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monthly notes of the astronomical society of southern africa

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In this issue:

Cover picture: Eclipse watching group in Durban.

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News Note: Planet found around Proxima Cen

A recent paper in Nature (Anglada-Escudé et al, Nature **536**, 437, 2016) has convincingly demonstrated the existence of a surprisingly earth-like planet in orbit around the nearest star, Proxima Centauri. The mass of this planet is estimated at 1.3 earth masses (minimum) and its orbital period is 11.2 days. Its orbital radius is around 0.05 times the distance of the Earth from our Sun.

Since Proxima is a very cool star, a red dwarf of spectral type M5.5V, with an effective temperature of about 3000K, the new planet is in a position where its surface temperature should be about 234K, according to model calculations. The irradiance on the planet should be about 65% of the Earth's.

Of course, nothing is known about the atmosphere or lack thereof of the planet. Proxima is a flare star and its radiations could be very destructive. The planet could also have a rotation period locked to its revolution period.

The discovery was made by analyzing the radial velocity variations of Proxima Cen itself. The presence of any planet in orbit around it will cause small periodic changes which are detectable with modern high-resolution spectrographs. The observed full amplitude of the 11.2 day variation was found to be 2.8 ms^{-1} in this case. The measurements were made with specialized high-resolution spectrographs, mainly the HARPS (High

Accuracy Radial Velocity Planet Searcher), attached to the ESO 3.6m telescope in Chile.

The extraction and analysis of the data was very tricky due to possible interference arising from flares on Proxima. The data also show evidence of the star's rotation at about 80-83 days. However, no reason other than the presence of a planet is likely to explain the 11.2 day variations.

Note: Proxima was discovered in 1915 by RTA Innes, working in Johannesburg.

News Note: Stellar Flares on Proxima Centauri

With speculation about possible life on the planet orbiting Proxima (Proxima b), this report on past observations may throw some gloom on that prospect.

Several stellar flares have been recorded on Proxima Centauri during observing sessions of time series photometry performed at the Bronberg and Kleinkaroo Observatories over the period 2006-2012. Telescopes of 30 and 35cm aperture were used with CCD cameras and photometric filters.

In total 135 hours of observations were made, of which 74h were in the R-band, 23h in I and 38h in V. Some of those observations, 10 hours in total, ran simultaneously using both telescopes.

No clear flares were recorded during the observations made in the I band.

Seven distinct flares were recorded during the observations made in R, of which the largest showed a magnitude increase of 0.52. It took place on UT 28.867 April 2011.

This flare showed a rise time of about 20 seconds and a decay time of about 10 minutes, not atypical for such flares. Another flare with a 0.14

magnitude increase in R was recorded later during the same run at UT 28.985 April 2011.

Two distinct flares were recorded during the observations made in V of which the largest showed a magnitude increase of 0.24. It took place on UT 28.985 April 2011 and was the same flare as that seen with the other telescope (the R = 0.14 magnitude increase). The simultaneous record of the same flare in R and V hints at a flare spectrum more energetic at shorter wavelengths, as might be expected. It could also explain why no obvious flares were seen in the I-band.

Unfortunately, since the V run had started later that night, the giant R = 0.52 flare was missed by less than an hour. It would have reached a magnitude of around V = 0.9. A V = 0.9 magnitude increase means a momentary more than doubling of the 'normal' visible radiation level coming down on the nearby planet Proxima b. Imagine that to happen on planet Earth.

I wonder if there are more records of continuous observations of Proxima Cen. Surely we have missed the most powerful Proxima flares.

(Berto Monard / Kleinkaroo Observatory, Calitzdorp)

News Note: HERA telescope gets $9.5 million funding injection.

The Hydrogen Epoch of Re-ionization Array (HERA) brings more international funding to South Africa with a $9.5 million investment to expand its capabilities, as announced today by the US National Science Foundation. HERA is located only a few kilometres from the MeerKAT radio telescope, which began initial science operations in July, marked by Department of Science and Technology Minister Naledi Pandor.

HERA, which was recently granted the status of a Square Kilometre Array (SKA) precursor telescope, currently has 19, 14-metre radio dishes at the SKA South Africa Losberg site near Carnarvon. These will soon be increased to 37. The $9.5 million in new funding, will allow the array to expand to 220 radio dishes by 2018.

This innovative telescope aims to detect the distinctive signature that would allow astronomers to understand the formation and evolution of the very first luminous sources: the first stars and galaxies in the Universe.

The HERA radio telescope follows in the footsteps of a precursor instrument called PAPER (Precision Array for Probing the Epoch of Re-ionization) also located in the Karoo.

(Figure 1. The HERA Telescope (left).

The much more sensitive HERA, operating in the Karoo with minimal man-made radio interference, will explore the billion-year period after hydrogen gas collapsed into the first galaxies, a few hundred million years after the Big Bang, through the ignition of stars throughout the Universe – the first structures of the Universe we observe today.

"The Universe was formed in a Hot Big Bang of particles and radiation 14 billion years ago, but soon cooled down and was dark for hundreds of millions of years, before any stars formed. Nobody yet knows when these stars formed. Today's announcement increases the chances that signs of the first stars and galaxies ever to be created will soon be detected – in South Africa's Northern Cape," explains the SKA South Africa Chief Scientist, Dr Fernando Camilo.

Four hundred thousand years after the Big Bang, the Universe was largely made up of neutral hydrogen, the simplest and most common element. Eventually, while the Universe at large expanded, ever-larger clouds of hydrogen gathered due to their mutual gravitational attraction. In time, some of these clouds became dense and hot enough that hydrogen atoms fused and the first stars formed. These first brilliant objects flooded the Universe with ultraviolet light that split or ionised all the hydrogen atoms between galaxies into protons and electrons – the beginning of cosmic re-ionization.

SKA South Africa senior astronomer Dr Gianni Bernardi says: "HERA – which operates at low radio frequency – has enough sensitivity to detect cosmic re-ionization and we hope to map it very precisely by statistically measuring how the fraction of neutral hydrogen changed with cosmic time. HERA has the potential to transform our knowledge in one of the main SKA science areas."

The work is all the more impressive because the telescope's minimalist design makes it a relatively inexpensive structure. Because each antenna will point in a fixed direction, they do not have to move around, so no expensive moving parts are required.

Fig 2. HERA under construction.

Project Engineer Kathryn Rosie is responsible for HERA's construction in the Karoo. "HERA is a truly Karoo-based instrument. Construction materials are sourced and fabricated from within South Africa – predominantly from the Carnarvon area. Because the bulk materials of construction are light industry materials such as wood and PVC pipe, there is opportunity for local businesses, which don't necessarily have a "high

technology" customer base, to be a part of this awesome science instrument. We have local contractors installing our main support poles, cutting our structural elements to size, and making up our reflector surface panels from bulk supplied material," says Rosie.

"Similarly, for our construction crew in the prototype phase, we assembled a team of local young people who have taken on the construction and made it their own. Two SKA South Africa interns who were part of the fibre-training programme in 2015, are included in the team of four. They have rapidly developed into very capable HERA builders who can hold their own with everything from land survey equipment, to general construction and the maintenance of the front-end signal chain of a radio telescope. We intend to grow this team in 2016 to effect the larger build," continues Rosie.

The University of California, Berkeley, leads the experiment in collaboration with partner teams from the USA, UK, Italy and South Africa. Participating South African institutions include Rhodes University, the University of KwaZulu-Natal, the University of the Western Cape, the University of Witwatersrand and SKA South Africa.

Connecting HERA to MeerKAT, Dr Rob Adam, SKA South Africa Managing Director, said that "among other investigations, MeerKAT will study evolved galaxies in the later Universe, while HERA will peer back nearer to the dawn of time, when the first stars and galaxies were being formed. In this way they address complementary scientific questions."

"This shows that the site selection for SKA South Africa was of such a good standard that we attract more international funding to South Africa and the site is a host for other scientific instruments," continues Adam.

In the next decade, MeerKAT will become integrated into SKA1-MID, Southern Africa's portion of the largest astronomical project of all time, the Square Kilometre Array. This will be complemented by SKA1-LOW to

be built in Australia, which in turn will study in much greater detail the pioneering detections expected from HERA.

HERA is one of a number of low frequency telescopes, including the Murchison Widefield Array (MWA) in Australia and the LOw Frequency ARray (LOFAR) in the Netherlands that are pathfinders for SKA1-LOW to be located in Australia.

News Note: Eta Carinae: Violent stellar wind collision in the binary star monster

Wednesday, October 19 - Eta Carinae is a massive, bright stellar binary system. The more massive component is one of the largest and most luminous stars known. In the central region of the binary, the powerful stellar winds from both stars collide at speeds up to 10 million km per hour. An international research team led by Gerd Weigelt from the Max Planck Institute for Radio Astronomy (MPIfR) in Bonn including SA Astronomical Observatory (SAAO) postdoctoral fellow, Dr. Nicola Clementel has for the first time studied Eta Carinae using near-infrared interferometric imaging techniques. The team obtained unique images of the wind collision regions between the two stars. These discoveries improve our understanding of this enigmatic stellar monster. The observations were carried out with the Very Large Telescope Interferometer (VLTI) of the European Southern Observatory (ESO).

"There is a long history of South African interest in this truly remarkable star, which continues to astonish us", says Prof Patricia Whitelock (SAAO & UCT). During the 'Great Eruption' it would have been the second brightest star in our skies and its changes were followed and recorded by several well known people, including Burchell, Herschel and Maclear. Very much more recently, observations that led to our understanding that eta Carinae was actually a binary star were made from SAAO at Sutherland in the Northern Cape.

The more massive of the two stars in the Eta Carinae system, called the primary star, is a monster because it is about 100 times more massive and five million times more luminous than our sun. In late phases of the evolution, such massive stars lose huge amounts of gas before they explode as a supernova. Studies of this dramatic mass-loss process are important to improve our understanding of stellar evolution.

Both stars of the Eta Carinae binary system are so bright that the powerful radiation they produce drives matter from their surfaces in the form of massive, fast stellar winds. These high-velocity stellar winds violently collide in the space between the two stars. Extreme physical processes occur in this innermost region, where the very fast stellar wind from the less massive but hotter companion star crashes into the dense primary star wind with a velocity of about 3000 km per second (more than 10 million km per hour). In this collision region, temperatures reach many tens of millions of degrees, hot enough to emit X-rays. In the past, it was not possible to resolve this violent collision zone, because its extension is too small even for the largest telescopes.

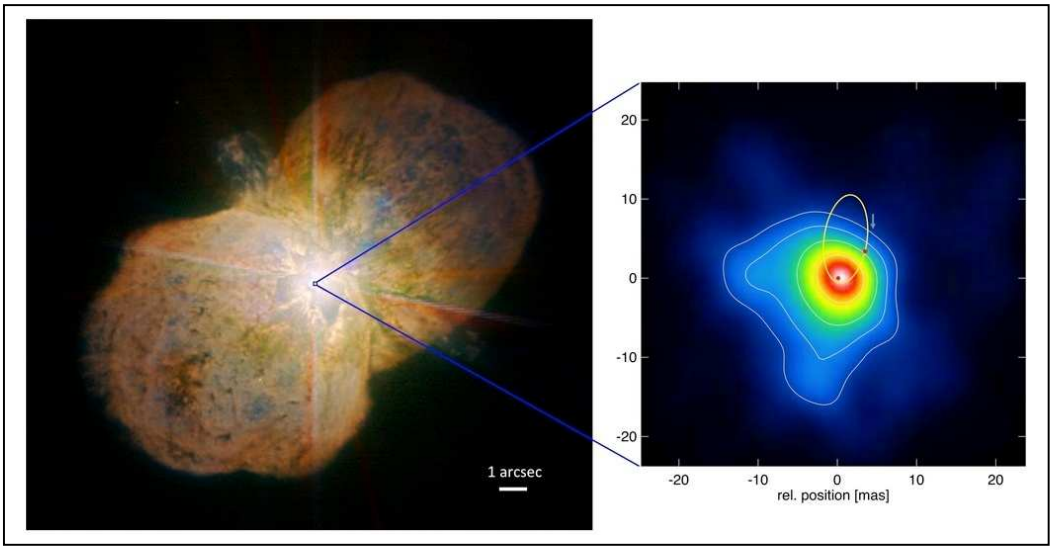

Fig 1: Eta Carina (left)

For the first time, an international team of astronomers led by Gerd Weigelt from the Bonner Max Planck Institute for Radio Astronomy has obtained extremely sharp images of Eta Carinae (see Fig. 1) by using a new imaging technique based on long-baseline interferometry. This technique

combines the light from three or more telescopes to obtain multi-telescope images called interferograms. From a large number of interferograms, extremely sharp images can be reconstructed using sophisticated image reconstruction techniques. This interferometric imaging method can achieve a resolution that is proportional to the distance between the individual telescopes.

The new Eta Carinae observations were carried out with the AMBER interferometry instrument of ESO's Very Large Telescope Interferometer(VLTI; Fig. 2). . The team combined the infrared light from three of the movable VLTI telescopes with 1.8-metre mirror diameter. Because the largest distance between the telescopes was about 130 metres, an angular resolution was obtained that is about 10 times higher than the resolution of the largest single telescope.
"Our dreams came true, because we can now get extremely sharp images in the infrared regime. The ESO VLTI provides us with a unique opportunity to improve our physical understanding of Eta Carinae and many other key objects", says Gerd Weigelt.

The applied high-resolution imaging technique allowed the team to obtain, for the first time, both direct images of the stellar wind zone surrounding the primary star and the collision zone in the central region between the two stars (Fig. 1). Because this technique provides both high spatial and spectral resolution, it was possible to reconstruct images at more than 100 different wavelengths distributed across the Brackett Gamma emission line of hydrogen. This is of great importance for astrophysical studies of Eta Carinae, because these multi-wavelength images show both the intensity and the velocity distribution of the collision region. Velocities can be derived from the multi-wavelength images because of the Doppler effect. These results are important to improve physical models of the wind collision zone and to better understand how these extremely massive stars lose mass as they evolve.
"The unprecedented level of details of this VLTI multi-wavelength observations is at the same time fascinating and challenging. The high-

quality data allow for better understanding of the physical properties, but also place stronger constrains which require an increased effort in modelling this fascinating object. These techniques and new instruments also provide new possibilities for studying stellar outflows", explains Dr. Clementel (SAAO).

Editor's note. For further details on SA's long involvement with Eta Carina, see:
Whitelock, P. (2005) *Eta Carinae: a South African perspective* South African Journal of Science 101

ANNUAL GENERAL MEETING OF THE ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

Date: 17 August, 2016
Venue: The Willows Country Lodge
Time: 19h00 to 21h30

Present:

Council	**Role**
Dr Pierre de Villiers	President, Chair - Hermanus Centre
Bosman Olivier	Membership Secretary
Johan Smit	ASSA Pretoria Chair
Lerika	Cross Secretary
Adv AJ Nel	Treasurer
Chris Stewart	Council Member, Section Director Instrumentation
Jerome Jooste	ASSA Johannesburg Chair

Council Appointees

Dave Blane	Section Director Double and Variable Stars
Allen Versfeld	Section Director Imaging

Apologies

Tim Cooper	ASSET Trustee

Dr IS Glass	Committee Member
Dr Claire Flanagan	ASSA Scholarship Convenor
Eddy Nijeboer	Cape Centre Chair
Case Rijsdijk	Vice President, Chair - Garden Route Centre, MNASSA Editor
Auke Slotegraaf	Sky Guide Editor, Section Director Deep Sky
Christian Hettlage	Web Master
James Smith	Web Manager

ASSA members and visitors present

Wilmi le Roux, Clyde Foster, Michelle Ferreira, Dr Barbara Cunow, Neville Young, Nigel Rotherham, Linda Rotherham, Dr Louis Lombaard, Laura Lombaard, Michael Poll, John Maynier, Fred Oosthuizen, Gilbert Maloka, Andy Overbeek, Rudolf Strydom, Jess van Elferen, Neil Viljoen and Anton du Toit.

Bosman Olivier, ASSA Membership Secretary and ASSA Pretoria Council Member, who fulfilled the role of host and Chairman for the AGM, welcomed everyone and opened the meeting.

Reports

Presidents Report on Council

The Constitution prescribes a number of conditions to Council, such as its obvious composition, election procedure and functioning, the last of which reads that Council shall frame an annual report on the activities of Society, which I am now submitting on its behalf.

I can confirm that that all the Constitutional requirements applicable to Council's activities have been executed scrupulously. Whereas the Constitution calls for quarterly meetings there were actually five Council meetings conducted by Skype voice calls in September, November, February, April and June with an average attendance by 8 Council members and 3 Appointees. These meetings were conducted in a very

effective manner because of both well-drafted Agendas from the Secretary and the efficient IT connection skills of Chris Stewart. It gives me great pleasure to acknowledge and thank the Council members and Appointees for the dedication and enthusiastic manner in which they participated in Council meetings and discharged their voluntary obligations. It's a pleasure working with such a bunch of knowledgeable and committed members. Thank you to each and every one.

One of the keys to Council's effective functioning is the updated Deadlines list which is forms part of every Agenda and serves as timely reminders of reporting or submission deadlines.

A financial sub-committee met on occasion to iron out uncertainties regarding the crucially important issue of finances. I thank them for giving me much better clarity about the best approaches and for generally helping to prevent Council meetings getting bogged down in financial nitty-gritty during Skype sessions. Thank you very much for your help.

A lot of the Society's activities will be dealt with in the Section Reports, but there are a surprising number of activities *not* mentioned in these reports, which I'll briefly summarise to complete a comprehensive overview of the Society's activities.

First among these and very much not in the "public eye" must be the thorough reviews and updates of both the Communications document, which is an extremely important and useful summary of all Council members' and appointees' responsibilities and recommended methods of execution, and the ASSA website. Monumental tasks both and well executed.
Council is in the process of updating the software required to prepare the Sky Guide Africa South for publication by Struik. Together with MNASSA these two publications give very effective execution to the Constitution's reference to the role of publications to contribute to ASSA's prime objective to "encourage and stimulate the study and enjoyment of

Astronomy". Both are publications to be proud of and the hours of hard work required to ensure their publication is almost unheralded but most appreciated. Congratulations and Thank You to all involved

An initial initiative to cooperate with SKA in educational outreach was independently initiated with the first of quarterly workshops for all Science teachers in the Overberg region by the Hermanus Centre. SAAO and SKA's involvement should now be easier to enrol with a successful first round under the belt. This very rewarding activity will hopefully be copied at other Centres in future.

There was an approach for contact from an astronomy group in Namibia and this hopefully be responded to together with an initiative to try to bring all astronomical activities country-wide under the ASSA wing for at least activity reporting.

The drop of the Rand against the major currencies forced Council into revising the annual free subscription to Sky & Telescope for Honorary members to a fixed monetary contribution be applied at the recipients preference.

There were a number of noteworthy projects initiated by Council members:
The Big 5 of the Southern Skies project was initiated by the Deep-Sky Director Auke Slotegraaf and is still ongoing. It is a project that cannot be encouraged enough in all observation and outreach activities.
Case Rijsdijk planned and coordinated a very worthwhile Stellar Highway to commemorate the centenary of the discovery of Proxima Centauri in South Africa, with very effective commemorative information plaques and models of the Sun and Proxima Centauri. Well done, Case.
Claire Flanagan deserves the credit for initiating an extremely worthy ASSA project for the partial eclipse of 1st September. A sub-committee did sterling work on this project and the ASSA website has an updated and very professional web-page on this project. Thank you for your excellent

work on this project Claire, Auke, Lerika, Case, Allen, James and Thank You in anticipation for all everyone who is going to promote awareness of the event and participate on the 1st September, particularly at schools.

Finally, I am ending this report in the same way as Matie Hoffman started off last year. He referred to the Secretary as the nerve centre of the Society, which is actually an uncannily accurate analogy. As the initiator, coordinator, outcomes-demanding follow-upper and, where necessary, nagger the Secretary fulfils in my view the most demanding and arguably important portfolio on Council. Thank you very much, Lerika, for your dedication to ensuring the effective functioning of Council. I frequently used her as a sounding board and always benefitted from her sound advice and experience. I really do appreciate your support over the past year, Lerika, and am selfishly but appreciatively looking forward to more of the same in the year ahead.

I thank you for your kind attention.

Pierre de Villiers

ASSA Scholarships:

The ASSA Scholarship

The ASSA Scholarship was established in 2000 to encourage the study of Astronomy at any Southern African university at the 2nd and 3rd year level. The Scholarship is funded by ASSA, and has a value of R17 500 for 2016..

The 2016 ASSA Scholarship has been awarded to Brandon du Preez, third year BSc student at the University of Cape Town, majoring in Mathematics and Astrophysics. Du Preez held the 2015 scholarship, and obtained excellent results for his second-year courses.

HartRAO-ASSA Scholarships

The three HartRAO-ASSA Scholarships, established in 2015, are generously sponsored by the Hartebeesthoek Radio Astronomy Observatory and are administered by ASSA. For 2016, the value of each was R16 000. Two full scholarships were awarded in 2016 to the following full-time students:

Jeremy Smith: 3rd year Electrical and Computer Engineering student at UCT; Jeremy was a 2015 ASSA / HartRAO scholarship holder, and
Mvelo Dhlamini: 1st year BSc student at Wits University.
The third HartRAO-ASSA Scholarship was split between two part-time UNISA students
Verlon Etsebeth: Etsebeth was a 2015 ASSA / HartRAO scholarship holder, and is currently in his third year of a BSc (Physics) degree, and
Francois Botha: Botha is currently studying 2nd and 3rd year courses towards a BSc (Physics and Mathematics); he was a 2014 SAAO scholarship holder.

HartRAO will again be funding three HartRAO-ASSA Scholarships, of R16 000 each, for 2017.

Scholarships Committee

The Scholarships Committee currently comprises Ian Glass, Marion West (representing HartRAO), Maciej Soltynski, Andrew Gray, and Claire Flanagan (convenor). Sivuyile Manxoyi, who served on the committee as an SAAO representative while the SAAO scholarships were available, has agreed to re-join the committee. Maciej Soltynski, who served as convenor for the past fourteen years, stepped down in 2015, and the position was taken by Flanagan.
The convenor would like to express thanks to the committee (especially Mr Soltynski), and the ASSA Treasurer (AJ Nel) for their work this year. The generous funding from the Hartebeesthoek Radio Astronomy Observatory is appreciated, and our thanks goes to those who made this possible – Prof

Nithaya Chetty (Deputy CEO, Astronomy, NRF) and Dr Ludwig Combrink (Director, HartRAO)

Claire Flanagan (Convenor, ASSA Scholarships Committee)

Astrophotography Section

1 Member Activity: The astrophotography section continues to encourage the submission of photographic images of astronomical subjects, which are added to the ASSA image archive. This archive is hosted on Flickr, and the images within the archive are displayed on the ASSA website, under the Gallery, grouped by photographer and subject. We only accept submissions from South African photographers, or that were captured in South Africa. We do not require the photographer to be an ASSA member, nor do we refuse submissions based on quality, in line with the requirement that the section work to promote and encourage the art of astrophotography.

Submissions continue to improve, though, both in the number of regular contributors and the general quality of work. Richard Ford remains the top submitter by volume – by his own count, he has submitted almost a thousand images to the archive. His nearest competitor is Clyde Foster, who can be relied upon to provide consistently excellent planetary images, which he also shares with international collaborators to monitor Martian weather patterns.

2 Astrophotography Competition at Scopex: The section director was on the judging panel of last year's astrophotography competition at ScopeX. The winning entry was a very impressive image, submitted by Neil Viljoen, printed on large format glossy paper. The quality of his work was so high, representing a considerable investment in equipment and time, that some questioned whether we should allow "Professional" images in an amateur contest. However, we decided to allow the entry and grant first prize for two reasons:

I. The rules of the competition make no distinction between “Professional” and “Amateur” images.
II. It was objectively the best entry by far

Hopefully the excellent quality of the winning image will raise the bar for the local astrophotography community and inspire us to raise our own standards.

3 Astronomical Videos: An ASSA YouTube channel has been created, which will serve to publish different kinds of relevant video content:

3.1 Time-lapse videos: examples include Martin Heigan’s video of the recent Mercury transit, and the Section Director’s videos demonstrating the rising and setting of constellations

3.2 Live Streamed videos: Starting with the September Eclipse, but hopefully extended to include

3.4 Video recordings of talks given at Symposium, ScopeX, and other events.

3.5 Educational videos (animations demonstrating how the inclination of the Earth’s orbit leads to the seasons, for example).

3.6 Member submissions of Video Astrophotography work

4 Website: A new section has been added to Astrophotography Section page, to teach newcomers how to do astrophotography. The content of this section began life as a series of pages originally written for Urban Astronomer, but it will now be hosted on the ASSA website where it will be more useful in service to South Africa’s growing astrophotography community.

5 Planned Activity: The section will be producing a guide on how to image the Sun, as part of ASSA’s outreach program for the September solar eclipse, with a focus on photographing images produced by pinhole

projection. The general public will be invited to share their photos, and we will publish a selection of the most noteworthy on the ASSA website.

6 Awards: The Director awarded a Director's Observing Commendation to John Gill, for recently having completed a photographic survey of all objects on the ASSA Top 100 Deep Sky Objects list. The full set of these images will be added to the archive, on its own page.

Allen Versfeld, Director

Cosmology Section

1 The aims of the Cosmology Section are:

(i) To disseminate news of importance in the field of cosmology to members;
(ii) To circulate scientific papers in the field of cosmology to members; and
(iii) To do research and promote the study of cosmology as a science.

2 Membership is currently 26.

3 Activities: A number of interesting events were reported on and discussed during the year. The possible impact of cosmic wind on the formation of galaxies was reported to members. Cosmology beyond the Standard Model of Particle Physics and Dark Matter in the early universe were discussed among members. The brightest ever supernova occurred and has been reported. Einstein's "spooky at a distance" created quite a number of discussions. A number of reports about the possibility of discovery of a particle more massive than the Higgs Boson has been received and circulated to members. Quasars, primordial galaxies and very massive stars at the end of the epoch of recombination were circulated and discussed.

4 On-line courses

Mr. Maciej Solstynski was instrumental in bringing on-line courses to the attention of members. The director completed a course presented by the University of Edinburgh on the significance of the discovery of the Higgs Boson.

Frikkie de Bruyn , Director.

Deep Sky

I'm pleased to report to this meeting that the Section has had a good year.

Dave Blane, both Double Star and Variable Star Collaborator, continues active observing in these areas. He has submitted 1,738 variable star observations to the AAVSO and has participated in a number of observing programmes arranged by them. Dave also completed their course on DSLR Photometry, and I look forward to learning from him. Dave continues with the measures of Dunlop's double stars, as well as other selected interesting double stars.

The Nebulae & Clusters activity area has been supported by several good folk, including Hannes Pieterse. Hannes has accepted the role of Programme Co-ordinator for Deep-Sky Marathons, and has created a highly-detailed resource on the ASSA website, to my knowledge the first such one-stop shop for marathon info. Hannes has assisted John Gill (ASSA Durban) with the planning of a marathon for the Centre.

The two stalwarts of the Section, Magda Streicher and Richard Ford, continue their vigil at the eyepiece. Magda's work on Volume 2 of her "Deep-sky Delights" nears completion. She also continues to write columns for MNASSA and the ASSA Pretoria Centre newsletter. She gave an address at the February Southern Star Party about her personal take on deep-sky observing.

Richard continues to work hard towards completing the Bennett Catalogue; within the next weeks he should have reached this milestone. As of this writing, his contribution to the deep-sky database totals 393 sets of observations.

Feed-back on observing has been given to Dirk Rossouw, Cheyenne Kersting, Johan Brink, Pierre de Villiers. Feed-back on deep-sky photographs has been given to Dawie Venter, Johan Moolman, Leslie Rose, Christine Kersting.

Several observers are working on the ASSA Top-100 list. Dawie Venter has announced his intention to photograph all 100 objects, while John Gill of ASSA Durban has successfully photographed them, and is to be congratulated. (For the record, the first to do this was Michael Moller, in 2013.)

Hannes Pieterse and Carol Botha have helped with the completed planning of the Big 5 Project. Metal badges were designed and produced and are now available for distribution. They are individually numbered and as they are allocated, the names of the recipients will be listed on the Section's web page. Designs and costing for Big 5 T-shirts and sticker sets were finalized, and are ready for production. The support of ASSA Council, in the form of significant funding for the production of these materials, is gratefully acknowledged.

The first Big 5 observation has already been received, from Dewald van Rensburg of Despatch, Eastern Cape. The formal launch of the programme will only be later this year, though! Two non-ASSA members joined the Big 5 WhatsApp chat-group.

The second edition of *'Nightfall'* will appear in October. Contributing authors are Owen Brazell, Doug Bullis, Bruce Dickson and Magda Streicher.

The Deep-sky Observer's Companion online database (DOCdb.net) continues to be used as a growing online repository, with 233 registered users. To date, 3 584 observations are collected in the database. Prof Courtney Seligman continues to provide updates from time to time.

Finally, it's a great pleasure to announce that John Gill has earned an Observing Certificate for his observing notes and photographic record of the ASSA Top-100 Objects.

Auke Slotegraaf, Director

Historical Section

During the past year (Calendar Year 2014) the following has happened concerning the History of Astronomy.

1 Website

Preparation work was done to update the website to the new Wordpress format. Archival material was scanned and converted to readable PDF files.

2 Publications

Individuals in their private capacities wrote articles with historical content. Please note my appreciation to the following people:

I.S. Glass; “Jacob Karl Ernst Halm (1865-1944)”; MNASSA Vol 73 Nos 1 & 2 February 2014
Greg Roberts; “Amateur Optical Tracking in South Africa during 1957 - 2014. Part 3”; MNASSA Vol 73 Nos 5 & 6 June 2014
Greg Roberts; “Amateur Optical Tracking in South Africa from 1957 – 2014. Part 4”; MNASSA Vol 73 Nos 7 & 8 August 2014

Greg Roberts; “Amateur Optical Tracking in South Africa during 1957 – 2014 – Part 5”; MNASSA Vol 73 Nos 11 & 12 December 2014

3 Obituaries

MNASSA published obituaries on the following astronomers:

Halton (Chip) Arp; MNASSA Vol 73 Nos 1 & 2 February 2014
John Dobson; MNASSA Vol 73 Nos 1 & 2 February 2014
Thomas Harry Hope (Tom) Lloyd Evans 1940 - 2014; MNASSA Vol 73 Nos 5 & 6 June 2014
Dr Michael Gaylard; MNASSA Vol 73 Nos 7 & 8 August 2014
Doc Jannie Smit; MNASSA Vol 73 Nos 9 & 10 October 2014
Mary Fitzgerald; MNASSA Vol 73 Nos 11 & 12 December 2014

Chris de Coning, Director

Instrumentation Section

Activities of the Instrumentation Section largely revolve around communication, outreach, guidance and education, plus the important aspect of encouraging people in the pursuit of their personal instrumentation projects. There is no drive to formally induct members into the Section. Rather, the approach has been to address ASSA members’ ad-hoc needs for information on a case by case basis.

In support of the Society’s general communication efforts, which equally support the instrumentation Section’s goals, the following activities are ongoing:

Moderate the ASSA FaceBook page
Moderate the Yahoo! Group mail lists
Moderate the Telescope Making SA FaceBook page

The Section directly supports the needs of both ASSA members and the general public regarding selection, construction, purchase, maintenance and use of instrumentation. This is mostly done via the Amateur Telescope Making (ATM) class, the Telescope Making SA FaceBook page, e-mail correspondence, telephonic discussion, and ScopeX.

The distinctly South African "Telescope Making SA" Facebook group has attracted members from around the world. This international involvement produces an energetic flow of ideas, information, technical assistance and encouragement. Some of the (at times unusual) approaches to instrumentation developed locally have, after being highlighted in this medium, been favourably received and copied abroad. Prospective members are vetted prior to admitting them to the group and appropriate behaviour is gently but firmly enforced.

The ATM class has been continuously active since mid-1991, so this year celebrates its 25th year of operation. It attracts a steady stream of newcomers to the art, with a good success rate of people finishing their first instruments. In addition, after completion of their first telescope, a fair number of participants stay on or return in order to tackle more advanced projects. Members come and go according to their needs and available time, work at their own pace on individual projects, and sometimes return after a long hiatus dictated by personal circumstances. The class is run informally in a flexible manner to accommodate the vagaries of members' lives.

Consequently there is no way to ascertain the number of people or projects engaged in at any one time. Membership of ASSA, whilst encouraged, is not a prerequisite for participation in the ATM class.
ScopeX, which grew out of the ATM class, is currently ramping up for the 15th annual event. In addition to the primary goals of general astronomy outreach and publicizing the Society, it provides a platform for the telescope making community to exhibit their work and thereby encourage newcomers to engage in this fascinating hobby. Having a plethora of

instruments at one place enables visitors and members alike to see, touch, compare and even use a variety of instruments - both commercial and amateur-built or modified. This sparks discussion of ideas, approaches and relative merits, enabling people to make informed choices. ScopeX reports are published separately.

At the last tally, 261 individuals have signed the ATM class manifesto since it was introduced in 2005. The Telescope Making SA FaceBook page currently has 526 members. Notable projects currently underway include a 24" mirror, a Yolo telescope and a complete telescope control system developed from scratch. To date (apart from ScopeX), no formal communal projects have been initiated within the Section. However, the 24" and the telescope control projects are likely to evolve into collaborative ventures. The Director is also putting together a portable telescope and camera control system for astrophotography in the field, largely employing off-the-shelf components in order to ease construction and integration such that others could possibly replicate it for their own purposes.

Chris Stewart, Director

Observing Section Report

Observable and astronomical related events, ASSA competitions etc. have been posted using the various channels and include sightings, images, comments and questions from the public, to which I respond or pass on to the relevant ASSA Sections, specialists and collaborators. For this I would like to thank, Dave Blane (Shallow Sky Director), Tim Cooper and Greg Roberts for their help. A warm thank you once again to Michael Poll (ASSA Pretoria Centre) for submitting the Centre's observing reports this year. These will be archived on the ASSA web page. I would like to encourage the other Centres to also submit theirs.

Comets once again featured prominently during the course of the year with Comet C/2013 X1 (PANSTARRS) visible in our evening skies at present. The comet's outburst in early January this year was photographed by the Director.

During August 2015, two reasonably bright comets were visible in our evening skies, Comet C/2014 Q1 PANSTARRS at around +6 magnitude in Crater and C/2013 US10 Catalina in Pavo, at magnitude +7.5.

In March this year comet 252P/LINEAR increased in brightness and coma size putting up quite a show and it was a naked eye apparition from dark sky locations. Observations and images via the various channels were submitted by Tim Cooper, Neville Young, Mark Burkhardt, Oleg Toumilovitch and Christoph Hohlfeld.

Various calls for the participation of South African observers have come from abroad and these have been passed on via the ASSA discussion group. Queries from local astronomy enthusiasts such as the ones below have been answered or sent to the relevant Centre's.
Are there days where I can observe the sky from the observatory in Johannesburg?
Please could I kindly ask you to assist me. I would like to enquire whether the southern cross will be visible in the early hours of tomorrow morning (13 November 2015) from the Skukuza area. I have tried many websites but so far I have had no luck.
Please would you also furnish me with the details on becoming a member.

The big event of the year had to be the transit of Mercury, which was observed by many ASSA members from various of locations, with the Pretoria Centre hosting a successful observing event at the CSIR Conference Centre.

The Geminids meteor shower, Orionids and Eta Aquariids were well advertised via the various channels and the Director was fortunate to be

able to observe the Eta Aquarrids over the course of four mornings (4 -7 May 2016), in conjunction with Tim Cooper.

A live feed from the town of Springbok was provided to Slooh for the lunar eclipse in the early hours on the 28th September 2015. The experience gained will hopefully stand in good stead for the upcoming live feed of the partial solar eclipse (1st September 2016) that ASSA members will make available country wide.

The Director is committed to actively promoting astronomy and ASSA by holding numerous outreach and Club (Soutpansberg Astronomy Club) events at public venues and schools as well as stargazing evenings in the Limpopo region.

Kos Coronaios, Director

Photometry and Spectroscopy

1 Spectroscopy

1.1 Current Status

Percy Jacobs and the author are to the best of their knowledge the only amateurs actively doing spectroscopy currently. Even though they are located near to one another we have been working in isolation and not collaborated on any projects.

1.2 Observations

Very low resolution work is generally done with the Star Analyser 100 or the Rainbow Optics200 transmission grating. Focus had been on observing B and Be type stars with just over 120 observations for the 2015 -2016 period. Unfortunately no new Be stars have emerged from these observations and the low resolution of the system does not show the

slight flux variances associated with the Doppler shift in the wings of the hydrogen alpha line of known Be stars.

The Astronomical Telegraphs, ATEL, or novae and other transients is used to do nova searches of the southern sky with wide field DSLR imaging and the use of Iris and Astrometrica to process and blink the images. Periodic flux changes of known variables have been observed in the images but no transients brighter than magnitude eight, which is the limiting magnitude of the images have been detected.
Other stars observed are the southern Wolf-Rayet stars such as WR48 Theta Muscae and WR11, Gamma 2 Velorum for periodic changes in the emission lines.

Extended objects such as comets and nebula are in the realm of slit spectrographs and are not well observed with transmission gratings though experimental observations were performed on a couple of occasions.

2.2 Improved Spectrographs

Percy Jacobs has experimented with optical fibre and an attempt to create a higher resolution spectrograph as described by G. Avila in the ESO publication CAOS but do not know how successful this was. The author is currently building a slit spectrograph using parts scrounged from a Czerny-Turner configuration.

1.3 Members Interest in Spectroscopy

Two ASSA members have expressed an interest. Neil Viljoen, webmaster for ASSA Johannesburg and the WRAC and Dr Pierre de Villiers our current ASSA president.

1.4 Analysis of low interest among members.

Spectrographs are very expensive and need to be coupled to a high quality monochrome CCD camera.
Telescope mounts need to be of high quality and track accurately.
Relatively steep learning curve regarding software to process the image and analyse the spectrum.
DSLR cameras are not optimised for spectroscopy though are used from time to time with transmission gratings.
Active members are busy with other projects.

2 Photometry

2.1 Current status

One member, Dave Blane, completed a DSLR Photometry course offered by the AAVSO. No other member has indicated activity in photometry.
Dave completed the course but is already active in Double and Variable Star projects so will not pursue DSLR photometry for now. The reasons are obvious: Photometry is very difficult and takes too much time. This would also impact on members starting out in photometry including the fact that some of the software used requires a steep learning curve.

As with spectroscopy good equipment is essential but the greatest bugbear is that photometric skies are hard to come by this affording a small window of opportunity to do really accurate work.

2.2 Projects

Roy Axelsen from Brisbane requested DSLR photometric measurements for delta Scuti type stars. The request was forwarded and Allen Versfeld volunteered. This was followed up with Roy and he said he had received no response from our members but that he was not surprised and understood as the activity regarding photometry was also on a very low level in Australia and New Zealand.

2.3 Future Plans

To get members of the Astro Imaging Workshops interested in Photometry. A good grasp on imaging methodology and the required software is essential to photometry which can be completed over a number of workshops.

2.4 Conclusion

Photometry and Spectroscopy could be separated as individual observing sections. Both are very demanding disciplines and require very different skill sets so can better be served by two dedicated directors.
In closing I wish Percy Jacobs all the best as incoming Director of this section and would like thank those that assisted me during my term as director.

Jerome Jooste, Director

Shallow Sky Observing Section

1 Sun

Chris Vermeulen was the most active Shallow Sky contributor having submitted excellent solar images and sunspot analysis in regular monthly reports.

The spectacular naked-eye sunspot AR2192 was well observed with images and received from many observers including Chris Vermeulen, Richard Ford and Kos Coronaios.

Chris Vermeulen has agreed accept the position of specialist/consultant in solar observing sub-section. His knowledge and experience will certainly be of great value to us in this area.

2 Moon

The Moon was a favourite target for our observers with numerous images of the Moon at all phases as well as conjunctions with bright stars and planets having been received. Richard Ford was particularly prolific with his excellent images.
The International Observe the Moon Night initiative was well supported with reports received from Louis Trichardt, Henley-on-Klip, Johannesburg Observatory and the Orion Observation Group in Paarl.

3 Comets

The “Christmas Comet”, Comet 2014 Q2 Lovejoy was well observed by several Shallow Sky observers. Kos Coronaios submitted a number of images of the comet from November to February and described the development of the tail as well as tail disruption events.
Comet Siding Spring’s encounter with Mars was also well observed with numerous images of the encounter having been submitted.
Observations and images of Comet C/2013 V5 (Oukaimeden) were also submitted by Kos Coronaios.

4 Meteors

A number of fireball reports have been received, with some of them more convincing than others. Several reports of “falling objects” and bright meteors were received which generated considerable discussion. Thanks to Tim Cooper, Brian Fraser and Allen Versfeld, among others, who helped in analysing the data and providing feed back to the people reporting the sightings.

Auke Slotegraaf, Hans and Evan spent three evenings with the Helderberg Eco Rangers observing and imaging the Geminid meteor shower. A comprehensive report was submitted which included a total of 53

Geminids and 23 sporadic meteors were counted. Thanks to Tim Cooper for his analysis and comments on these observations.

5 Asteroids

Regular workshops and training sessions for the International Asteroid Search Collaboration (IASC) were arranged and presented by Jerome Jooste with several schools being involved. At least two new asteroids have been discovered to date!

The IASC is an online educational outreach program for high schools and colleges, in which students make original asteroid discoveries. Each day students receive telescopic images, only hours old and taken along the ecliptic. Using the software Astrometrica, they accurately measure the time and position of asteroids moving in the background. The measurements are recorded in a report sent to the Minor Planet Centre (Harvard).

The ASSA NEO-Watch programme has been set up in collaboration with NASA. NASA has embarked on the Asteroid Grand Challenge, a programme to “find all asteroid threats to human populations and know what to do about them”. The Asteroid Grand Challenge involves detecting all near earth objects (NEOs) larger than 100 metres, characterise them and determine a way to mitigate them. But while dedicated search programs do a great job of finding these objects, follow up observations are required to characterise them and more precisely define their orbits. This pastime is well suited to dedicated amateur astronomers.

6 Occultations

The occultation of theta Librae by the Moon was observed observed with timing submitted by Kos Coronaios, Oleg Toumilovitch and Neville Young. Thanks to Brian Fraser for providing alerts for minor planet occultations and for providing advice on observing these as well as Lunar occultations.

7 Satellites

Thanks to Greg for his input in handling queries on sightings of satellites and “UFO’s” as well as the many interesting articles he posted on Facebook. While many images of Shallow Sky objects have been submitted over the past year these are reported to the Imaging Section unless there is some analytical or observational component in the submission.

8 Awards

I would like to nominate Chris Vermeulen for a **Director’s Award** for his Solar observations. His monthly reports comprehensive and detailed analysis of Solar sunspot activity, including excellent images and graphs of sunspot groups and numbers. He has also analysed the variation of Mean Daily Frequency over a period of time and goes on to predict future activity. Chris has also produced a comprehensive “*Amateur’s Guide to Sunspot Observation*” which he has made freely available. He is also mentoring other observers who have expressed interest in observing sunspots

Dave Blane, Director

Office Bearers 2016/17

B Olivier advised the meeting that as the key Council Members were all appointed at the previous general meeting - and all Members were still available to continue for the next year - there was no need for voting for positions on Council. There were a couple of changes to the list of volunteers for position of Appointees. The Council and Appointees’ positions for the 2016/17 year were presented and accepted as listed below.

Council Elected at AGM 2016/17

Role	Name	Email
President	Dr Pierre de Villiers	pierredev@hermanus.co.za
Vice President	Prof Matie Hoffman	HoffmaMJ@ufs.ac.za
Vice President	Case Rijsdijk	particles@mweb.co.za
Treasurer	Adv AJ Nel	assa@ajnel.co.za
Mem. Sec.	Bosman Olivier	bosman.olivier@gmail.com
Secretary	Lerika Cross	lerika@icon.co.za
Council Mem.	Chris Stewart	mwgringa@mweb.co.za
Council Mem.	Dr Ian Glass	glass.ian@gmail.com
Centre Chairs		
Bloemfontein	Prof Matie Hoffman	HoffmaMJ@ufs.ac.za
Cape	Eddy Nijeboer	eddy47@xsinet.co.za
Durban	Peter Dormehl	peterd@astronomydurban.co.za
Garden Route	Case Rijsdijk	particles@mweb.co.za
Johannesburg	Jerome Jooste	astronomersinc@hotmail.co.za
Midlands	Steffan Devos	sdevos@webbis.co.za
Pretoria	Johan Smit	johanchsmit@gmail.com
Hermanus	Dr Pierre de Villiers	pierredev@hermanus.co.za

Appointees reporting into Council

Role	Name	Email
Editor - MNASSA	Case Rijsdijk	particles@mweb.co.za
MNASSA Asst Ed.	Dr Ian Glass	glass.ian@gmail.com
MNASSA Rev. Editor	Vacant	
MNASSA Ass layout	Willie Koorts	wpk@saao.ac.za
Editor – Sky Guide	Auke Slotegraaf	auke@psychohistorian.org
Sky Guide Asst. Ed.	Dr Ian Glass	glass.ian@gmail.com
Webmaster	Dr C. Hettlage	hettlage@saao.ac.za
Web Manager	James Smith	smi.james.th@gmail.com
Scolarships	Dr C Flanagan	claireflan55@gmail.com
Observing Director	Kos Coronaios	elephantcastle@lantic.net
Comms Officer	Vacant	

Outreach Officer	Kos Coronaios	elephantcastle@lantic.net
ASSA Archivist	C de Coning	siriusa@absamail.co.za

Section Directors for 2016/17

Sections (Groups)	**Name**	**Email**
A -Shallow Sky	Clyde Foster	clyde@icon.co.za
B1: Deep Sky	Auke Slotegraaf	auke@psychohistorian.org
B2: Double/Variable Stars	Dave Blane	theblanes@telkomsa.net
C: Photometry/Spectroscopy	Percy Jacobs	percymj@iafrica.com
D: Cosmology and Astrophysics	F. de Bruyn	debruyn1@telkomsa.net
E: Historical	C de Coning	siriusa@absamail.co.za
F: Dark Sky	Vacant	
G: Imaging	Allen Versfeld	allen.versfeld@gmail.com
H: Instrumentation (including ATM)	Chris Stewart	mwgringa@mweb.co.za

Editorial Board

MNASSA -Editor	Case Rijsdijk
MNASSA Assistant Editor	Dr Ian Glass
MNASSA Ass. Layout Editor	Willie Koorts
Sky Guide -Editor	Auke Slotegraaf
Book Review Editor	Vacant
Professional Astronomer	Emeritus Prof. Brian Warner
Professional Astronomer	Emeritus Prof. Michael Feast

Awards by section Directors

The President awarded ***Observing Certificates*** to the following who were present for planning, and successfully completing the ASSA Top-100 Marathon on 2/3 July, 2016 by Deep-Sky Section Director, Auke Slotegraaf: **Dave Blane, Louis Lombaard, John Maynier and Andy Overbeek**.

The President then announced following awards and the relevant certificates would be sent to:

- **John Gill** was awarded an Observing Certificate for his observing notes and photographic record of the ASSA Top-100 Objects by Deep-Sky Section Director, Auke Slotegraaf and Astrophotography Section Director, Allen Versfeld;
- **Richard Ford** was awarded an Observing Certificate for the solar and sunspot observations made in 2015 and 2016 by Director of the Shallow-Sky Section , Dave Blane;
- **Greg Roberts** was awarded an Historical Section Certificate for his series of articles published in MNASSA on Amateur satellite tracking in South Africa by the Director of the Historical Section, Chris de Coning;
- **Percy Jacobs** was awarded an Observing Certificate for planning and successfully completing the ASSA Top-100 Marathon on 2016 July 02/03 by Deep-Sky Section Director, Auke Slotegraaf

Awards by ASSA Awards Committee

The ASSA Awards Committee, comprises the ASSA President and two Vice Presidents, decided on the following **Merit Awards**:

- **ASSA Pretoria Centre** promoting the practice of astronomy by arranging the highly successful Karoo Star Party, a very effective means of encouraging observation;
- **ASSA Bloemfontein Centre** for arranging the highly successful Bloemfontein Star Party, a very effective means of encouraging observation;
- **Star People** (http://starpeople.capetown/) for arranging the highly successful Southern Star Parties, a very effective means of encouraging observation.
- **Kos Coronaios** for dedicated, innovative and successful outreach initiatives in the Soutpansberg area which reached at least 5 000 visitors;

• **Star People** (http://starpeople.capetown for dedicated, innovative and successful outreach initiatives in the Cape Town area which reached at least 8 000 visitors.

Finally it was announced that **Dr Ian Glass** would be made an **Honorary Member** for his outstanding contribution to the ASSA over an extended period of time. ASSA now has 12 Honorary Members.

Presidential address by Dr P de Villiers

A Snapshot of ASSA's Health and Focus for the Ensuing Year

At the first Council meeting that I chaired last year I verbalised two intuitive objectives for myself:

- To facilitate the sharing of the expertise and experience at the various Centres and Sections more effectively among the astronomy community, and
- To strengthen ASSA's links to astronomy professionals and organizations.

I never got round to the second objective at all and based on my experience of the past year and my interpretation of the main focus for the second year of the current Council's term, I will leave that to my successor who, as a professional astronomer is better known in that fraternity and would probably serve ASSA's interests better in that regard.

In execution of the first objective of facilitating the effective and timeous sharing of experience and expertise among the various Centres, Council kindly approved a ceiling budget to cover the unavoidable expenses pertaining to such visits by myself. The Association was fortunate in the sense that it was possible to tag visits onto other trips that I undertook as a Director of the Institute of Timber Construction, which resulted in a major cost savings to the Society. Bloemfontein was the most expensive

leg of this journey but even after all those costs are known the total costs of the exercise should end up well below the limit approved by Council.

My visits to all of the ASSA Centres, and discussions with most of the Section Directors, was personally very insightful and hopefully mutually beneficial. A few summarising observations:

There is a truly impressive range of astronomical activity at the various Centres and expertise in the various Sections. The feedstock of "the study and enjoyment of astronomy" (our mission) is therefore broad and secure.
Not surprisingly the prime focus and *modus operandi* of the various Centres is almost unique, obviously driven by local considerations, experience and to a large extent by access to facilities (observatories in particular): Pretoria's prime focus on observing is clear and impressive, Durban's outreach numbers sometimes almost unmanageable, Johannesburg's range of observation + research activities is impressive and Cape Town's range of guest speakers (*twice a month!)* is mouth-watering and their public viewing in (and in collaboration with) Kirstenbosch can only be admired. The Midlands Centre's efforts in re-establishing the Centre is admirable and warrants whatever support ASSA can provide. Garden Route's members are described by Case as "armchair astronomers" but they are very participative and sharp, with a few exceptionally experienced members. Bloemfontein focuses very strongly on irregular but well attended observation sessions utilising the facilities of Boyden Observatory, specifically the 13" and 16" telescopes
Equally unsurprising is that the older Centres have settled into their "proven successful" comfort zones whereas the newer ones are still exploring what works best for them. The Pretoria Centre appears to be the most "set-in-its-ways", whereas the Hermanus Centre is the only one that embodies and successfully practises the concept of Special Interest Groups (beginners, cosmology, astrophotography and a Study Group).
There are a few common denominators:

Centre Chairs are generally the driving force behind their Centres and as such are an extremely precious resource for ASSA - which should therefore *not* be overburdened by ASSA commitments.
Centre Committees are the heartthrob of amateur astronomy activity in the country and should be supported and empowered in whatever ways are possible.
Centres exist to meet the needs of their members and therefore not surprisingly operate as island universes predominantly driven by internal demand. The question therefore needs to be asked (and it was asked twice during my visits): What are the benefits of ASSA membership to organised astronomy clubs or organizations?
Two obvious benefits of ASSA membership are:

- Access to its excellent publications SGAS and MNASSA, although the latter is in the public domain and free of charge;
- Face-to-face interaction with others sharing your interest in astronomy – frequently more knowledgeable or experienced than you – at Centre observation or outreach sessions or Star Parties, which will give access to extra-Centre people and expertise.

The visits to all the Centres strongly re-enforced my intuitive conviction that there is extensive and intensive expertise and experience vested in the Centres which is *not* shared. A proposal to provide a two-monthly finger-on-the-pulse of all astronomy activities, practises, concepts or projects undertaken throughout the country has already been submitted to and approved by Council. The rationale underlying this concept is obvious: If you become aware of cool ideas or concepts or practises in other parts of the country it will probably induce at least consideration of duplicating other Centres' successes in your own.

A key to the success of this proposal is that it must be *comprehensive & concise* and *easy to update & acquire*. An initial Excel reporting format, extensively "professionalised" by Chris Stewart, did not elicit a positive response. It is my conviction that this is the correct route and will

therefore vigorously pursue selling the benefits of participation to all Centres.
The second leg of the proposal was to include every Section Director, whose roles are to *coordinate & lead* the activities in their specialist section country-wide, in all the activities of their specialist sections in all Centres. Obviously the first and simplest step is to include the relevant Section Director(s) in the Centre Specialist Interest Groups' e-mail lists. By way of illustration, the ASSA Cosmology Section Director - Frikkie de Bruin – has already been included in the Hermanus Centre's two Cosmology Interest Groups e-mail lists. Frikkie being Frikkie has already responded to these communications and therefore proved its practical application.
Thank You Frikkie for adding value to both your Specialist Section and the Hermanus Centre's special interest groups activities.
Obviously the third and perhaps most challenging leg of the proposal is to include at least the activity reports of non-ASSA astronomy clubs (Soutpansberg, West Rand, South Peninsula, Senekal, Grahamstown, Windhoek) and other astronomy related groups and activities (the Star Parties, Orion Observation Group, ScopeX, ATM Class, the Star People) as well as educational outreach anywhere in the country. It would be wonderful to have an almost real-time overview of all astronomy activities country-wide.

The Afrikaans saying "Beloftes maak skuld" is very true and I do appreciate the daunting challenges facing one to achieve this worthy objective, but I will be focusing on this ideal for the remaining year of my term.

In order to at least practise my obsessive preaching of sharing expertise and experiences I'll end by sharing with you a recent worthwhile and easily replicated project of the Hermanus Centre: The construction of a True Scale model of the Solar System over 3.9km on the Cliff Path in Hermanus.

The address concluded with PowerPoint overview of the project and thanked those present for their attention.

Solar Eclipse 1 September 2016

Clyde Foster

1 Introduction

An annular eclipse of the Sun occurred on Thursday morning of 1 September, 2016. The narrow path of annularity extended across central Africa and across to northern Madagascar.

From Southern Africa, this was observed as a partial solar eclipse, with decreasing levels of eclipse experienced further south. The eclipse was seen as a potential educational tool and the ASSA council assembled a core team to create an eclipse information “project page” on the website, contributed material for at least three articles in the print media. The Star newspaper produced an article based on the webpage, Case Rijsdijk wrote an article for the George Herald covering the Southern Cape, Kos Coronaios for the Zoutspansberger and the Mirror, covering the bulk of Limpopo. Dr Claire Flanagan also provided three radio interviews before the event.

The Moon took roughly two hours to move across the partially obscured Sun, with maximum coverage experienced at approximately 11.00 SAST.

ASSA Centre activities, individual and independent group report back
The following provides an indication of some of the observing events that took place around the country, without necessarily being comprehensive. The contributions and feedback of all those that submitted their feedback is appreciated and acknowledged, and apologies are extended to those that are not, due to space constraints, included in the report.

2 ASSA Pretoria/Johannesburg

Allen Versveld ran a video feed for Slooh, and he was at least able to provide an uninterrupted feed of the eclipse from the South African point of view. Shortly after final contact, he represented ASSA in a short interview on Slooh's eclipse show

Neville Young captured two images showing solar radiance and a lovely dip around maximum eclipse.

Johan Smit did an “event” at work in Midrand and estimates about 50 of his colleagues came, saw, asked questions and appreciated the time off their desks!

Johan Moolman, Percy Jacobs, Ettiene von Rauenstein, Gerrit Kotze, Martin Heigan, Mark Burkhardt, Jacqueline Boshoff and Claire Flanagan all made contributions which captured their experience of the eclipse.

Fig :. Viewing the Eclipse from Maryvale College (photo: Andy Overbeek)

Andy Overbeek took his 80 mm f/7.5 apochromatic refractor, mounted on a Celestron CG-4 mount, to Maryvale College in Johannesburg. He decided to utilise a solar filter and allow the children to look through the telescope safely rather than using projection. He submitted a nice description of events, emphasising the personal reward when undertaking an event like this: it was the most successful astronomy session he had ever had. Everyone had a lot of fun and it was the best use by far that he ever got out of his telescope.

Grades 1's, 2's and 3's experienced the eclipse through eclipse glasses. Grades 4 to 7, as well as teachers and ground staff, saw the eclipse through eclipse glasses, a telescope and pinhole projectors. Making pinhole projectors out of cardboard is so easy to do, and is so effective, and it wouldn't be difficult for all schools to make them for a solar eclipse.

All in all, about 370 people got to experience the eclipse at Maryvale College. It is such an uncomplicated event to observe because it happens over a long period and it is an ideal event to introduce school children to science and, more specifically, astronomy

3 ASSA Cape Centre

Richard Ford put in a sterling effort from Brakenfell to try and capture the eclipse despite almost overcast conditions. He used his 12" Dobsonian and Canon 750D camera to capture some interesting images. The obscuring cloud, with breaks in between, certainly produced a number of artistic and atmospheric results. Playing hide and seek with the cloud, he managed to capture 11 images of the eclipse.

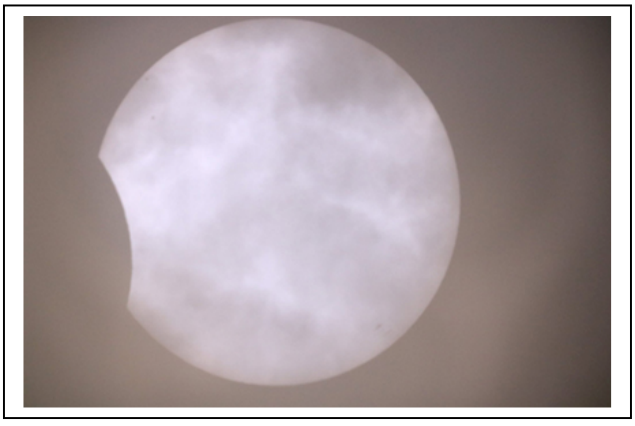

Fig 2: A typical cloudy view from the Cape Centre (photo: R. Ford)

Leslie Wolf used a Nikon P600 compact, with a solar filter over the lens to capture a nice widefield view from Constantia. Edward Foster also managed to take a few images despite the far from ideal conditions.

4 ASSA Durban Centre

In Durban, the weather played ball and the eclipse was observed through two solar telescopes and also projected through a finder scope by John Visser, before the South-Wester came through and it clouded over.

In order of 200 members of the public were present for the viewing of the eclipse through the scopes and viewing glasses that were sold to members of the public. Exceptional organisation by Logan Govender resulted in significant publicity for the event including a mention and interviews on SABC 3 TV and eTV news that evening, an interview on a local radio station and print media.
The URL to the video clip on SABC TV news :
https://www.youtube.com/watch?v=fw3JnlOcKZQ&feature=player_embedded&noredirect=1

Fig 3: Group viewing from Durban.

5 ASSA Bloemfontein/UFS

A public viewing session, arranged by Matie Hoffman and Dawid van Jaarseveld, was held at the UFS where numerous students were given the opportunity to view the eclipse either by telescopic projection or visually using eclipse glasses

6 ASSA/Soutpansberg Astronomy Club

A successful outreach event during the Annular Solar Eclipse, on behalf of the Astronomical Society of Southern Africa (ASSA) was held by the Soutpansberg Astronomy Club at Ridgeway College on the morning of the 1st September. Kos Coronaios ASSA Observing and Outreach Director as well as Chairman of the SAC was on hand to explain some of the solar system dynamics as well as answer questions . Three telescopes, one projecting the solar image, one supplying a live YouTube live stream for Slooh and ASSA and one for viewing were used. Pinhole projection using the gazebo was also utilised. Thank you to Ridgeway College for providing the venue and to Sarah and James Coronaios who helped setup and operate the telescopes.

Figs 4 & 5: Viewing by Soutspansberg group.

7 GRASSA – Garden Route Centre

Lucas Ferreira set up a 200 mm Celestron with solar filter and Case Rijsdijk used a 150 mm Dobsonian for image projection in the George Botanical Gardens. It clouded over, but a few members of the public did get an occasional, watery glimpse, of the eclipse when there was a break in the cloud cover, similar to Richard Ford's image, Fig. 2 above.

8 Conclusion

Despite poor weather conditions in certain sections of the country, the partial solar eclipse of 1 September 2016 was well observed from South Africa. Many images were obtained, but more importantly a number of outreach events were held where large numbers of the public, and in some cases children in particular, were exposed to the wonders of seeing the eclipse first hand and being given the scientific background to what was seen. Thanks is expressed to all those that took part.

Editor's Note. One of the positive spin-offs from the event is the success of the pin-hole project – this can still be a useful educational tool, even when there is no eclipse! A fact the ASSA outreach should exploit.

ASSA News: SABC Interview on "The race to Mars"

With heightened public interest in the arrival of the latest ExoMars mission to Mars, including the Trace Gas Orbiter (TGO) and the Schiaparelli Entry, Descent and Landing Demonstration module (which unfortunately appears to have crash landed), Clyde Foster Shallow Sky director, and Mars specialist, was invited to Auckland Park, Studio 9 on 24 October to take part in a live televised interview on SABC 3 news Channel 440 at 21h10 with Rene Vest. The interview was titled "The Race to Mars" but actually consisted of two segments.

The first was entitled “About the planet Mars” and profiled the planet, why it is of interest, its atmosphere and weather conditions. A number of Clyde’s images of Mars were used in the interview.

The second segment discussed the suitability of Mars for human habitation and was entitled “The possibility of humans surviving on Mars”.

The two links for the segments are:

https://www.youtube.com/watch?v=_vHgzbDfVos

https://www.youtube.com/watch?v=Xl1ko-GmSHU

Colloquia and Seminars

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

Also included in this section are the colloquia/seminars at the SAAO, UWC and the Astrophysics, Cosmology and Gravity Centre at UCT, ACGC. Also included are the SAAO Astro-coffees which are 15-20min informal discussions on just about any topic including but not limited to: recent astro-ph papers, seminal/classic publications, education/outreach ideas and initiatives, preliminary results, student progress reports, conference/workshop feedback and skills-transfer.

SAAO

Title: Developments at IDIA – Preparation for MeerKAT
Speaker: Brad Frank
Date: 8 September
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: The MeerKAT Large Survey Projects (MLSPs) will use thousands of hours of MeerKAT's operational lifetime to address a variety of important questions related to galaxy formation, extreme physics and the evolution of our universe. The imaging MLSPs are largely commensal and share lots of overlap – both scientifically and technically. At IDIA, we plan to exploit the scientific overlap between the imaging MLSPs to develop a calibration and imaging pipeline framework – which we are currently developing and testing on the African Research Cloud Proof of Concept ARCADE.
In my talk I will provide an overview of the imaging MLSPs and I will talk about the pipeline design and progress that we have made with ARCADE thus far.

Title: Frontier Development Lab
Speaker: Nicolas Erasmus
Date: 29 September
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: In my talk, I will give a brief overview of the Frontier Development Lab programme and it's objectives, giving some detail of the three challenges we undertook. I will then go into more detail about the specific problem my team tried to answer, namely which asteroid deflection technique we as mankind should focus our efforts on in preparation of one day facing the inevitable discovery a Potentially

Hazardous Asteroid (PHA). These are asteroids that are large enough that they could cause significant damage when impacting Earth.

Title: The landscape of astronomy outreach in India: a tale of scale, scope and consolidation
Speaker: Niruj Ramanujam (NCRA-TIFR and the POEC of the ASI)
Date: 13 October
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: Astronomy outreach in India has a long and colourful history, involving a large diversity of stakeholders. This incredible diversity has been prompted by issues that are fairly unique to India. I will describe a few of these issues and talk about the various stakeholder communities and the work that they have been doing over the last few decades.

Indian astronomy is now entering an exciting phase, with five funded megaprojects and a number of upcoming centres of astronomy research. This provides opportunities as well as poses problems for astronomy outreach to address. I will describe these projects and their associated outreach activities.

The Astronomical Society of India set up a Public Outreach and Education Committee two years ago. This has a national scope and has been initiating many different campaigns across the country. I will talk about some of the activities of this committee and describe our future plans and some of the challenges ahead.

NASSP

Title: Explaining dark energy and dark matter. The Cosmology at the beginning of 21st century.
Speaker: Dr. Alvaro de la Cruz Dombriz, ACGC UCT Cosmology group
Date: 23 August
Time: 16h15 – 17h00
Venue: Maths Building, MAM111

Abstract: Some of the most important open questions in both Cosmology, Gravitation and Astrophysics, concern the lack of explanations for the presence, nature and key features of the Dark Energy and the Dark Matter components. In order to do so, my research at the UCT Cosmology group aims to explore viable extended theories of gravity able to pass astrophysical and theoretical tests, fit the latest data from satellites, telescopes and particle accelerators. Eventually, constraints for the parameters of the suggested theories and models might be found, leading to unveil the underlying gravitational theory, the dimensionality of the space-time and the origin and late fate of the Universe. I will provide an overview of the state of the art different techniques under study at the UCT Cosmology group and explain several possibilities of pursuing a career in Cosmology.

Title: Nonlinear potential structures in two-dust (or ion) plasmas
Speaker: Dr Shimul Maharaj from SANSA
Date: 6 September
Time: 16h15 – 17h00
Venue: Maths Building, MAM304

Abstract: I will present theoretical results for plasma models with two heavy dust (or ion) constituents and electrons (and ions for plasmas with dust). The results will demonstrate how the sign of the charge on the dust grains affects the polarity of the supported nonlinear potential structures such as solitons and double layers. Solitons are symmetric (bell-shaped)

structures in potential. Double layers, on the other hand, are asymmetric (ramp-like) potential structures. Additionally, I will discuss how stopbands can arise for fast mode solitons in certain restricted regions in parameter space. The stopband is an intermediate range of speeds for which fast mode solitons cannot propagate. On either side of the stopband are two passband regions where fast mode solitons can propagate.

Title: Straight outta NASSP
Speaker: Thuso Simon
Date: 13 September
Time: 16h15 – 17h00
Venue: Maths Building, MAM304

Abstract: I will give some tips on how to become a data scientist analysist from studying in NASSP.

Title: Thermal and Kinetic Sunyaev-Zeldovich effect: detecting the missing baryons
Speaker: Dr Yin-zhe Ma (UKZN)
Date**:** 20 September
Time**:** 116h15 – 17h00
Venue**:** Maths Building, MAM304

See UWC Seminar of the same title.

Title: Solar variability detected by spectral analysis of Earth and satellite observations during various solar cycles
Speaker: Dr Pieter Kotze, SANSA
Date: 4 October
Time: 16h15 – 17h00
Venue: SAAO Auditorium

Abstract: In this presentation it will be shown how the Sun's magnetic field varies during a solar cycle and the influence this variability has on the

heliosphere. Various spectral analysis techniques will be used to reveal the changing pattern of certain periodicities in particle and geomagnetic activities as observed by both satellite and ground observations, e.g. the 27–day rotation period. This information can be used to detect the axisymmetric solar magnetic field during the prolonged and unusual minimum of solar cycle 23-24.

ACGC

Title: How much cosmological information can be measured?
Speaker: Dr. Yin-Zhe Ma (University of KwaZulu-Natal)
Date**:** 20 September
Time**:** 12h00
Venue**:** MAM1.10

Abstract: Cosmologists' work is to measure the modes of fluctuations in the Universe. The total number of modes one can measure depend on the maximum space that one can observe, and the highest value of perturbation modes one can measure. In this talk, I will give a physical picture of how this “total information” changes in the past and future time, and discuss how many number of modes cosmologists can be measured now, and in the future. In addition, I will discuss how can use the 21-cm intensity mapping technique to map out more structures of the Universe and therefore acquire more information from it, and how the future radio astronomy surveys (FAST, BINGO, CHIME, SKA) can help to pin down the physics of early Universe**.**

Title: A different look at black holes in quantum gravity
Speaker: Dr. Raúl Carballo-Rubio (UCT and IAA Granada, Spain)
Date**:** 18 October
Time**:** 12h00
Venue**:** MAM1.11

Abstract: Semiclassical effects on black hole spacetimes unveil intriguing thermodynamic relations. It is however unknown how to embed this semiclassical picture in quantum gravity in a self-consistent way. Most importantly, observational features associated with this theoretical enterprise are far from encouraging. In this talk I review the wiggle room that our current theoretical and experimental knowledge leaves for alternatives to this picture to breathe. One particular alternative will be illustrated, making emphasis on the implications that would follow for astrophysical black holes and the associated observational opportunities.

UWC

Title: IDIA and you: An update on IDIA developments and plans
Speaker: Prof. Russ Taylor (UCT, UWC, IDIA)
Date**:** 9 September
Time**:** 14h00
Venue**:** Room 1.35 of the New Physics Building, UWC

Abstract: UWC is a partner in the Inter-University Institute for Data Intensive Astronomy (IDIA) which was established one year ago this month. The mandate of IDIA is to undertake and build capacity for data intensive research in astronomy in South African universities. After a year of organization and partnership building we are gearing up to launch IDIA programs and projects. I will present on the IDIA strategy and vision, what has been happening in IDIA, future developments, and how you can become involved.

Title: Relativistic effects in the cosmic magnification
Speaker: Adams Duniya
Date**:** 18 September
Time**:** 14h00
Venue**:** Room 1.35 of the New Physics Building, UWC

Abstract: Weak (gravitational) lensing is known as the standard source of cosmic magnification in an inhomogeneous universe. However, apart from the weak lensing effect, the cosmic magnification acquires relativistic corrections owing to: Doppler, integrated Sachs-Wolfe, time-delay and other (local) gravitational potential effects, respectively. These corrections grow on very large scales and high redshifts, which will be the reach of forthcoming surveys, like the SKA and BOSS. In this talk, I will discuss these relativistic corrections in the magnification angular power spectrum, on very large scales; their imprint on dark energy (DE), and whether these corrections may be important in discriminating and/or putting constraints on DE models.

Title: Thermal and Kinetic Sunyaev-Zeldovich effect: detecting the missing baryons
Speaker: Dr Yin-zhe Ma (UKZN)
Date**:** 21 September
Time**:** 11h00
Venue**:** Room 1.31b of the New Physics Building, UWC

Abstract: Previous studies of galaxy formation have shown that only 10 per cent of the baryons are in compact objects, while 90 per cent of them are missing. Numerical simulation shows that the missing baryons are in a state of diffuse plasma with temperature 10^5 to 10^7 Kelvin, which is hard to be detected by X-ray observations. We will present two studies that coherently detect the missing baryons. The first is the cross-correlation between the kinetic Sunyaev-Zeldovich maps from Planck with the linear reconstructed velocity field. We find significance (4.6 sigma) detection of the peculiar motion of gas on Mpc scales. Further studies show that this bulk motion indicates that the concentration of gas constitutes a fraction of f_b=0.8, which indicates that all baryons are detected with the Planck kSZ maps. Second, we cross-correlate the thermal Sunyaev- Zeldovich from Planck maps with gravitational lensing from the Canada France Hawaii Lensing Survey (CFHTLenS) and constrain the diffuse baryon component with the various pressure profile. We find

that the 1 and 2 halo terms detected at 3.96σ and 3.67σ confidence level (CL) respectively. The effective virial temperature of the isothermal gas is found to be in the range 7 *10^{5}--3*10^{8} K. In addition, by stacking the pairs of luminous red galaxies, we can place a constraint on the temperature of the filament in between the dark matter halos. This gives the first detection of the "missing baryons" outside galactic halos.

Title: Point source detection on the sphere: controlling the false discovery rate
Speaker: Dr. Yabebal Fantaye (Arete Research Chair, AIMS)
Date: 7 October
Time: 14h00
Venue: Room 1.35 of the New Physics Building, UWC

Abstract: I will present a topological multiple testing scheme for detecting peaks on the sphere under isotropic Gaussian noise, where tests are performed at local maxima of the observed field filtered by the spherical needlet transform. The proposed algorithm, combined with the Benjamini-Hochberg procedure for thresholding p-values, provide asymptotic strong control of the False Discovery Rate (FDR) and power consistency as the signal strength and the frequency of the needlet transform gets large. This setting is relevant to realistic experimental circumstances, in particular for detecting point sources in the cosmic microwave background maps. I will present some preliminary results from applying this novel multiple testing method to the recent Planck cosmic microwave background radiation data.

Title: Cosmic backreaction and Gauss's law
Speaker: Pierre Fleury (UCT/UWC)
Date: 14 October
Time: 14h00
Venue: Room 1.35 of the New Physics Building, UWC

Abstract: Cosmic backreaction refers to the general question of whether a homogeneous and isotropic cosmological model is able to predict the correct expansion dynamics of our Universe. In this talk I'll introduce the backreaction issue in general, and then focus on a particular aspect of it, namely the validity of the continuous approximation: does a system of point masses expand the same way as a fluid does? I'll show that it essentially does in Newtonian cosmology, and that Gauss's law is a key ingredient for this result. However, things are expected to be much different for modified theories of gravitation…

Book Reviews

An Astronomer's Tale – A Life Under the Stars. Fildes, Gary : Cornerstone Random House 2016. ISBN 978 178 089 5550.

Gary Fildes grew up in a blue collar neighbourhood in the North East of England. After leaving school he worked as a bricklayer for 25 years. From an early age he had a great interest in astronomy, and taught himself to observe the heavens, using a series of amateur telescopes. He also was active in astronomy clubs and their outreach activities. At first these took place in a dark site not far from his home town of Sunderland. Eventually an excellent dark site was located in the Kielder Forest, part of the Kielder Water & Forest Park in the county of Northumberland. Fildes was the driving force behind the erection of an observatory in the park, where the public could be shown what the skies look like at night, unhampered by light pollution. Today this observatory is visited by thousands of interested people every year, where they are entertained by lead astronomer Gary Fildes and his team.

The book consists of Gary's biography, which is interspersed with chapters discussing a representative collection of constellations and noteworthy objects in them, arranged by season. Although aimed at people fascinated by the heavens and living in the northern hemisphere, there is sufficient

material of interest to a person south of the equator. In addition, the book is an inspiring tale of what could be achieved by a man who has a passion for his hobby.
Etienne Gouws

Now – the Physics of Time. Richard Muller. Norton. ISBN 978-0-393-28523-9

Muller is Prof of Physics at the University of California, Berkeley. He takes a fresh look at the enigmatic question of the Arrow of Time. A well argued look at the fundamental nature of Time, something that has troubled theologists, philosophers, physicists and you and me, from the earliest of times. He explores the real question of what is Now! And also what is "the flow" of Time?
Muller's monumental work will spark major debate about the most fundamental assumptions of our Universe, and may crack one of the longest standing enigmas of Physics.

The book has received positive reviews from Lee Smolin, Neil deGrasse Tyson and Saul Perlmutter, Nobel Laureate and student of Muller. A must read for anyone wanting to know a little more about Time.

Case Rijsdijk

Sky Delights: Equuleus the Pony

Magda Streicher

In antiquity Equuleus represented the front leg of the larger constellation Pegasus the Winged Horse, or even that of a second, smaller horse.

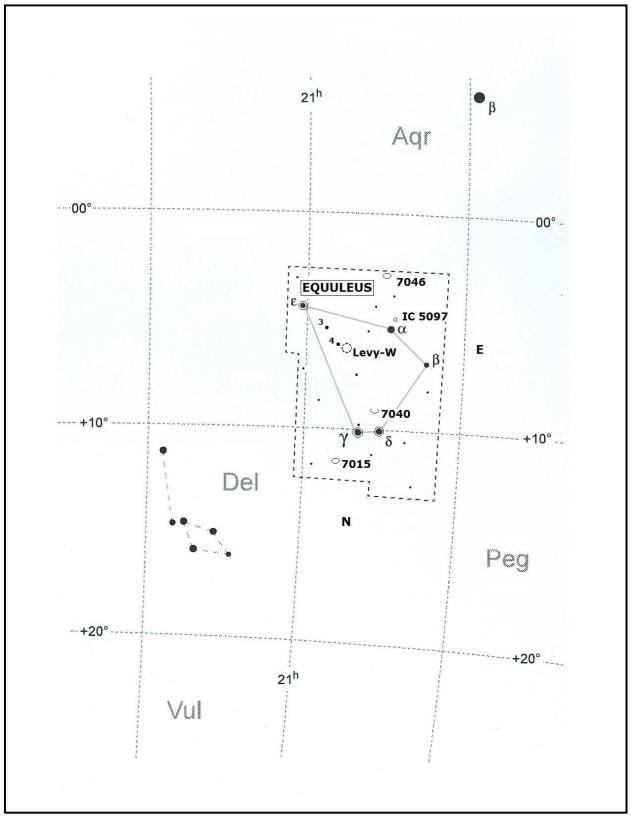

Fig :: Equuleus Sky Chart

Equuleus is the second smallest constellation, at 72 square degrees just smaller than the constellation Crux.

The constellation forms a kind of square between the stars Pegasus and Delphinus, and one of the last constellations to be named. The Greek astronomers saw these stars up against the side of Pegasus as the front part of Pegasus. The Germans called it Kleine Pferd; the French named it Petit Cheval – both so descriptive.

Equuleus is not exactly a constellation one would get very excited about, but recognition should nevertheless still be given to it. It is home to a few interesting double stars and a few galaxies and star groupings. Its corners are marked by magnitudes alpha 3.9, beta 5.1, delta 4.4, gamma 4.6 and epsilon 5.9.

The southernmost corner star, epsilon Equulei is a triple star, the two main component stars, type F5, being magnitude 6 and 6.3, and both displaying

a pale yellow colour. The separation is only 0.8", which is very difficult to split. The C companion shines in a pale blue with a magnitude of 7.1 in a position angle of 70 and separation of 10.7". The stars in combination create a rare colour contrast, which makes it a triple treat to admire to love and observe. The beauty of this double star is that you can even split the C companion from AB with only 30x magnification in any telescope. It was discovered by FGW Struve in 1835 and is about 200 light years distant.

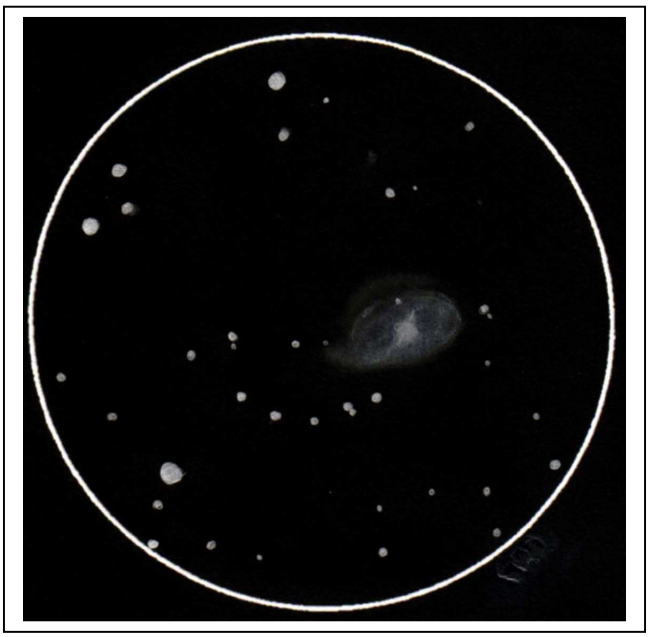

Fig 2: NGC7046 (courtesy Chipendale Observatory)

On the southern border with Aquarius a group of galaxies cuts the constellations in half. The brightest galaxy in this close group is **NGC 7046**, although at magnitude 13 it is difficult to observe. It is a spiral galaxy with a nice string of stars on its south-eastern edge. The galaxies in this group are IC 1362, 1364, 165, 1366, 1367, 1368 and 1370. However, one degree east of this group of galaxies is a faint close grouping of a dozen magnitude 11 stars which truly give the impression of an open cluster.

Mystery surrounds **IC 5097** barely 40' south of alpha Equulei. It might be only a quadruple star; in the field of view only a close, very faint double star can be spotted situated in a busy star field. It is not listed as a galaxy.

Towards the middle area of the constellation the asterism **Levy-W** can be found. Wendy Levy, who discovered this asterism, is the wife of the well-known David Levy, famous for searching comets. David Levy co-discovered the comet Shoemaker-Levy 9 which collided with Jupiter in July 1994. Asteroid 3673 Levy was named in his honour. However, the

asterism is nicknamed Wendy's Ring, which indeed it appears to be, although the stars are positioned in only half a ring, but the "Ring" is indeed special to observe. The northern and southern magnitude 9 stars proudly show of their yellow to orange colour. The half ring is completed with three faint stars bulging out towards the north-east. The asterism can be found a degree north-east of the star 4 Equulei.

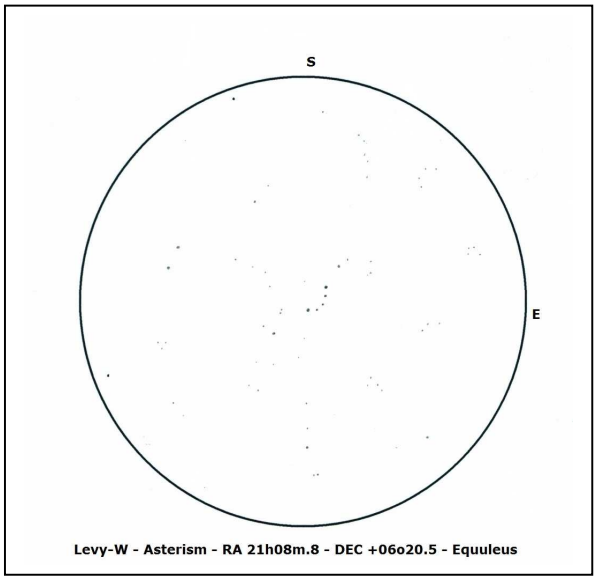

Fig 3:The asterism Levy-W

Barely a handful of galaxies are scattered in this constellation. They are all very faint, but with a large telescope and dark skies some of them can be glimpsed if some care is taken. **NGC 7040**, situated in the northern part of Equuleus, displays a smooth surface brightness with a glimpse of a hazy halo. In the south-eastern star field a few colourful yellow stars group together.

Forming the northern corner is the star Delta Equulei, a binary with the AB magnitude 5.2 and 5.3, but too close to split, with a revolution of only 12 years. The stars are about eight times the luminosity of our sun. The third C companion (discovered in 1833) is a magnitude 9.4 star with a separation of 47.7" in a position angle of 14. Some observers see the stars in the colour of sapphire and topaz yellow. A string of three field stars towards the east completes this pretty picture. It was discovered by Otto Struve in 1852.

A degree west is gamma Equulei, a very tight, whitish double star of magnitude 4.7 and 11.5 with a separation of only 1.9". There could be a C companion with a 12.5 magnitude and D with a 5.9 magnitude, also catalogued as star 6 Equulei – perhaps debatable.

NGC 7015, situated close to the border with Delphinus, is a faint oval east-west galaxy, slightly brightening up towards the middle. Hubble pictures show an open spiral with a very dense nucleus. The galaxy pair with another fainter galaxy IC 5083, situated barely half a degree north. Again a nice asterism can be found 40' west, forming a triangle with the two galaxies. The string of magnitude 11 stars contains a magnitude 8 yellow star on the southern tip with fainter stars stringing along north-east.
The 88 constellations made the cut in 1930 when they were listed by the International Astronomical Union and their boundaries were officially laid out by Belgian astronomer Eugene Delporte.

Even though Equuleus is known only as a small pony against the starry night sky you can still ride it to distant worlds.

OBJECT	TYPE	RA	DEC	MAG	SIZE
epsilon Equulei	Triple Star	20h59m.1	+0418'	6, 6.3 – 0.8" sep 7.1 -	10.7" PA 70
NGC 7015	Galaxy	21h05m.6	+11o24'.8	11.5	1.8'x1.6'
Levy-W	Asterism	21h08m.8	+06o20'.5	8.5	5'
gamma Equulei		21h10m.3	+10o08	4.7, 11.5 – 1.9" 12.5	47.7" PA 5
NGC 7040	Galaxy	21h13m.2	+08o50'.3	13.5	1.0'x0.7'
delta Equulei		21h14m.5	+10o00'	5.2, 5.3 9.4	47.7" PA 14
NGC 7046	Galaxy	21h14m.9	+02o50'.3	13	1.6'x1.4'
IC 5097	Quadruple Star	21h14m.9	+04o27'.9	14?	-?

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 electronic journal, the *Monthly Notes of the Astronomical Society of Southern Africa (MNASSA)* bi-monthly as well as the annual *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, Pretoria and Sedgefield district (Garden Route Centre). Membership of any of these Centres automatically confers membership of the Society.

Sky & Telescope: Members may subscribe to *Sky & Telescope* at a significant discount (proof of membership is required). Please contact the Membership Secretary for details.

Internet contact details: email: assa@saao.ac.za Home Page: http://assa.saao.ac.za

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