les Années 1751 & 1752 et partie de 1753. *Mémoires de l'Académie Royale des Sciences*, pp. 398-456.

La Caille, N.-L. de, 1766. *Journal Historique du Voyage fait au Cap de Bonne-Espérance*, Paris, Chez Nyon ainé.

Maclear, Sir T., 1866. *Verification and Extension of La Caille's Arc of Meridian at the Cape of Good Hope*. London, Lords Commissioners of the Admiralty. ☆

BS Tel, a High Amplitude δ Scuti or RRc Lyrae Star

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Abstract: *BS Tel was selected as part of an observation campaign on W UMa variables in 2007. The observation in white light that year and subsequent B and V filters in 2008 and 2010 have confirmed that the star was misclassified on discovery.*

Introduction

An observation campaign from light polluted skies using personal telescopes (PT) on the outskirts of Johannesburg, South Africa, began in winter 2006. The principal objective of the campaign was the determination of periods of selected W UMa stars. During this campaign (2007) BS Tel was observed and its light curves analysed. It is clear from the curves that BS Tel was miss-classified as a W UMa star.

Discovery:

The discovery of the star BS Tel is credited to Shapley, Boyce and Boyd from photographic plates at the Boyden Observatory, Bloemfontein in 1940. Table IV of their publication, page 244 itemizes HV 9765 as an eclipsing variable of the W Ursae Majoris type.

BS Tel Identifiers:

BS Tel is listed in Simbad as BS Tel and HV 9765.

Candidate selection:

Particular candidates for the observational campaign were chosen according to a few important criteria:

1. $14 > m_V > 8$. The candidates are all in the vicinity ~ – 60 degrees and have had no previous in depth research undertaken on them. (Exhaustive web searches: *NASA ADS* site, *Simbad* etc.)
2. The candidates display “high” amplitude, which is vital considering the size and sensitivity of the equipment deployed.
3. Observations within the $14 > m_V > 8$ band should not be adversely affected by bright moon nights.

High Amplitude Delta Scuti (δ Scuti) or RRc Lyrae Star?

The initial Delta Scuti (δ Scuti) stars discovered were those with amplitudes in excess of $A_V \geq 0.3$ mag. It was later determined that HADS only make up a minority of the entire DSCT group. Hog and Petersen (1998) suggest that HADS constitute approximately 10% of DS stars. HADS have also been known as dwarf Cepheids, RRs stars, anomalous Cepheid variables and ultrashort period cepheids. The metal poor objects of the group are usually called SX Phoenicis (SX Phe) stars.

HADS are mostly Population 1 stars on the main sequence or just above the main sequence with radii estimated at 2-3 solar radii. Their mass range is between 1.5-2.5 solar masses (Rodriguez 2004). Compared to the low amplitude DS (LADS) their rotational velocities are very low. Slow rotation could be a precondition for radial pulsation and high amplitudes. McNamara (1997) and Breger (2000) claim that DS stars have radial pulsations of large amplitudes, if they have rotation with $v\sin i \leq 30$ km.s^{-1}.

HADS can be described as mainly radial, monoperiodic high amplitude objects whereas the low amplitude DS stars are mostly nonradial, multiperiodic low amplitude objects. In terms of light amplitude the fundamental oscillation is dominant for HADS (McNamara 2000). This was first suggested by North et al. (1997).

Rodriguez (2004) summarized the changes observed in periods for HADS. HADS with the shortest periods show the largest positive changes whereas HADS with long periods display negative changes.

Katrien Kolonberg (private communication 2010) suggests BS Tel displays typical High Amplitude Delta Scuti (HADS) light variation. Luis Balona (private communication 2011) disagrees with this identification as HADS should not be found so far from the plane of the Milk Way. He also argues that the frequencies detected are far lower than any known HADS apart from those listed by Derekas et al. (2003). The low frequency implies a high luminosity which places the star even further than the plane of the Milky Way.

Equipment and observations

Initial white light CCD photometric observations were undertaken for 5 nights commencing 7 July 2007, using a Starlight Xpress MX716 self-guiding camera. Data were collected using a pier mounted Meade LX200GPS 30cm (12-inch) PT at a light polluted site in Kyalami, on the northern outskirts of Johannesburg, South Africa. Images including the program star were captured to fits files with a field of view (FOV) of ~660 x 600 arcsec^2 and a resolution of about 110 arcsec mm^{-1}. Control of the PT and camera was done using MSB Astro-Art. Computer time is set every 4 minutes, automatically via the net from Dimension 4 using a local time server.

Follow up observations in both B and V filter commenced in September 2008 and continued in June 2010. The following table indicates dates of all observations. A total of 2915 observations in V filter and 1934 in B filter were completed in 2008 and 2010.

Table 1: **Dates of observation, filters employed and integration time.**

July 2007	Filters	Integration time
07	White light	20 sec
15	White light	20 sec
16	White light	20 sec
17	White light	20 sec
18	White light	20 sec
September 2008	**Filters**	**Integration time**
4	V and B	90 and 140 sec
5	V and B	90 and 140 sec
6	V and B	90 and 140 sec
June 2010	**Filters**	**Integration time**
1	V and B	90 and 140 sec
3	V and B	90 and 140 sec
5	V and B	90 and 140 sec
6	V and B	90 and 140 sec
7	V and B	90 and 140 sec
8	V and B	90 and 140 sec
9	V and B	90 and 140 sec
17	V and B	90 and 140 sec

The annotated figure 1 illustrates the selected comparison (C), check (K) and program star (V).

Image reductions: Astronomical Image Processing 4 Windows (AIP4Win). (http://www.willbell.com/aip/index.htm) was utilised in data reduction. AIP4Win uses two dimensional aperture photometry in the reduction process.

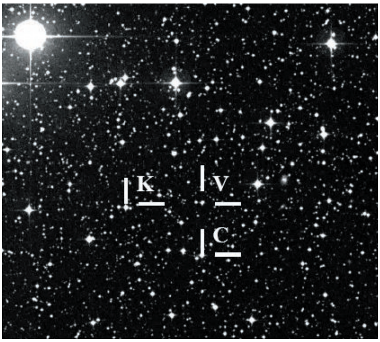


Figure 1: **Leicester Digital Sky Survey of the BS Tel field denoting the C, K and V stars. Annotations added by author.**

Table 2: **BS Tel B,V and B-V data**

V	13.82
B	14.20
B-V	0.38

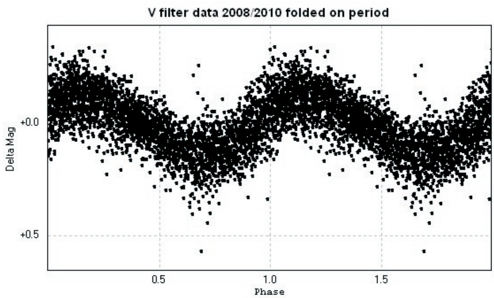


Figure 2: **Phase binned V Filter from 2008/2010 folded on a period of P = 0.2588 days**

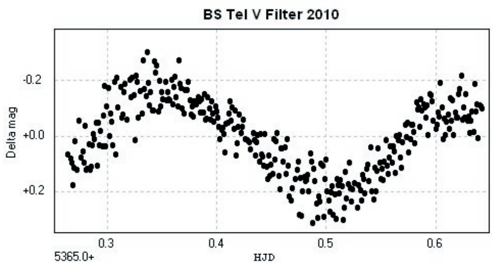


Figure 3: **A typical night's observation.**

Analyses of reductions:
Figure 2 shows the V filter observations in 2008/2010, phase binned and folded on a period of *P* = 0.2588d.

Filtered observations:
Johnson V filter observations from 2008 and 2010 are discussed.

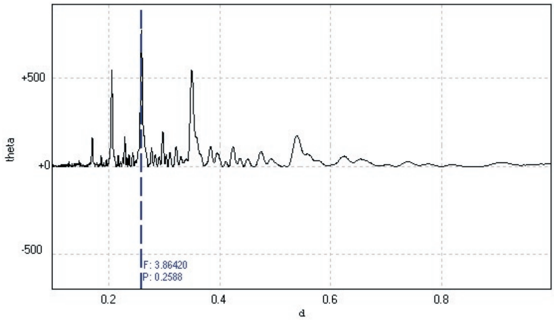


Figure 4: BS Tel V Filter Peranso primary period of *P* = 0.2588d

V Filter:
From a time span of 651.4269 days we derive an epoch of

HJD 2454714.2153 (±0.0005) + *E**(0.2592d) ± 0.0008d

The data was initially examined using the Lomb-Scargle method (Lomb (1976) and Scargle (1982)) in Period Analysis Software (Peranso). Peranso is designed specifically for working with large multi-night astronomical data sets. Both statistical and Fourier transform algorithms are available. Figure 4 shows a period of *P* = 0.2588d derived from Peranso.

Colours:
Using Tycho star TYC 8751-1686-1 with B11.6 and V10.2 from the Celestia Catalogue as a standard star we derive a B-V= 0.4. Calculations compare very favourably in B filter with that of Shapley B=14.2 (1940). Table 2 tabulates the B,V and B-V values from extinction calculations.

The colour index of B-V = 0.38 suggests a T_{Eff} in the region of 6 800 K (Kaler 1989). This places BS Tel in the instability strip.

Figure 3 shows a typical night's observation. HJD 2450000+ as observed.

Pulsation detection
Further processing of the data using Period04 (Lenz and Breger, 2005) produced the following results. Table 3 provides frequencies detected in Period04.

Figures 5 and 6 show the periodogram of BS Tel B Filter before and after prewhitening of 3 frequencies.

Table 3: BS Tel frequencies as determined by P04.

Frequency Number	Cycles per day B Filter	Cycles per day V Filter	Amplitude Magnitude B Filter	Amplitude Magnitude V Filter	Phi B Filter	Phi V Filter	Snr B Filter	Snr V Filter
*f*1	3.855	3.861	0.149	0.126	0.079	0.867	snr: 42.13	snr: 39.35
*f*2	2.517	2.528	0.048	0.048	0.698	0.401	snr: 13.41	snr: 11.72
*f*3	0.852	7.729	0.038	0.024	0.883	0.381	snr: 10.69	snr: 6.36
*f*4	3.897	1.107	0.032	0.027	0.521	0.329	snr: 9.04	snr: 5.88

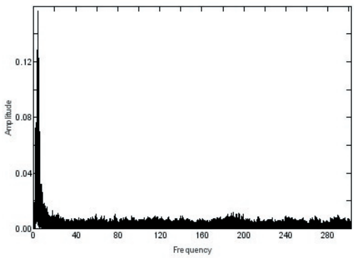


Figure 5: BS Tel before prewhitening.

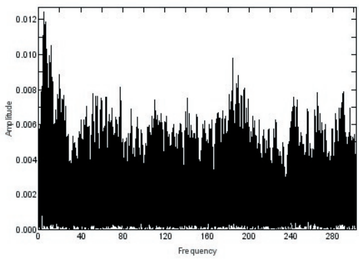


Figure 6: BS Tel after prewhitening of 3 frequencies.

Conclusion

Figure 2 and figure 4 clearly show that BS Tel is not the variable type W UMa. It is likely that this star is a HADS type variable and the exact classification would be facilitated by a spectroscopic follow up. In this regard application has been made to the SALT team for spectral observations of BS Tel.

From the discussions with Balona (2011) there exists the very real possibility that BS Tel could be an RRc Lyrae star that shows the Blazhko effect. RRc stars with Blazhko effect are practically unknown, but they should exist and this would make it a rather interesting star.

References

Breger, M. 2000. Delta Scuti Stars (Review). *Delta Scuti and Related Stars,*ASP Conference series, 210. Breger, M. & Montgomery, M.H. eds.

Derekas, A., Kiss, L.L., Szekely, P., Alfaro, E.J. et al.; 2003; arXiv:Astro-ph/0303018v1 2 March 2003

Hog, E., Petersen, J.O. 1977. *Hipparcos parallaxes and the nature of Delta Scuti stars.* A&A, 323.

Kaler, J., 1989, *Stars and their Spectra,* CUP

Lenz, P., Breger, M., 2005, *Comm. In Asteroseismology,* 146

Lomb N.R., 1976, Ap&SS, 39, 447

McNamara, D.H., 1997. *Luminosities of SX Phoenicis, Large Amplitude Delta Scuti, and RR Lyrae stars*. PASP. 109.

McNamara, D.H., 2000.*The High Amplitude Delta Scuti Stars,Delta Scuti and Related Stars.* ASP Conference series, 210. Breger, M. & Montgomery, M.H. eds.

North, P.; Jaschek, C.; Egret, D. 1997, *Delta Scuti Stars in the HR Diagram*

Rodriguez, E., 2004. *High amplitude Delta Scuti type variables.* Comm.Ast. V145

Scargle J.D, 1982, Ap.J, 263, 835

Shapley, H.; Boyce, E.; Boyd, C.; 1940, AnHar; V90.

http://www.ledas.ac.uk/DSSimage

http://www.starlight-xpress.co.uk/

http://www.msb-astroart.com/

http://www.thinkman.com/dimension4/

http://users.skynet.be/fa079980/peranso/index.htm

http://www.univie.ac.at/tops/period04/ ☆

Astronomical Colloquia

These form an important part of a research facility, often as a sort of pre-publication discussion or a discussion of an individual's current research, and as such it is virtually impossible to "publish" this material. However by recording the topics discussed in the form below does indicate to those, who are unable to attend, what current trends are and who has visited to do research: it keeps everyone 'in the loop' so to speak.

SAAO Colloquia

Title: The Nainital-Cape Survey
Date: Thursday 26 May
Time: 12.30 PM
Venue: SAAO Auditorium
Speaker: Santosh Joshi (Aryabhatta Research Institute of Observational Sciences (ARIES), India)
Abstract: The Nainital-Cape survey is an ongoing survey programme to search for the new rapidly oscillating Ap (roAp) stars in the Northern hemisphere. In this talk I shall present an overview of the project and discuss the future prospective of the project in the light of up-coming observing facilities at ARIES.

Title: Long-term Modulations in Ultraluminous X-ray Sources
Date: Thursday 23 June
Time: 12.30 PM
Venue: SAAO Auditorium
Speaker: Deatrick Foster (Vanderbilt/SAAO)

Abstract: The nature of ultraluminous X-ray sources (ULXs) found in nearby galaxies continues to be a subject of intense speculation and debate. ULXs had been considered possible hosts of intermediate-mass black holes (IMBHs); however more recent models invoke slightly heavier than stellar-mass black holes (20--50 solar masses) in extreme accretion states to account for their observed spectra and luminosities. I will summarise the latest results on ULXs and discuss the need for a systematic investigation of their long-term periodic and aperiodic modulations.

Title: The binary central stars of planetary nebulae
Date: Thursday 2 June
Time: 12.30 PM
Venue: SAAO Auditorium
Speaker: Brent Miszalski (SAAO)
Abstract: Planetary Nebulae represent a powerful window into the evolution of low-intermediate mass stars that have undergone extensive mass-loss on the asymptotic giant branch. The nebula manifests itself in an extremely wide variety of shapes, but exactly how nebulae are shaped into such a diverse range of morphologies is still highly uncertain despite over thirty years of vigorous debate. Binaries have long been thought to offer a solution to this vexing problem. Now, thanks to recent surveys and improved observing strategies, it appears clear that a binary channel, in particular common-envelope (CE) evolution, is responsible for a large fraction of planetary nebulae. Binary central stars provide invaluable contributions to the study of common-envelope evolution and to the formation of jets in binary systems. We have started to identify strong links between binarity and morphology, including a high proportion of bipolar nebulae and rings of low-ionisation filaments resembling SN 1987A. Equally important arethe newly found binary CSPN with intermediate periods, which appear linked to chemically peculiar stars whose composition was modified by binary evolution. In this talk, I will give an overview of recent results and on-going work in this rapidly changing field. I'll also discuss potential projects with South African telescopes.

Title: The New Generation of Wide-Field Surveys
Date: Thursday 9 June
Time: 12.30 PM
Venue: SAAO Auditorium
Speaker: David Gilbank (SAAO)
Abstract: Large surveys will be responsible for a significant fraction of the major discoveries in astronomy in the coming decade, with considerable funds and resources devoted to projects such as LSST, DES and Pan-STARRS. In this talk, I will discuss the status and latest results of a recently completed 1000 square degree imaging survey, the second

Red-sequence Cluster Survey (RCS-2), primarily aimed at discovering clusters of galaxies out to z~1. I will summarise the science goals relating to cosmology, strong gravitational lensing, and the physical properties of galaxy clusters, and describe the areas in which SALT might efficiently be used to maximise returns from on-going science. In the second half of the talk, I will focus on results from galaxy evolution using the survey data themselves, and discuss a new project, only recently begun, probing the structure of our own Galaxy using the Sagittarius Stream unveiled via maps of stellar overdensity.

Title: Lenticular Galaxy Formation - An Observer's Perspective
Date: Thursday 7 July
Time: 12.30 PM
Venue: 1896 Building
Speaker: Sudhanshu Barway (SAAO)
Abstract: Lenticular (S0) galaxies form a morphological transition class between ellipticals and early-type spirals in the Hubble (1936) classification system. When comparing properties, it is found that the bulges of lenticular galaxies are very similar to elliptical galaxies, while their disks have similarities to the disks of spiral galaxies, except that they lack conspicuous spiral arms. Our understanding of the formation and evolution of lenticular galaxies, in terms of the individual physical processes involved, is still unclear, inspite of extensive attempts both by observational and theoretical means. In my talk, I will present an overview of our efforts to understand the formation and evolution of lenticular galaxies. We made detailed investigation of the morphology of representative sample of lenticular galaxies, using our own observations as well as data from SDSS and 2MASS. Our finding suggests that the formation of lenticular galaxies not only depends on the total luminosity of galaxy but also on the environment of the host galaxy. I will also describe the detailed analysis of correlations between various observed properties of lenticular galaxies as a function of luminosity and environment of host galaxy.

Joint Cape Town Cosmology & Astrophysics Colloquia

Title: Wide Field Spectroscopic Surveys in the Era of HETDEX and SKA
Date: Monday, 13 June
Time: 11:00
Venue: RW James C
Speaker: Gary Hill (McDonald Observatory)
Abstract:The Hobby-Eberly Telescope Dark Energy Experiment (HETDEX) aims to make a direct detection of dark energy at z~3, in the case that it is a cosmological constant. HETDEX uses baryonic acoustic oscillations and the shape of the Lyman-alpha emitting (LAE) galaxy power spectrum to constrain H(z) and Da(z) to percent levels. As a

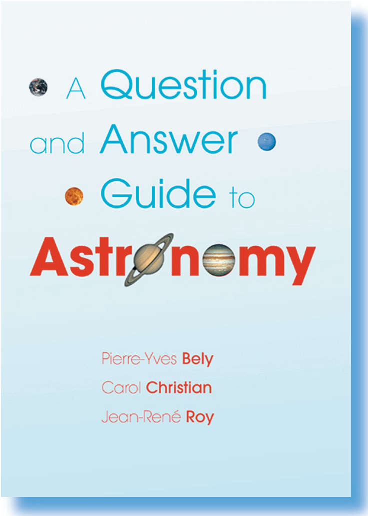
result, the experiment will place tight constraints on possible dark energy evolution, complementing studies of the phenomenon at low redshift (e.g. BOSS and DES). HETDEX will also provide the most accurate constraint on the curvature of the Universe, needed by the lower redshift surveys to break the degeneracy with the effects of dark energy on the expansion rate.

In late 2011 and 2012 the US$34M HETDEX project will upgrade the 10 m HET and outfit it with a new wide field corrector and an array of 150 integral-field spectrographs to survey a 400 sq. degree area in the north galactic cap. Each fiber-coupled unit spectrograph will cover 350-550 nm, simultaneously at 5.7 A resolution, providing ~36,000 spectra per exposure. This instrument, called VIRUS, will open up surveys of the optical emission-line universe for the first time, and in particular will be used to detect ~0.8 million LAE galaxies with $1.9 < z < 3.5$ and more than a million [OII] emitting galaxies with $z < 0.5$. The 3-D map of LAE galaxies in 9 cubic Gpc volume will be used to constrain the expansion history at this early epoch.

The prototype of the VIRUS unit spectrograph (VIRUS-P) is a powerful instrument in its own right. Used on the McDonald 2.7 m Smith reflector, it covers the largest area of any integral field spectrograph, and has coverage down to 340 nm. We have used VIRUS-P to complete a pilot survey to better measure the properties of LAE galaxies in support of HETDEX, among other investigations where it is uniquely powerful.

I will discuss the lessons learned in this major upgrade of the HET, and how they may apply to SALT. I will also discuss the synergy between HETDEX, SALT, and the Square Kilometer Array (SKA), which could lead to new avenues for South African astronomy.

Title: Observing the Darkness
Date: Wednesday 29 June
Time: 12 noon (followed by lunch)
Venue: Main lecture theatre at AIMS
Speaker: Prof. Martin Kunz (University of Geneva)
Abstract: The presence of a mysterious dark energy in the universe poses many challenges for cosmology. In my talk, I will discuss the current limits on the equation of state, and show why during another period of accelerated expansion -- inflation - an omega close to -1 is not necessarily an indication for a cosmological constant. I will then review the different possibilities for the nature of the dark energy, focusing especially on the importance of the dark energy perturbations, their role in distinguishing between scalar field dark energy and modified gravity models, and on our current and expected future constraints on them. ☆



A Question and Answer Guide to Astronomy

by Pierre-Yves Bely, Carol Christian and Jean-René Roy
Published by Cambridge University Press, 2010
Paperback: xiv + 280 pages, 66 b/w and 305 colour illustrations
ISBN: 978-0-521-18066-5
Size: 175 x 247 x 16 mm.
Mass: 0.6 kg
Price: R300.00 (incl. VAT and postage), available from Cambridge University Press, South Africa, email: cambridge@cup.co.za, postal address: PO Box 50017, Victoria and Alfred Waterfront, Cape Town 8002, South Africa.

This slim volume is deceptive and is not your standard sort of FAQ (frequently asked questions) book, nor is it a book you read through: but it is an outstanding reference book that can be dipped into. Open it anywhere and there will be a question you always wanted to know the answer to!

The first thing that I liked about the book was the layout. The seven contents pages are clear and divided into ten well selected sections, which give quick access to the 250 questions that are answered in 263 pages, containing many clear graphs, drawings, diagrams and up-to-date images. The questions cover the full range of topics, from conversational questions like "Why is Pluto no longer a planet?" and "Can planetary alignments cause disruptions on Earth?", to more philosophical questions such as "What is the Anthropic Principle?", "What is life?" and "What was there before the Big Bang?" In between are the more practical sorts of questions that educators come across, for example, "Why are stars round?" and "What is the difference between a reflecting and refracting telescope?" For astronomers and communicators there is an abundance of useful analogies and alternative ways of explaining complex topics such as "What is string theory?", "What is Dark Energy?" and others.

The answers are always clear, concise, accurate, use plain non-technical language and the authors show a remarkable ability to match their answer to the demands of the question. They display a great skill in tackling even the most awkward questions, ones that most others authors would simply exclude! Furthermore they do so without "dumbing down" the answer. They also don't shy away from questions with little or no real scientific merit, and the answers to these are serious, rational and not simply dismissive. For example, in answering Q185 (Could aliens have visited the Earth?) the authors include a reference to a book and to another related question.

The latter is an aspect that I value, in that in answering questions they often give references to other related entries in the book to remind the reader of a detail they may have missed, or not yet read, or to extend the scope of the answer, and so create a thread that enables a reader to follow a particular topic in a more detailed way. This then enables the book to be used as more than a simple Q&A guide, but rather one that can be readily adapted for use as an introductory text for an astronomy course for beginners.

There are only one or two equations in this book. Not even the equations for Kepler's Laws are included, and some readers may see this as an omission, as they could have been added in an appendix. I believe the author's decision to leave them out to be correct. There are numerous books that derive these and other equations, and have examples as to how to use them, but this book is about explaining astronomy related issues at a public interest level, and for those wishing to delve deeper into certain topics, there is an excellent collection of references and a bibliography at the end.

The authors are all experts in their field and it is clear that they have had a great deal of experience in communicating their expertise to both the public and educators as reflected by the extensive range of questions and answers they present. The book is well edited, uncluttered and the material in it is readily accessible. First published in French in 2008, this up-dated English edition is highly recommended, and to my mind, should be an essential volume in all libraries and on the shelf of anyone with the remotest interest in astronomy. And at about 'a rand a page', it is excellent value.

Case Rijsdijk

Pierre-Yves Bely is an engineer specializing in the design and construction of large optical telescopes. He was Chief Engineer for the Canada-France-Hawaii Telescope and has worked on the Hubble Space Telescope and on the design of its successor.

Carol Christian is an astrophysicist and is Deputy of the Community Missions Office at the Space Telescope Science Institute. In addition to providing technical and outreach support to NASA missions, she is a collaborator on the Google Sky and World Wide Telescope projects for exploration of the sky on the Internet.

Jean-René Roy is an astrophysicist specializing in the evolution of galaxies and the formation of massive stars. He is Senior Scientist at the Gemini Observatory, which hosts two of the largest telescopes in the world, one in Hawaii and the other in Chile.

Contents:

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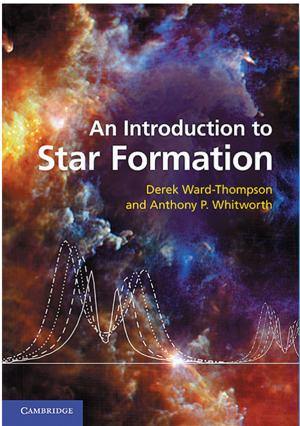

An Introduction to Star Formation

By Derek Ward-Thompson and Anthony P. Whitworth
Published by Cambridge University Press, 2011
Hardcover: pp xx + 208xiv, 81 b/w illustrations
ISBN 978-0-521-63030-6
Size: 247 x 174 mm
Mass: 0.6 kg
Price: R600.00 (incl. VAT and postage), available from Cambridge University Press, South Africa, email: cambridge@cup.co.za, postal address: PO Box 50017, Victoria and Alfred Waterfront, Cape Town 8002, South Africa

The success of the recent Spitzer and Herschel satellites in extending sensitive observations to the medium- and long-wavelength regions of the infrared has led to many new observations of star-forming regions. Coupling these with the high-resolution millimeter-wave mapping to be expected from the ALMA array telescope in Chile, the field is bound to experience explosive growth in the near future. This book by Ward-Thompson and Whitworth has thus appeared at a very opportune moment.

An Introduction to Star Formation is aimed at the advanced undergraduate or beginning graduate student. The introductory chapter lists some of the aims of research in this area. There are still many unanswered questions. Though star formation takes place in molecular clouds, the minimum requirements for it to occur at all are not completely clear and the efficiency of the processes in converting the available matter into stars is still a matter for investigation. Though the Initial Mass Function (the mass distribution) of stars shows a lot of uniformity from one location to another, the reason why this should be so is not understood. Stars in binary systems constitute the majority of all those formed and theory is also lacking in this area. Then there are the questions around planetary formation, such as what their mass distributions are likely to be.

On a macroscopic scale, interacting galaxies often support extremely high star formation rates, leading to starbursts. Also, a good deal of time on large telescopes is devoted to observing how the rate of star formation has evolved since the early stages of the universe.

A good deal of the book recapitulates the basic physics behind the processes at work – line and continuum radiation mechanisms, the 21-cm line etc. The conditions within molecular clouds – molecular and line radiation, dust content and composition, cooling processes, magnetic fields, fractal structure, turbulence, are all covered. The conditions leading to collapse and the theoretical models of this are gone into, not neglecting the fact that the idealised uniform spherical clouds the models often deal with do not really exist in nature.

The actual formation of protostars and their observational characteristics are covered in Chapter 6. The contraction towards dense cores, which must get rid of their increasing thermal energy through molecular line radiation, is treated, discussing also how development appears on a Hertzsprung-Russell diagram (in the case of low-mass stars) – e.g., the Hayashi and Henyey tracks which are followed before long-term evolution commences along the Main Sequence. The far-infrared is the region where the warming cores are first detected. Further evolution leads to outflows, detectable in molecular line profiles. Jets, believed to be involved in dissipating angular momentum, are often detected and finally the nuclear processes start, leading to T-Tauri and other visible pre-main-sequence stars. Massive stars, on the other hand, form somewhat differently. OB stars are associated with HII regions and, though not mentioned much in this book, PAH (polycyclic aromatic hydrocarbons) emissions. Some of the theory of HII regions and emission measures is incidentally presented here. The definition of column density might usefully have appeared in the index.

I found this book to be a useful compendium of the rather wide-ranging basic theories required to form an understanding of star formation, a subject that still has many poorly understood areas and that will undoubtedly attract future generations of astrophysicists.

Ian Glass

Contents

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Ophiuchus, the Herb Healer

by Magda Streicher
magdalena@mweb.co.za

Image source: Stellarium.org

Ophiuchus is one of these shady constellations that bring a feeling of mystique to the observer. Ophiuchus the Serpent Bearer was known in ancient times as the herb healer, but there is also a thought that the constellation was named after a Polish king. However, popular largely because the star formation is very large – eleventh in size out of the 88 constellations and home too many globular clusters. If you have to look for globular clusters in just about all the categories then Ophiuchus offers quite a variety. But it is also a constellation with a few surprises apart from being a globular home town. Let's explore this out-of-the-ordinary constellation which is perhaps neglected to some extent because of famous neighbours. *(It should also be one of the Zodiac constellations! - Ed)*

It is appropriate to start an article about this globular-rich constellation with a description of the globular cluster **NGC 6218**, also known as Messier 12, which is located towards the western part of the constellation, approximately 8^{o} east of magnitude 2.7 delta Ophiuchi. NGC 6218 is a beautiful, bright globular cluster that is well resolved with varied-magnitude stars. The small core is special in the way that it is very dense when compared with other globular clusters in Ophiuchus. Clear star strings dance out from the dense core, with two outstanding short strings on the western edge of the cluster. With higher magnification a slight haziness towards the north-west indicates a few faint stars, which could explain the somewhat oval appearance. In the field of view towards the east of the globular cluster are a few bright stars arranged in a sort off square shape. Charles Messier discovered this beautiful object on the night of 30 May 1764.

The near twin neighbour, **NGC 6254**, also known as Messier 10, is situated 3.5^{o} south-east of NGC 6218. NGC 6254 is a lovely star-rich globular cluster which displays a flimsy edge. The inner tight core is relatively large, bright and slightly oval in shape. Faint stars dotted the surface with a few dark and open patches in between. Higher magnification reveals an outer tenuous edge with a few dainty strings which seem to becoming busier with starlight towards the southern edge. It is an outstanding object that displays a handful of yellow stars in the glittering stardust.

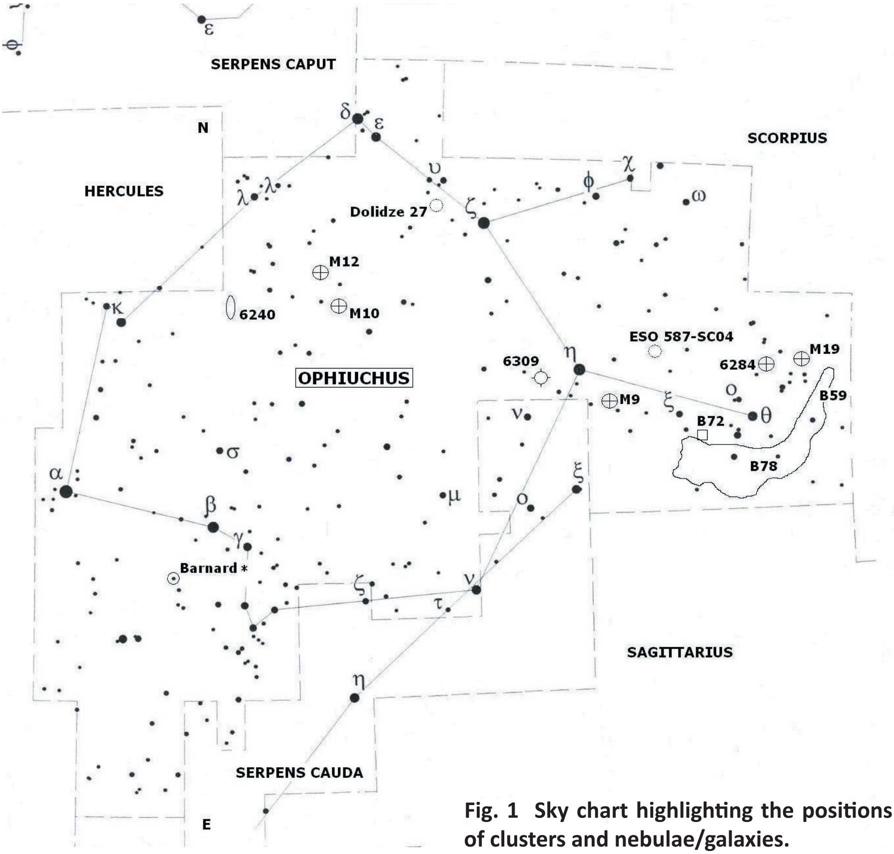

Fig. 1 Sky chart highlighting the positions of clusters and nebulae/galaxies.

Situated 4.5° north of NGC 6218 is the galaxy **NGC 6240**. Although this is only a very faint haze in a slightly north to south direction it is also a very interesting object. The Hubble picture of this galaxy displays a massive face-on spiral with looping arms and with what appears to be a double nucleus, the result of a collision between two progenitor galaxies. The shape reminds one of a butterfly familiar to planetary nebulae.

The magnitude 9.5 star TYC (4252502), better known as **BARNARD'S STAR**, was measured by Barnard in 1916. This famous star is situated 3.5° east of magnitude 2.7 beta Ophiuchi in the north-eastern part of the constellation. According to Wolfgang Steinicke, Barnard published a chart, made in June 1816, where his fast-moving star is marked by an arrow. The high proper motion of this magnitude 9.5 dwarf star, which could be 11 to 12 billion years old, is situated only

5.96 light years away, second to the alpha Centauri system. An arrow-head asterism in the western field of view points the way towards Barnard's star. The author observed the star's motion from 2003 to June 2010 and found its movement to be about 1.2´ in a 354° direction.

The magnitude 2.4 eta Ophiuchi points the way 3° north to the planetary nebula **NGC 6309**. An observer's first response on seeing it would be, "What a special sight." A lovely uneven glow with woolly edges sometimes referred to as the Box Nebula. One's first impression is that of an out-of-focus double star, but higher magnification and close investigation shows a magnitude 11 star on the northern rim of the planetary nebula. The slightly washed-out grey planetary nebula revealed a more defined south-south-eastern side.

The constellation Ophiuchus also has within its borders a few open clusters, which we do not expect to find there; one such object is **DOLIDZE 27**, situated in a triangle north with magnitude 2.5 zeta and magnitude 4.6 eta Ophiuchi in the south-western part of the constellation. The cluster displays only a few widely spaced stars in an east to west direction. Part of the cluster is four members visible in an uneven line towards the western part. The brightest star situated north in this group is the magnitude 6.8 (HD 149662). Most of the stars in this group display a yellow to deep orange colour.

Georgian astronomer Madonna V Dolidze concentrated on surveying emission-line stars, red stars and other objects from the late 1950s through to well into the 1970s. Most of her work was done using objective-prism plates with the Abastumani 70-cm Maksutov telescope, and star groups were reported only incidentally from these surveys.

The cluster **ESO 587-SC04** is situated further south and halfway along the western side of the leg between theta and eta Ophiuchi. The group displays five stars that vary between magnitude 11 and 13 in close proximity. They are mostly yellow to deep orange in a diamond cross shape with a possibly faint double star towards the middle area. Fainter stars flow away into the western part of the field of view.

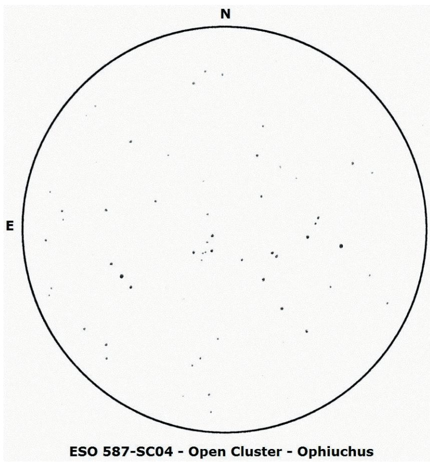

Fig. 2 This cluster displays a close group of five yellowish stars.

The rho Ophiuchi region situated in the south-western corner of the constellation stretches into the neighbouring Scorpius and is surely one of the most outstanding parts of the Milky Way. Different types of objects reside in this cloud of nebulosity and are definitely worth a mention.

Well into the southern part of the constellation are a whole bunch of globular clusters situated close to one another. **NGC 6284** found its home 4^{o} west of the magnitude 3.5 theta Ophiuchi and half-way to the constellation Scorpius border. Not all globular clusters are bright, large or rich in stars, and NGC 6284 displays only a small, faint puff of light. With the utmost care and high magnification few specks of starlight can be seen in the soft outer edge. The object creates in one a very strong sense of the truly enormous distance between the deep starry skies and the eye of the observer. It is striking that the star field to the north-west of this globular cluster is generously scattered with stars, in contrast with the relatively bare south-eastern star field. William Herschel discovered this object in 1785.

Barely 1.5^{o} south is **NGC 6273**, also known as Messier 19, and by contrast a typical, rich globular cluster with a pleasant character. It brings along a special feeling with its frosted, concentrated look and the impression of a fleecy, speckled edge as if the faint stars are being blown away in a breeze. Higher magnification reveals an unusual star-like core slightly

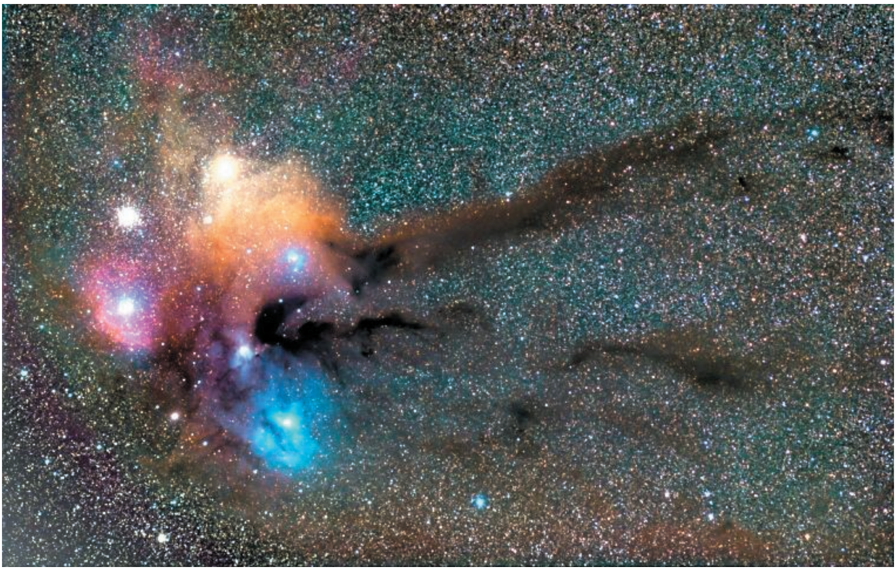

Fig. 3 Rho Ophiucus is one of the most unmistakable and colourful nebula in the sky. Photo credit: Dieter Willasch.

Fig. 4 The Snake Nebula, officially known as B72 or LDN 66. The clearly S-shaped dust lane is on the northern edge of B78. Photo credit: Dieter Willasch.

off centre, the reason for the elongated north-south direction. In shape NGC 6273 gives the impression of being one of the largest ovals as far as globular clusters are concerned and almost appears to double in size with averted vision. Several long chains of faint stars can be seen, and more so towards the north-western part of the globular cluster. The object was discovered by William Herschel on the night of 5 June 1764.

Several dark nebulae can be seen in the constellation, but as we know by now, light pollution stops us from seeing many wonderful objects, which can be found only in ideal dark star-filled night sky conditions. Ophiuchus is famous for a number of well-known dark nebulae discovered by Edward Emerson Barnard. He used wide-field lenses and the 24-inch Bruce telescope to take superb photographs of the Milky Way. They showed dark cloud structures, rifts and holes where there were only few stars visible. Perhaps one of the best known is **B59**, better known as The Pipe Nebula, with the stem of the pipe in an area 1.8° south of magnitude 3.2 theta Ophiuchi. Adjacent north-east is **B78**, which can be seen as the larger dark area also known as the bowl of the pipe. The two objects also go under the names of LDN 1773 and LDN 42 in the *Lynd's Dark Catalogue*.

Another very impressive dark nebula regularly seen on photographs is **B72**, or LDN 66, more popularly known as The Snake Nebula. This clearly defined S-shaped dust lane is situated on the northern edge of B78. The whole area is about 7° in extent. The best way to observe it is to use binoculars for the dark areas, but a dark and transparent sky is definitely a prerequisite.

Just 3.5° south-east of magnitude 2.4 eta Ophiuchi **NGC 6333**, or Messier 9, can be found, with perhaps a nice tale to reveal. This globular is bright, large and roundish in shape with a large, even bright core, but not star-like. The core of the object is not round, but displays a somewhat uneven shape. With careful observation faint stardust can be seen scattered on this round haze of light. High magnification brings to the fore faint stars loosely gathered towards the fringy and grainy edge. A short string of four stars swings out on the western edge of the globular cluster (see sketch). The dark nebula B64 is situated a few arc-minutes away towards the western field of view. On the night of 1 May 1935, Cyril Jackson discovered his first comet (Comet C/1935 M1) barely 12´ south of NGC 6333 at RA: 17h19m3, DEC: -18° 42´. It can be assumed with reasonable certainty that Jackson was observing M 9 when he discovered the comet.

In April 1929 Jackson discovered his first minor planet, which he called Catriona, a remarkably productive career followed during which he discovered 72 new minor planets. Apart from Comet C/1935 M1, he discovered two more comets known as 58P Jackson-Neujmin and comet 47P Ashbrook-Jackson.

A night sky filled with starry splendor brings with it a feast of satisfaction and a veritable healing for the weary soul, without medication from the herb doctor ... or so we hope! ☆

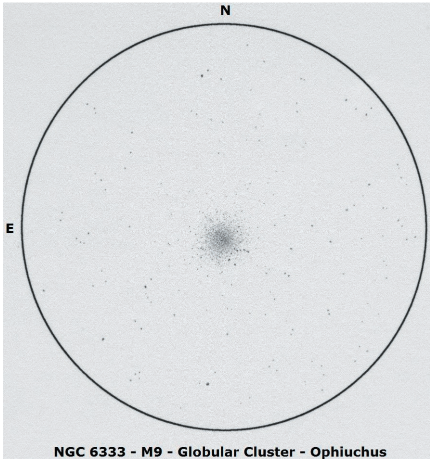

Fig. 5 This globular cluster, NGC 6333 also known as M9 has an asymmetric core.

Object	Type	RA (J2000.0)	Dec	Mag.	Size
DOLIDZE 27	Open Cluster	16^h36^m5	-08°56′	7	25´
NGC 6218 - M12	Globular Cluster	16 47 2	-01 58	6.8	14.5´
NGC 6240	Galaxy	16 53 0	+02 24	12.9	2.0´x0.8´
NGC 6254 - M10	Globular Cluster	16 57 1	-04 06	6.6	15.1´
NGC 6273 - M19	Globular Cluster	17 02 6	-26 16	6.7	13.5´
ESO 587-SC04	Open Cluster	17 04 4	-19 27	11	2.5´
NGC 6284	Globular Cluster	17 04 5	-24 47	8.9	5.6´
B 57	Dark Nebula	17 08 3	-22 50	6	5´
NGC 6309	Planetary Nebula	17 14 1	-12 55	10.8	16”
NGC 6333 - M9	Globular Cluster	17 19 2	-18 31	7.6	9.3´
B 78	Dark Nebula	17 21 1	-26 47	6	-
B 72	Dark Nebula	17 23 5	-23 38	6	4´
BARNARD’S STAR	Star	17 57 8	+04 44	9.5	-

astronomical society of southern africa

The **Astronomical Society of Southern Africa** (ASSA) was formed in 1922 by the amalgamation of the Cape Astronomical Association (founded 1912) and the Johannesburg Astronomical Association (founded 1918). It is a body consisting of both amateur and professional astronomers.

Publications: The Society publishes its own electronic journal, the *Monthly Notes of the Astronomical Society of Southern Africa (MNASSA)* bimonthly and an annual printed *Sky Guide Africa South*.

Membership: Membership of the Society is open to all. Potential members should consult the Society's web page assa.saao.org.za for details. Joining is possible via one of the Local Centres or as a Country Member.

Local Centres: Local Centres of the Society exist at Bloemfontein, Cape Town, Durban, Harare, Hermanus, Johannesburg, Pietermaritzburg (Natal Midlands Centre), Pretoria and Sedgefield district (Garden Route Centre). Membership of any of these Centres automatically confers membership of the Society.

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