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mnassa

monthly notes of the astronomical society of southern africa

Contents: Volume 73 Nos 9 & 10

October 2014

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In this issue:

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 OBITUARY DR JANNIE SMIT – IRREGULAR LIGHT CURVE OF PSR  
 J1723-2837 – COLLOQUIA AND SEMINARS – SKY DELIGHTS:  
 PEGASUS – CULTURAL ASTRONOMY IN SOUTHERN AFRICA

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**Cover: Telescopes at Scopex 2014**

## ASTRONOMICAL SOCIETY OF SOUTHERN AFRICA

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

**Publications:** The Society publishes its 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.saa.ac.za](http://assa.saa.ac.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 Sedgfield 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@saa.ac.za](mailto:assa@saa.ac.za) Home Page: <http://assa.saa.ac.za>

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*Rising* does not accomplish that end as fully as it could. Further, Alcock could have commented at greater length on the heterogeneous quality of the available sources – from early missionaries and explorers to anthropologists and linguists. Very few of these people had interest in or knowledge of astronomy. Thus the “scholarly” record is incomplete and often misconstrued. This online book is thick with citations to pertinent literature, but Alcock gives little insight into the relative quality of, say, Hahn (1881), or Schapera (1932-1979), or Skotnes (2010). Some sources including Ritter (1972), Hromnik (1981-1999), and Wade (2009) have been discredited or are highly contested. It may not be the author’s task to judge who is worthy and who is not, but some acknowledgement of Schapera as a “pioneering ethnographer” or Hromnik’s speculations as “controversial”, and the like, would assist readers in recognizing that not all sources have equal standing.

Having said that, I am truly impressed by the amount of raw data in the 398 pages of *Venus Rising*. There is doubtless plenty to make sense of and to utilize. One potentially significant contribution to South African society is the application of cultural astronomy to basic science education. Much to his credit, Alcock gives some ideas for school lessons in Appendix B. While organising the Oxford Conference Jarita Holbrook also made sure to convene workshops for educators in order to spread awareness of what might be done. In the country of SALT and SKA it is still all too easy for most people to feel entirely divorced from scientific endeavor, but the Oxford Conference and *Venus Rising* make me more optimistic than ever that South Africans will take up the challenge of reclaiming the sky as part of their rightful heritage.



# **mnassa**

**Vol 73 Nos 9 & 10 October 2014**

## **Report from the ASSA Council 2013-2014**

*Prof. Matie Hoffman, President ASSA*

### **1 Introduction**

After having served for one year as president of the Astronomical Society of Southern Africa (ASSA), it is my privilege to present this report from the ASSA Council. It includes a brief overview of ASSA as an organization, followed by a brief summary of the activities of the Council during the year 2013 to 2014. Lastly, with the aim of providing some guidelines for the immediate future, I take a somewhat personal look back to my own interactions and involvement with ASSA over the years.

### **2 The Society**

Astronomy plays a significant role within the scientific community in South Africa and I think we can claim that within the astronomical community of South Africa, SSA has a strong presence. It provides a home for both professional and amateur astronomers, though the majority of members are amateur astronomers. ASSA’s publications include the *MNASSA*, *The Sky Guide Africa South* and the content of the society’s official website. Members who have not done so recently would be well advised to visit and explore our webpage at <http://assa.saao.ac.za>. ASSA is governed by a constitution that is revised from time to time (e.g. in 1979 and 2011) but there have been more frequent amendments, most recently in November 2013. Members can find the updated constitution on the web page. The



ASSA web page is also useful to non-ASSA members since it contains information on astronomy in South Africa in general: for example on non-ASSA astronomy clubs, outreach events, etc.

The objectives of the Society (as indicated in the constitution) are:

- To encourage and stimulate the study and practice of astronomy, *inter alia* by awarding scholarships to deserving candidates at tertiary institutions.
- To establish and maintain various *sections* in order to: -  
- facilitate astronomical observing by *members* and to receive and report astronomical observations made - facilitate astronomical outreach by *the society*.
- To disseminate information about astronomy that may be of use to observers, and to others interested in astronomy, by means of *publications*.
- To do all such lawful things conducive to the attainment of these objectives.

The Council has the responsibility to provide leadership and support so that the society and all its members can work towards these objectives. There are seven ASSA Centres, four along the coast – Cape, Hermanus, Garden Route and Durban Centres, and three in the interior of South Africa – Pretoria, Johannesburg and Bloemfontein. Members of the Centres are automatically members of ASSA.

Membership of the Centres varies between 20 and 100 giving a total of approximately 400 members. Because of geographic and other considerations, there are also Country Members for whom it is not possible to participate in the activities of a Centre. Adding the Country Members the total membership of ASSA at present is approximately 800. ASSA provides a home for a range of people, from the professional astronomer, the serious amateur and the enthusiastic members of the public. I am convinced that we can safely claim that the impact of ASSA exceeds the number of its members by far. This is thanks to the use of the

it as a cultural resource. Like the rivers and mountains, the plants and animals, the sky was something to learn from and to live by.

A major step toward that synthetic vision came not at the Oxford conference but in the form of an announcement on the ASSA website in September: Dr Peter G. Alcock's important new publication, *Venus Rising: South African Astronomical Beliefs, Customs and Observations*, was now accessible online. Dr Alcock, an authority on crop science and the water supply in KwaZulu-Natal, is perhaps best known for his 2010 book *Rainbows in the Mist*, which dealt with South African folklore and indigenous knowledge of weather phenomena.

*Venus Rising* represents a thorough compilation of what has been, to present, a fragmented and incoherent body of material. This online text might well be the key reference work in Southern African cultural astronomy for years to come. It surveys African interpretations of the Sun and Moon, eclipses, the fixed stars, planets, comets, and meteors, as based on praise poetry, riddles, and songs, as well as place names and material culture. Alcock admits in the introduction that *Venus Rising* signifies a beginning rather than the end of the study of indigenous astronomy. His work is predominantly descriptive – comprising numerous, sometimes tedious, lists of terms – rather than analytical. Its strength is as a storehouse of references buried in scholarly and other literature. Presenting a broad spectrum of indigenous knowledge as an intelligible category for further study is Alcock's signal achievement.

Nonetheless, some who delve into *Venus Rising* may be disappointed that it provides little guidance as to the value or meaning of indigenous astronomy. What was (and for some, still is) Southern African skywatching like? Who was (and is) doing it? How and why? And why should "we" with our atomic clocks and space telescopes care about these "obsolete" practices? Someone has yet to point the way clearly for future researchers as well as for those wishing to utilize indigenous knowledge for educational or heritage tourism purposes. In its current form *Venus*

Comment and Review:

## Venus Rising: Cultural Astronomy in Southern Africa

Keith Snedegar  
Utah Valley University  
Orem, Utah, USA

As someone who has long held an academic interest in the astronomical traditions of Southern African peoples, I have only begun to feel in the last few months that the topic was receiving the attention it deserves. In July the Tenth Oxford Conference on Archaeoastronomy brought to Cape Town international scholars of the relationship between astronomy and culture. Several conference sessions were dedicated to indigenous African knowledge of the sky. Dr Jarita Holbrook of the University of the Western Cape merits special praise for organising the fruitful scientific gathering. Her concerted efforts have done much to open new vistas in what is still an emerging field. For further particulars, see the conference website <culturalastronomy.sao.ac.za> and YouTube channel <https://www.youtube.com/user/astroholbrook>.

The truth be told, I was unable to attend the conference. But even at a distance one could observe the unfurling of primary scholarship in satisfying forms. Thebe Medupe (North West University) gave an update on his ongoing Timbuktu Science Project. Sven Ouzman (University of Western Australia) warned of the influence of popular pseudoscience in the interpretation of Southern African astronomical traditions. Maogomme Masoga (UNISA) discussed points of contact between indigenous knowledge systems and modern science. And Motheo Koitsiwe (NWU) presented results of his fieldwork collecting star lore among the Batlhako of Mabeskraal. Altogether the Oxford X participants offered up a good deal of substance, but this far-flung observer couldn't help but yearn for a synthetic vision of what precolonial Africans might have thought when they looked up at the night sky. I would like to believe that they saw

electronic communication media, events like star parties and ScopeX as well as the involvement of ASSA's members in various astronomy outreach projects not necessarily organized by ASSA itself.

To further its objective to *"facilitate astronomical observing by members and to receive and report astronomical observation"* and also to *"facilitate astronomical outreach"* the society relies on its specialized Sections. According to the constitution, *"The council will form sections of the society to co-ordinate and monitor specific areas of activity within the society so as to ensure that the society meets its objectives."* There are eight Sections – Deep Sky, Shallow Sky, Dark Sky (emphasizing the sky and what is out there to be observed) and five additional sections which emphasize the human endeavours and techniques in studying the astronomical universe. The reports from the Sections appeared in the previous edition of *MNASSA*.

### 3 The Council

There are 14 Council members which include the chairs of the seven Centres. The Council met approximately every second month via Skype during this period. The use of Skype for Council meetings was initiated by Council Member Chris Stewart a few years ago. As a result, Council meetings are well attended with typically only two or three apologies.

The secretary, Lerika Cross, plays an active and very important role in the activities of the ASSA Council, including preparing agendas and minutes for each meeting. She also takes care of a lot of follow-up work to provide momentum to decisions of the Council. The Section chairs frequently update the Council on the activities of the Sections. Council is also kept up to date by the various Council Appointees such as the editors of *MNASSA* and the *Sky Guide*.

Highlights of activities during this period include:

- important amendments to the constitution;

- improving communication channels - Auke Slotegraaf, assisted by the ASSA webmaster Christian Hettlage, undertook a revision of the existing ASSA website. A major novelty is the new discussion forum
- Improved communication between ASSA and ASSET (Astronomical Society of Southern Africa Endowment Trust) with an ASSET Trustee, Tim Copper, now participating in Council meetings and a Council member, Ian Glass, appointed as an ASSET Trustee after the retirement of Mr Andrew Gray, who is thanked for his many years of service.
- Auke Slotegraaf continued as Editor of the *Sky Guide* and was given a contract for the 2015 edition;
- *MNASSA* has been published 6 times during the year electronically. Case Rijdsdijk has continued as Editor, Ian Glass has taken over the typesetting and layout and Lia Labuschagne has taken over as Book Editor. Both Willie Koorts and Maciej Soltynski are thanked for their years of service. The website is [www.mnassa.org.za](http://www.mnassa.org.za).
- The treasurer, Adv. A J Nel, has been corresponding with the Department of Social Development on getting the ASSA registered as non-profit organization, NPO.

#### 4 Reaching ASSA’s Objectives

##### 4.1 Looking back

Rather than setting out theoretical models for how ASSA should further its objectives, I will discuss the issue as viewed from the context of my personal experience to illustrate how ASSA (and other institutions) was there when it mattered.

My involvement with astronomy and the ASSA originated in an interesting way. The seed of my interest in astronomy was planted when I attended the Wits Planetarium as a young boy from the Free State. Later, in 1985, as just another member of the general public I heard about the approach of Halley’s Comet. Another visit to the Wits Planetarium provided powerful additional momentum and it was during that time that I moved to the

OBJECT	TYPE	RA	DEC	MAG	SIZE
NGC 7094	Planetary Nebula	21h36m.8	+12°47′.2″		158″
NGC 7078 Messier 15	Globular Cluster	21h29m.8	+12°10′.2″	6.2	12.3′
NGC 7193	Open Cluster	22h02m.9	+10°48′.3″	10.2	12′
HD 209458 Group	Open Cluster	22h03m.2	+18°53′.5″	7.6	*
28 Pegasi Group	Open Cluster	22h10m.5	+21°03′.0″	9	14′
GSO2237+0305 Einstein’s Cross	Galaxy	22h40m.5	+03°21′.5″	16.5	2′
NGC 7317	Galaxy	22h35m.9	+33°56′.8″	13.6	0.5′x0.5′
NGC 7318	Galaxy	22h35m.9	+33°57′.8″	13.4	0.9′x0.9′
NGC 7318A	Galaxy	22h36m.0	+33°57′.5″	13.3	1.7′x1.2′
NGC 7319	Galaxy	22h36m.1	+33°58′.7″	13	1.5′x1.1′
NGC 7320	Galaxy	22h36m.1	+33°57′.1″	12.6	1.7′x0.9′
NGC 7331	Galaxies	22h37m.1	+34°25′.3″	9.5	10.5′x3.7′
NGC 7335		22h37m.3	+34°27′.3″	13.3	1.3′x0.6′
NGC 7336,		22h37m.2	+34°29′.0″	14.7	0.5′x0.4′
NGC 7337		22h37m.4	+34°22′.0″	14.4	1.1′x0.9′
NGC 7340		22h37m.6	+34°25′.8″	13.7	0.9′x0.6′
Stephan’s Group	Asterism	23h37m.4	+34°08′.6″	13	1.5′
HD 222454 Group	Open Cluster	23h40m.7	-07°57′.4″	6.8	14′x4′

angled spiral, elongation approximately north-south and relatively easy to glimpse through an ordinary amateur telescope. Closer investigation reveals faint knotted areas on the surface with a much brighter oval-shaped nucleus. On the hazy north-western tip of the galaxy two faint stars can be glimpsed with careful observation and can easily be mistaken for possible supernova explosions. NGC 7335 is situated close on the eastern rim of NGC 7331. Only 2 arc minutes further north the galaxy NGC 7336 could at best be only another fleck of light. Two more galaxies, NGC 7337 and NGC 7340, situated slightly further east, complete this group of five galaxies.

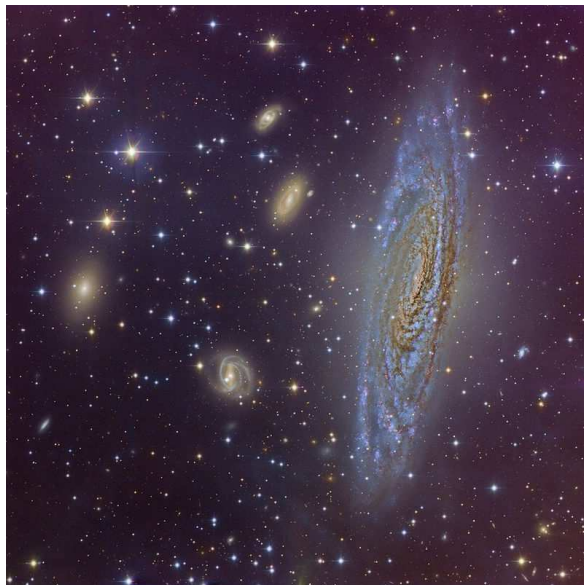
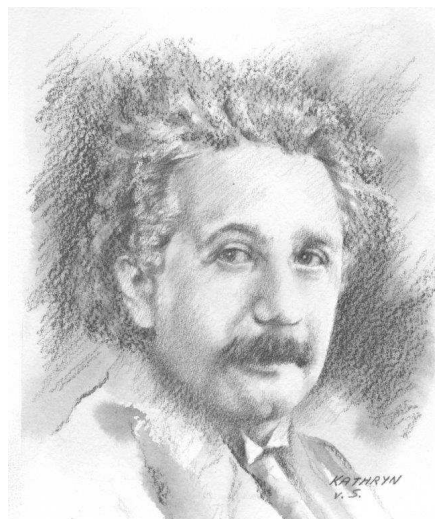


Fig 5. NGC7331, a large spiral galaxy

A surprise was discovered in the star field between Stephan's Quintet and The Deer Lick group of galaxies. Stephan O'Meara spotted a tight string of stars in an east-west direction almost halfway between these two compact groups of galaxies. He characterized this handful of stars as "fleas" surrounding the group of deer!

In mythology Pegasus was the son of Neptune and Medusa who at his father's command leapt into the sea. He seems, however to have come back to earth again with wings. So, fly with this sky-figure horse through the depths of the universe and explore these fascinating objects, and admire once again the brilliant brain of Mr Einstein That will keep you busy for a long time!

Fig 6. Albert Einstein, from a sketch by Kathryn van Schalkwyk



then University of the Orange Free State to start teaching in the Physics Department. Of course I needed a telescope to look for the comet. I borrowed a telescope designed for terrestrial use and made quite a few "discoveries" in the sky including "another comet" near the Southern Cross. While attending my first ASSA meeting ever in the old telescope building of Carl Henize on the site of the Lamont-Hussey Observatory on Naval Hill in Bloemfontein, I learned that "my comet" was a globular cluster containing approximately 1 million stars. I experienced a paradigm shift when I looked at the resolved cluster through the "fantastic" 8-inch telescope of Mr. Hammie Terblanche from Dewetsdorp. I thought at that time that he must be very wealthy. The ASSA members told me that I should be able to see Saturn in the early morning hours through a 4.5-inch telescope that I convinced the Physics Department to buy. I was totally unaware of the 60-inch telescope of the UOFS at Boyden Observatory. I did find Saturn and showed it to many other people and so started my life in astronomy outreach. With all the excitement around Halley's Comet, and having learned in the meantime that the university actually had an observatory, we arranged a visit for the students to Boyden Observatory. I remember that we were not even allowed to come near the 60-inch telescope building, but nevertheless we saw a magnificent comet through the historic 10-inch Metcalf telescope. This was followed by the fragments of Comet Shoemaker-Levy 9 colliding with Jupiter in 1994. The Bloemfontein, Johannesburg and Pretoria Centres collaborated to share this "show" on the SABC-TV link from Sutherland with thousands of people. This was supplemented with images from the Boyden 60-inch telescope using a CCD camera. (See also *MNASSA* Vol. 53 Nos 9 & 10). By that time I had been introduced to all the 'elements' that dominated the next 20 years – and more – of my life: physics, telescopes, ASSA, Boyden and Lamont-Hussey ... which became a planetarium recently. It was interesting to see quite a number of the ASSA members who participated in the 1994 Shoemaker-Levy and Jupiter activities at the recent AGM in Johannesburg. One of them, Chris Stewart, received a President's Award for his initiative in starting a Telescope Makers Class and continuing with it for the next 20 years.



## 4.2 Looking forward

All enthusiastic members of ASSA will have their own unique story to tell. *The question now arises: how ASSA can contribute to the stories of future astronomers and amateur astronomers.* For the large part we can just stay with the basics:

- Provide opportunities for people to see the celestial delights through a telescope;
- Provide opportunities for more people to visit South Africa's few planetariums and astronomical observatories;
- Take advantage of special astronomical events and spread the message using the mass media.

Since astronomy is very much a hands-on and an observational science, we should also "*facilitate astronomical observing by members*". With this in mind, we should add:

- Provide training opportunities for ASSA members so that they can participate in astronomical observations and report their observations to the relevant Sections;
- Promote the "maker culture" of building one's own telescope.

There has been a significant growth in the professional astronomy community in South Africa during the last few years thanks to projects such as SALT, NASSP and SKA. Along with this the number of astronomy enthusiasts in the country is also steadily growing due to the high profile of these projects. However, the same cannot yet be said about the number of ASSA members and Centres. Thus, ASSA should draft a healthy growth strategy by:

- increasing participation of existing members, recruiting more Country Members and, where possible, establish new Centres;
- broadening its geographical footprint in line with being the Astronomical Society of **Southern** Africa;

superimposed on its south-eastern edge. With averted vision, a soft elongated faint nebula roughly east-west opposite and to the north-west marks the combined interacting light of galaxies NGC 7318A and NGC 7318. With higher power the nebula, split by two bright star-like points, indicated the nuclei of these two galaxies. With care and concentration, NGC 7319 shows up as a haze with a low surface brightness just north of NGC 7320. Hanging on the south-western edge of the group, NGC 7317 has the appearance of two fuzzy stars thanks to a magnitude 13 star at the north-western edge just 16" from the nucleus. The entire group is crammed into a circle of less than 4 arc minutes. The odd-one-out member is NGC 7320c, which can be spotted a few arc minutes off to the north-east of this tight group. It is the most crowded of all the Hickson compact group of galaxies, and it is unbelievable that all of them will fit into our Milky Way galaxy. With patience one can be rewarded with a successful attempt at viewing the Quintet. "A huge intergalactic shock wave shown by the magnificent green arc in the Hubble picture is the effect produced by one galaxy falling into another at millions of miles per hour. As NGC 7318A collides with NGC 7318B, gas spreads throughout the cluster, atoms of hydrogen are heated in the shock wave, producing the green glow. The molecular hydrogen is one of the most turbulent forms of molecular hydrogen ever seen. This phenomenon was discovered by an international team of scientists of the [Max Planck Institute for Nuclear Physics](#) (MPIK) in [Heidelberg, Germany](#). Most notable is the fact that this collision can help provide a view into what happened in the early universe 10 billion years ago when it formed."

If this sounds like too much of a challenge and one that you do not feel like taking on with strength and admiration, then there is another group of galaxies just half a degree further north, known as the **Deer Lick Group**. American amateur astronomer Tom Lorenzin bestowed the common name on this galaxy group NGC 7331 to honour the Deer Lick Gap, which lies in the mountains of North Carolina. Another possibility is that it is because numerous small galaxies hover nearby like deer clustered around a salt lake. To describe the group in more detail: NGC 7331 is a large



Another grouping also discovered by a well-known Amastro member is Bruno Sampaio Alessi. This grouping is situated close to the south-eastern border with Pisces. Alessi had the ability to search out nice tight grouping, most of the time outstanding against the star field. The mostly yellow and orange stars form a concave shape towards the west named for its brightest star, the **HD222454 Group**, situated just north of the dark nebula LBN 434.

Only three of the four bright stars popularly known as the Square of Pegasus are part and parcel of the constellation. The north-eastern corner star is alpha Andromedae situated virtually on the border line of the two constellations. It would be nice if Pegasus could claim all four corner stars for its constellation.

Perhaps the best known group of galaxies situated very close to the northern border with Lacerta is NGC 7320 and its members. Édouard Jean-Marie Stephan (31 August 1837 – 31 December 1923) was a French astronomer who discovered this group, now known as **Stephan's Quintet** (Arp 319), but at the time was not aware of its nature, which is 300 million light years away from us.



Fig 4. Stephan's Quintet

This tight group is a challenge to select, so one needs time, dark skies, a relatively large telescope and a lot of patience, and perhaps confidence too. But to study groups like this is well worth the effort and very satisfying when bagging some of these faint galaxies. The largest of the group is NGC 7320, which could be a foreground galaxy of the group. The galaxy is situated on the south-eastern edge of the group and appears as a soft oval haze with a slightly brighter core and a magnitude 14 star

ASSA should also consider “voluntary associations” with informal astronomy clubs that are more widely spread over the country than the Centres.

### 1. Congratulations and words of thanks

It is my privilege to thank all my colleagues on the ASSA Council for their dedication to the Society and the amount of time they spend on the activities of the Council and the Society. It is also an honour to congratulate the ASSA members who received the following awards during the 2014 AGM (See the previous edition of *MNASSA* for more information):

- **McIntyre Award to Dr Ian Glass** for his publication, Nicolas-Louis de la Caille - Astronomer and Geodesist;
- **Merit Award to Auke Slotegraaf** for his sterling contribution to the modernisation of the ASSA website, as well as establishing the new ASSA communication channels, whilst maintaining his normal high standard as Deep Sky Section Director;
- **Long Service Award to Maciej Soltynski** in appreciation for his many valuable contributions made to furthering ASSA interests over 25 years.
- **President's Award to Chris Stewart** for his contribution to the art of telescope making in South Africa for a period of 20 years.

## ASSA Endowment Trust (ASSET)

Report of the Trustees of the ASSA Endowment Trust (ASSET) to the Annual General Meeting of ASSA 2014

We are pleased to report that during the 2013 year, all outstanding amounts due to SARS have been settled.

The Trust's accounts are fully up to date and the two years 2012 and 2013 are presently with the auditors. Copies of the yearly accounts have been made available to ASSA and to *MNASSA*.

One Trustee advised that he wished to retire from that position and this was put into effect in the current, 2014 year, when Mr. M A L Gray who has been a trustee since the inception of the Trust in 1976 was replaced by Dr. I S Glass. We wish Mr. Gray a very happy and restful retirement in Brak River where we understand he has already formed a new astronomy club. We are also delighted to welcome Dr. Glass.

The Trustees have been concerned with the reduction of both the number and the total amount of donations to the Trust in recent years. To counteract this, it was suggested to ASSA Council that short appeals could perhaps appear in both *MNASSA* and the *Sky Guide*. We will continue our efforts to encourage more support in future years.

The galaxies NGC 7360, 7367, 7373 and 7376 are situated less than a degree to the east of the object. My best attempt at observing the galaxy with a magnitude of around 16 was the spotting of a faint double star of 10 magnitude about 8 arc minutes to the east. There are also three magnitude 9 stars in a string towards the south-west.

There is more to tell about Pegasus the Winged Horse constellation, with another object you might almost certainly not have seen which revolves around the star **HD 209458**. But if you wish to see the star it is only a degree north-east of the galaxy NGC 7177 and just west of a very red M1 magnitude 6.3 star. A planet has been discovered, now known as HD 209458b, around this star, surrounding it with controversy as it is not known whether it is a planet or a comet or both.

A grouping of stars, standing out clearly against background the star field and easy to find. Further north on the way to iota Pegasi is the star 28 Pegasi just east of this star grouping. About a dozen various-magnitude stars covered in yellow, white and orange jackets, quite outstanding in combination with the magnitude 6.6 super-white 28 Pegasi, form this group. So it is appropriate to call this cluster of stars the **28 Peg Group**.

The Amastro Forum is a group of deep-sky amateurs who search the starry field for groups of stars standing out against the background stars. Not only is it a break from searching faint objects, but it is also a daunting task to spot some of them. Then, if recognised, such objects are named after the discoverer. One such asterism, was discovered by Dana Patchick in 1980 and named by his friend Steve Kufeld as Asterism Minor, but the correct indicated nr is **Patchick 100**. This nice bright group can be found halfway between alpha and beta Pegasi on the Pegasus square's border line with the stars 4.5 tau, 3.5 mu and 3.9 lamda Pegasi in the near surroundings. It is a loose grouping easily seen through binoculars which appropriate displays perhaps a minor winged horse.



Fig 2. The globular cluster NGC7078

A very faint planetary nebula, **NGC 7094**, can be spotted (if your eyesight is very sharp and that through an amateur telescope) less than 2 degrees further north-east. It has all the qualities of only a faint out-of-focus star, small in size and covered in haziness. It's not at all easy to pick out these faint, small objects among similar-looking stars.

A delicate star grouping is situated midway between epsilon and magnitude 3.3 zeta Pegasi. The galaxy IC 5160 is only 6' north of the lovely open cluster **NGC 7193**. The sprinkling of a dozen faint stars is situated in an east-west direction. It could well be that the grouping and galaxy at the time of documenting could have been mixed up in the line of things.

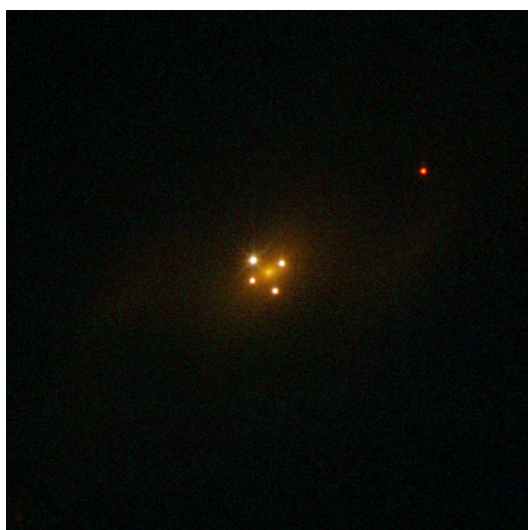


Fig 3. GS02237+0305, also called the Einstein Cross or Huchra's Lens.

Pegasus also has in its midst some very unusual objects. One such is **GS02237+0305**, a full 8 billion light years away from us in the far southern corner of the constellation, but it is probably better known as Einstein's Cross or as Huchra's Lens. A Hubble deep picture shows four images of a very distant quasar which has been multiple-imaged by a relatively nearby massive foreground object acting as a gravitational lens. The concept is difficult to understand, but this is in fact the edge of space and time. Rather do not even try to trace it, but you can admire the spot.

## ScopeX 2014

*L Cross, Chris Stewart and Case Rijsdijk*

### 1 Introduction

ScopeX has now become a regular feature on the South African Astronomical calendar and was held this year on Saturday 13 September, once again at the Military History Museum in Johannesburg. Having started in 2002 it has grown from strength to strength and each year brings in new technology like Webinars and Webex talks giving access to a far broader spectrum of speakers and a richer programme. With the support of the South African Agency for Science and Technology Advancement, SAASTA a wide variety of outreach activities have also been possible.



Fig 1. View of some of the telescopes on display

There were six talks during the day. All talks were recorded and will soon be available on the website for those who were unable to attend or who would like a second pass, as will be the reports, photos etc. Keep an eye on [www.scopex.co.za](http://www.scopex.co.za)

**2.1 10h30 - Gaia Space Telescope - Status and Challenges** by William O' Mullane, Gaia Mission Manager

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**Abstract:** In this session we briefly cover the astrometry principle of Gaia and the processing needed for it. Gaia has been in orbit since January 2014 so we can show some results from the mission and the actual performance of the satellite.

William O'Mullane moved up the satellite chain from control systems in the European Space Operations Centre to the science end of the missions in ESTEC and discovered Gaia. Started with C++ and moved on to Java and Enterprise level systems. Did some serious ground breaking numerical programming in Java. Managed a reasonable sized team and collaborated with the 300+ scientists and programmers on the Gaia Data Processing project. Now, he will be responsible for all the space robotic exploration science ground segments in ESAC Spain.

**2.2 12h00 The Radio Astronomy Road to South Africa** by Francois Kapp, SKA

**Abstract:** Radioastronomy is a comparatively young science. We'll take a brief look at where it came from, why we do it, and then trace it's path to South Africa, leading to the status of the MeerKAT radio telescope and plans for the soon to be constructed Square Kilometer Array.

Francois Kapp is currently the Digital Back End Sub-System Manager at SKA South Africa, a position he has held since 2006. He leads a team of 18 engineers responsible for the design and implementation of the Correlator/Beam Former, Digitiser and Time and Frequency sub-systems for the KAT-7 and MeerKAT Radio Telescopes. He is also the lead for South Africa's participation in the Canada/UK led Central Signal Processing Consortium of the Square Kilometer Array project. Prior to this he has variously worked designing Application Specific Integrated Circuits for Capacitive Sensors, on Electronic Warfare Systems and on the South African space program in avionics.

**Sky Delights: A Horse with Wings**

Magda Streicher

Who among us is not so familiar with the yet far-northern Pegasus constellation with its very clear square shape and, as a bonus, also appears fairly large. The constellation is very popular, especially with amateur astronomers who observe the depth of its deep-sky objects. To search this large constellation can be done just for fun, but it takes care and determination to study it thoroughly.

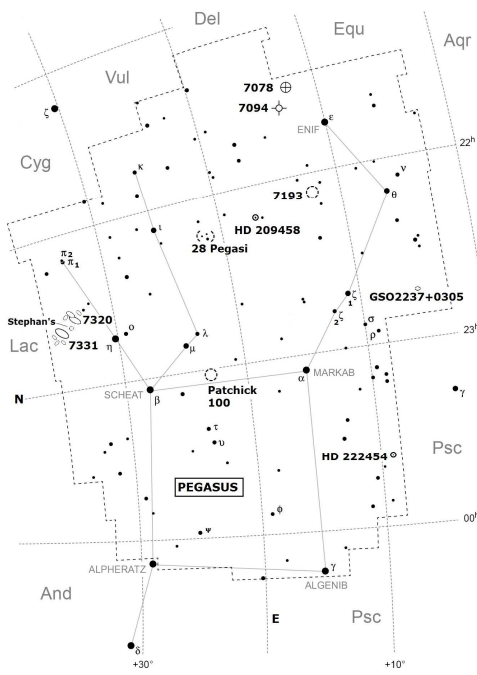


Fig 1. Map of Pegasus

Of course, we can get going right away with perhaps one of the most beautiful objects, Messier 15, which can be found located proudly at the horse's muzzle, almost as if it were a delicacy being offered to it.

The globular cluster **NGC 7078** (M15) stands out amazingly clearly against the background star field situated only 3 degrees west of the magnitude 2.3 epsilon Pegasi. M15 was discovered by Jean-Dominique Maraldi in September 1746. It is large and bright and displays many faint stars that almost give a three-dimensional impression. What strikes one is the very bright core that almost works itself up to an inner pin-prick core. Many faint stars in strings on the periphery intermingle with one another. It is objects like this that make it worth all the effort to seek out and discover some of the secrets it offers.

## AIMS

**Title:** Classification of Astronomical Light Curves - Feature Selection Strategies

Speaker: Arun Kumar

Venue: AIMS research centre

Date: 21 July

Time: 12h00.

## UCT

**Title: Preparing for the data storm: An introduction to Bayesian astronomy**

Speaker: Dr Aaron Robotham (UWA/ICRAR)

Date: 15 September

Time: 16h00

Venue: MCB LT 1 (UCT)

Abstract: Any modern astronomy PhD student will inevitably have to deal with more data than any normal human will see in a lifetime. When we panic we tend to make rash decisions, so preparing for this data deluge is the best defence you have. Best practices have also rapidly improved over the last 30 years, so proper statistical analysis is not necessarily something senior mentors (many of whom came from a data starved era) are well equipped to help you with. Here I will present some intriguing examples of when poor analysis will lead you down misguided paths, and will outline broad strategies for how to make sure your conclusions will stand the statistical-test-of-time. In other words, even if you don't know what to do, you will know what to Google.

## 2.3 14h00 - SA's involvement in international space science missions from Rosetta to CubeSats by Prof. Herman Steyn, Univ Stellenbosch

**Abstract:** A talk on the Rosetta mission and information on the 3 EU CubeSat missions currently being worked on, i.e QB50 – 50 CubeSats will be launched in Jan 2016 at low altitude to take measurements of the thermosphere and do re-entry research. Africa's only contribution will be ZA-AeroSat that we are currently building

DeOrbitSail – a 3-unit Cubesat will deploy a 4 x 4 meter drag sail to demonstrate rapid deorbiting from 650 km (launch end of 2014). We developed the attitude control system for this mission. CubeSail – another 3-unit CubeSat will deploy a 4 x 4 meter solar sail to demonstrate solar sailing (launch end of 2014). We also developed the attitude control system for this satellite.

Professor Herman Steyn is head of Satellite Engineering and Control Systems at Stellenbosch University (SU). He holds a Masters Degree in Electrical and Electronic Engineering from SU, a Masters Degree in Satellite Engineering from the University of Surrey in the UK, as well as a PhD from SU. Prof. Steyn's space experience started with the development of Africa's first fully indigenous satellite called SUNSAT during the late 90's. He then had a four-year stint as Principal Engineer and Team Leader for satellite control systems at Surrey Satellite Technology Limited, where he participated in many European Space Missions. When he returned to South Africa in 2002, as Head of Product Development at SunSpace Information Systems (SA's first satellite engineering company), he helped to develop, build and commission earth observation satellites for international customers and SumbandilaSAT for the SA government. In 2005 he joined SU full time and established a satellite engineering group in the Electronic Research Laboratory to develop low cost nanosatellites.

## 2.4 15h00 - Observations of Near-Earth Asteroids and the Impact Hazard to Earth by Dr Henry Throop, Univ of Pretoria & PSI, Tucson

**Abstract:** From the meteor that killed off the dinosaurs 65 million years ago, to the Chelyabinsk impactor over Russia in 2013 that injured thousands, meteor impacts are a part of life on our planet. In the last year, NASA has announced plans to ramp up its asteroid search and monitoring programs to identify thousands of potentially hazardous asteroids, and make plans to divert these asteroids if one is found headed toward Earth. Dr. Henry Throop will talk about the risk of asteroid impacts on Earth, and what can be done about them. He will also describe his research into studying these bodies using SAAO's telescopes at Sutherland, and discuss how South African amateurs can contribute to this search.

Prof. Henry Throop is a Senior Lecturer at the University of Pretoria, and a Senior Scientist with the Planetary Science Institute in Tucson, Arizona, USA. He received a PhD in Planetary Science from the University of Colorado, USA, in 2000. His work focuses on the outer solar system, and he has published over 40 articles in scientific journals, on topics ranging from the rings of Saturn and Jupiter, to planet and star formation, to astrobiology and the origins of life, to searching for (and co-discovering) Pluto's smallest moon, Styx, in 2012. He is a frequent consultant to the US's NASA and the National Science Foundation. While working at NASA, he was responsible for the oversight and management of two of the NASA's major scientific research programs. Throop's work has been featured in Science, Nature, Time, The Washington Post, and on the History Channel and National Geographic TV. He has been interviewed on SABC Morning Live, in the Sunday Times, and on SAfm. Throop has been working on NASA's New Horizons mission since 2003, and to him, Pluto will always be a planet.

**2.5 16h00 - Building a Semi Geodesic Dome** by Chris Forder, ASSA Cape Centre

**2.6 17h00 - Astrophotography: How to create beautiful images of the Night Sky** by Allen Versfeld, ASSA Imaging Section Director

**Title: Cosmology with the largest all-sky surveys**

Speaker: Maciej Bilicki UCT

Date: 15 October

Time: 16h00

Venue: MCB LT2

**Abstract:** Our view of the low-redshift Cosmic Web has been revolutionized by various wide-angle galaxy redshift surveys such as the Sloan Digital Sky Survey. However, the trade-off between depth and sky coverage limits a systematic three-dimensional account of the entire sky beyond the Local Volume. In order to reliably map the Universe to cosmologically significant depths over the whole sky, one must draw on multiwavelength datasets and state-of-the-art photometric redshift techniques. I have been leading a dedicated programme of employing the largest photometric all-sky surveys – 2MASS, WISE and SuperCOSMOS – to obtain accurate redshift estimates of millions of galaxies. The first outcome of these efforts – the 2MASS Photometric Redshift catalogue (2MPZ) – was publicly released in 2013 and includes almost 1 million galaxies with a median depth over 300 Mpc. In this talk I will detail how this catalogue was constructed and how using the WISE mid-infrared survey together with SuperCOSM

OS optical data allows us to push to depths over 1 Gpc on unprecedented angular scales. These photometric redshift samples, with more than 20 million sources in total, provide access to volumes large enough to verify observationally the Copernican Principle of universal homogeneity and isotropy, as well as to study various properties of dark energy and dark matter through cross-correlations with other data such as the cosmic microwave or gamma-ray background



any distinctions between the bulge and the bar. This approach is thwarted by the severe and patchy dust extinction in those directions. We revive the use of RR Lyrae stars as standard colors with the goal of producing de-reddened CMDs of some select fields, using multi-band light curves obtained with the DECam wide field camera on the Blanco 4m telescope at CTIO. The experiment is designed to be a micro pre-cursor survey, and serves as a test-bed for techniques that will need to be applied to LSST data — specifically photometry in very crowded fields, and for the discovery of faint variable phenomena to depths similar to LSST single epochs. This is a work in progress, and I will talk more about methods and some surprises than about any firm conclusions from the work to date.

**Title: Close Binary Central Stars of Planetary Nebulae**

Speaker: Brent Miszalski SAAO

Date: 8 October

Time: 16h00

Venue: MCB LT2

**Abstract:** Planetary Nebulae appear in an extremely wide variety of shapes, but exactly how they are shaped into such a diverse range of morphologies is still highly uncertain despite over thirty years of vigorous debate. Binaries have long been thought to offer a solution to this vexing problem. Now, thanks to recent surveys and improved observing strategies, it is clear that a binary channel, in particular common-envelope (CE) evolution, is responsible for a large fraction of planetary nebulae. These close binary central stars are a precursor phase to cataclysmic variables and offer several new insights into the late stages of binary stellar evolution. I will give an overview of the main results achieved so far including some exciting recent results. A particularly nice result is the discovery of only the second known close binary system including a Wolf-Rayet component inside a planetary nebula.

**Abstract:** Ever since the invention of the digital camera, astrophotography has never been so popular, or accessible. But because astrophotographers work at the very limits of what cameras are designed to do, they need to know a few specialised tips and techniques to get good results. Allen will walk us through the process of choosing and setting up equipment, capturing the raw images, and processing them in software to transform them from faint smudges to the beautifully colourful images we've gotten used to. To be followed by a Panel Discussion with some of South Africa's top astrophotographers.

### 3 Amateur Telescope Making and Awards

#### 3.1 Introduction

The purpose of the ATM awards is to recognise accomplishment and to spur people to stretch themselves, thereby advancing the intriguing art of amateur telescope making (ATM). By highlighting the merits of certain exhibits, it is hoped that others will adopt the good ideas and perhaps find way to make further improvements.

Instruments that previously garnered awards are not generally eligible for another, but significant improvements to those instruments might well. The judges may consider a component, a complete instrument or a body of work to be worthy.

#### 3.2 Criteria

The following characteristics are of particular importance:

**Workmanship:** Quality of finish, beauty, style, precision

**Innovation:** Application of new ideas, principles, materials, techniques

**Ambitiousness:** Difficult optical configuration, grand scope of project, courageous modifications

**Ingenuity:** Lateral thinking, unusual ways of solving old problems, interesting use of found materials

Once the selection has been made, the perceived needs of the recipients are as far as possible taken into consideration when deciding the allocation of the available awards. The items awarded are donated by commercial vendors, mostly in lieu of payment for exhibition space at ScopeX. We are grateful for their contributions to this special day.

Yet again we were pleased by the number of worthy examples of new and interesting items on display. In no particular order, here are the awards for 2014.

**ATM Judges:** Chris Stewart, Dave Blane, Chris Forder

### 3.3 ATM Winners

Forty-two items were formally entered and six people received awards:

**Peter Rendall:** Polar Disc Mount and Wooden Tubes

**Carmel Ives:** A-frame Polar Disc Mount

**Johan Smit:** Curved Bolt Drive, Binocular Collimator, Infinity Finder

**Michael Moller:** Steampunk Schiefspiegler

**Eric Slaghuis:** Minimalist Dobsonian Mount

**Dave Hughes:** Texereau-style Telescope and Mount

**Peter Rendall** has been busy, producing a slew of lightweight wooden tubes and experimenting with variations on the theme of polar disk mounts. His latest involves a metal base which folds up for storage and transportation. The declination assembly in wood sports a plate bearing comprising a Teflon sheet sandwiched between two Formica faces. All very stable, enough for at least a 10-inch Newtonian. Best of all, it can all be built fairly easily without the need for sophisticated tools. In time, it will be motor-driven. For this body of work, he received a Baader Planetarium 3.5mm Eudiascopic eyepiece, courtesy of Eridanus Optics.

Recent high-sensitivity, spectro-polarimetric imaging of the radio sky, and analysis of the NRAO VLA Sky Survey data is showing that the faint polarized sky is relatively more highly polarized than expected based on extrapolation of the polarization properties of strong radio sources. At the same time observations and modelling of integrated polarized radio emission from local disk galaxies are revealing significant integrated polarized signals. These results indicate that disk galaxies will comprise a significant fraction of the sub-microJy polarized source population, and statistical analysis of integrated polarized emission at sub-microJy levels will allow us to trace the emergence of coherent magnetic fields in galaxies

#### **Title: Radar science basics**

Speaker: Michael Kosch from SANSA Space Science Centre

Date: 17 September

Time: 16h00

Venue: MCB LT2

**Abstract:** This presentation will introduce the basics of radar operations. The principles of coherent and incoherent backscatter radars, as well as ionosondes, for ionospheric monitoring and research will be described. The applications and scientific uses for these three different types of radars will be explained. An example application is given for each type of radar.

#### **Title: Battling the Galactic Bulge with DECam and RR Lyrae stars**

Speaker: Dr Abhijit Saha NOAO

Date: 1 October

Time: 16h00

Venue: MCB LT2

**Abstract:** Analysis of the color-magnitude diagram in select fields towards the Galactic center would be useful for probing the kinematic and chemical history of the central regions of the Galaxy and for investigating

show early results. A network of such stars will be embedded in the survey data from surveys such as LSST and PanSTARRs, thus anchoring the photometry to a physical scale, with accuracies an order of magnitude better than is now possible.

**Title: UTR-2:pulsar astronomy below 40 MHz**

Speaker: Maciej Serylak UWC

Date: 19 September

Time: 14h00

Venue: Room 1.35 of the Physics Department, UWC

**Abstract:** UTR-2 is the biggest radio telescope in Europe capable of observing at frequencies as low as 8 to 40 MHz. After a recent upgrade, UTR-2 has increased its the number of known pulsars detectable at these low frequencies to 40. I will present general overview of UTR-2, some of its recent results and plans for the future.

**NASSP**

**Title: Toward the sub-microJy Polarization Sky**

Speaker: Russ Taylor, joint SKA research chair between UCT and UWC

Date: 10 September

Time: 16h00

Venue: MCB LT2

**Abstract:** Observations of polarization at radio wavelengths is one of our most powerful probes of the cosmic magnetic fields. Polarization imaging of the deep polarised sky offers the potential to trace the evolution of cosmic magnetism over time and to explore magnetic properties of populations of radio sources. The new capabilities of the modern radio interferometer arrays such as the JVLA and GMRT offer us our first opportunity to probe the microJy polarised sky in advance of deep and wide polarization surveys currently being planned for SKA precursor telescopes and the SKA itself.

**Carmel Ives** also showed off a polar disk mount, with an A-frame wooden tripod structure that folds flat for transportation. This design is simple to make, quick to set up, and particularly suited to our low latitude. Again it is amenable to retrofitting with an RA drive. This is worth emulating; if you want an equatorial mount and don't know where to start, this is the one for you. These efforts garnered her an Orion 25mm Plossl eyepiece courtesy of Eridanus Optics.

**Johan Smit** has also been a busy boy. On display he had - in addition to several examples of his earlier works - a collimator system for binoculars, an "infinity finder" to allow autofocus cameras to get an infinity lock in the dark, and a camera tracking platform sporting a novel curved bolt drive system. Any one of these would have been a worthy contender. For this body of work, he was awarded a 2" GSO 50mm eyepiece from The Telescope Shop.



Fig 2. Michael Möller's Schiefspiegler

**Michael Möller** produced the second Kutter Schiefspiegler to have emerged from the ATM class. Embellished in a distinctly Steampunk style, this instrument sports a coffee can primary mirror tube and a drainpipe

secondary tube. The latter incorporates a sliding lid to close the side aperture when not in use. Apart from using common found objects to good effect in true ATM spirit, he also crafted a rather nice wooden tripod worthy of supporting the OTA – a very necessary consideration for a long-focus instrument. And it certainly performs, as many visitors to the evening Star Party will attest. For this, he garnered a 2" GSO 42mm eyepiece from The Telescope Shop.



**Eric Slaghuis** produced a singularly elegant minimalist Dobsonian; lightweight, yet stable and rigid, from wood. Many passers-by paused for more than a moment to admire the multifaceted wooden tube. And then they came back again for a second look. Seasoned ATMers did more than pause, they lingered covetously. For this beautiful handiwork, Eric received a 2" GSO 30mm eyepiece from The Telescope Shop.

**Dave Hughes** took an ancient derelict optical tube assembly which had been donated to the ATM class, and turned it into something special. Recognising that it followed the style of Texereau, he went the whole hog to resurrect it in a way that would have made even Texereau proud. This entailed refurbishing and modifying the tube, refiguring the mirror, making new mirror cell and spider, building a mount from scratch, and so forth. In the end, only the wood of the tube, the glass of the mirror and the altitude trunnions could be said to remain of the original. A super effort, with an excellent steel tripod/pier, it was much admired. For this, he was awarded a 2" Baader ND filter, courtesy of The Telescope Shop.

### 3.4 Comments

Michael Moller said of his endeavour "Now while I'm fairly practically minded, I always consult my wife Robyn when it comes to things aesthetic. After discussing the technical aspects with her, we came up with a sketch of a light, femininely curved, open-cradle assembly which Robynn liked and I thought I could construct".

Chris Forder from Cape Town was one of the ATM judges and said: "The telescope making was fascinating, with a some world firsts both in concept and in design. It is also pleasing to see the telescopes were made from the optics through to the mechanical components, using many ordinary and household components in construction. In short, great folks, great scopes and great hopes for the future of ScopeX".

## UWC

### **Title: Small bodies in the Solar System**

Speaker: David Trilling of Northern Arizona University, SAAO and UWC

Date: 12 September

Time: 14h00

Venue: Room 1.35 of the Physics Department, UWC

**Abstract:** There are millions of small bodies in the Solar System: asteroids, comets, and the like. Together, the ensemble properties of these small bodies can reveal the conditions under which the Solar System formed as well as the evolutionary processes taking place today. In this talk I will present recent results on several Solar System astronomy topics. I will present a summary of my primary sabbatical project during for my year here in South Africa -- an outer Solar System project -- and some new results on the properties of Near Earth Asteroids. You will even get to hold a rock that fell from space!

### **Title: Sub-percent spectrophotometry from Ground Based Telescopes: DA White dwarfs as Spectral Energy Distribution Standards**

Speaker: Dr Abhijit Saha, the LSST Operations Simulation Lead Scientist US NOAO

Date: 26 September

Time: 14h00

Venue: Room 1.35 of the Physics Department, UWC

**Abstract:** The next generation of 'all sky' surveys will seek to do cosmology using mass tomography, BAO and SNe Ia. A key ingredient for these to be successful is accurate determination of redshifts for large numbers of galaxies, and accurate photometric magnitudes and colors for supernovae: the systematic errors in these methods are dominated by systematic errors in photometry. I will talk about an ongoing experiment to define 17-18 mag DA white dwarf stars as absolute standard sources with physical spectral energy density distributions accurate to a few milli-mag. I will

dimensional distribution will be explicitly described. They are parameterized either by solutions of a transcendental equation (the tortoise equation) or by solutions of a linear second order partial differential equation of Darboux type. Metrics, corresponding to solutions of the tortoise equation, are characterized as those that admit a 3-dimensional Lie algebra of Killing fields with 2-dimensional leaves. Metrics, corresponding to solutions of Darboux type equation, represent nonlinear gravitational waves obeying two nonlinear superposition laws.

**Title: Exploring the growth of cosmic structure in relativistic, highly nonlinear regions of space-time**

Speaker: Dr. Sean February (Centre for High Performance Computing - Cape Town)

Date: 30 September

Time: 12h00

Venue: M111 Maths Building, UCT

**Abstract:** In this talk I will describe an approach to more accurately model cosmic structure growth in the relativistic, nonlinear regime. Such regimes show up in cosmology as very large (several 100s of Mpc across) over densities (superclusters) or under densities (voids) having deep gravitational potential wells. Assuming spherical symmetry, these regions can be modelled by a radial inhomogeneity in the matter energy density according to the Lemaitre-Tolman-Bondi exact solution to Einstein's equations. Applying linear perturbation theory to a generic background LTB model, it was previously shown that a set of coupled partial differential equations arises out of this. I will go on to describe how we solved this PDE system under various initial conditions, and highlight some of our key results.

Finally, I will dedicate some time at the end to describe my current role as a Research Scientist at the Centre for High Performance Computing.

Members of the ATM class built and handed over to Sci-Bono a Dobson style solar telescope. Special thanks to Dave Hughes for grinding the 6" mirror and building most of the scope, and to Rodney Hyman for donating the plaque and providing aluminising services. Hugh Scholtz also contributed woodworking expertise. Chris Stewart handled design and technical aspects, and participated in the construction.



Fig 3. Handing over of the Solar Telescope

Again, thank you to our kind sponsors for the prizes. Well done to everyone who participated. Thanks for spending many hours patiently explaining and showing off your instruments to the

visitors under the blazing sun – and then wowing them with views of the night sky in the evening. Each year brings something new and sometimes themes emerge. This time, several innovations on show are likely to spark minor revolutions, i.e.: polar disk mounts, DC motor drives, curved bolt sectors and autofocus assistance for astrophotography. These advances to the art may seem small, but are certainly not insignificant. What will we see next year?

#### 4 Astrophotography

Thirty-four photos entered, of which three received awards:

Johan Smit: Asteroid Patentia occultation; Paul Smit: Eta Carina region;

Johan Moolman: Saturated Moon

#### 5 School projects

Nineteen students brought and exhibited their science projects. Many thanks go to Amanda Calitz (educator at the Nooitgedacht Primary School)

who brought 14 scholars from her school. Judging the school science projects was done by Michael Ellis and Akash Dusrath.

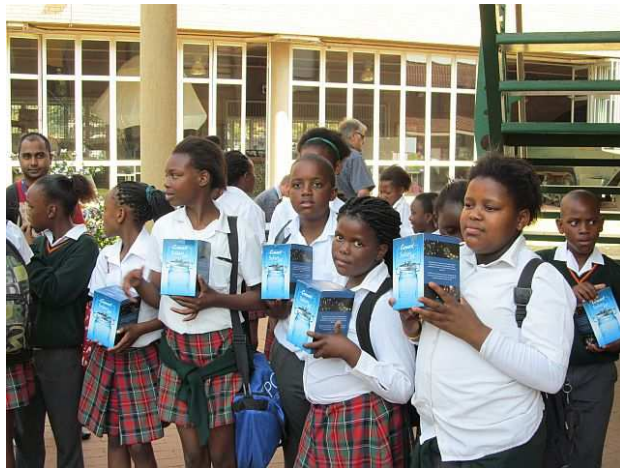


Fig 4 (left). Some of the Nooitgedacht learners at ScopeX

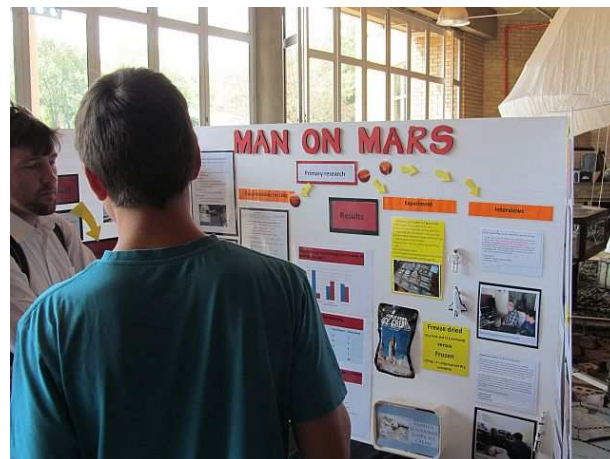


Fig 5 (right). School projects being judged.

## 6 Additional Activities and workshops

**6.1 Experilab** organized and conducted 5 Science Shows during the day.

**6.2 Exhibits** – Many commercial companies set up exhibits ranging from photographic equipment and books on astronomy through rocketry and the Camera Obscura to telescopes to suit all needs and pockets!

**6.3 Sci-Bono Science Centre** – Zibusiso Nyoni managed 4 sessions catering for about 120 learners aged 13 to 17 years old learners. Between them Sibongile Twala and Ndzalama Mavasa ran 19 sessions for the digital planetarium catering for around 450 learners.

**6.4 SAAO/EUNawe** Buzani Khumalo to ran four Solar System workshops which were attended by 80 learners from 6 to 10 years old – all the supplies brought by Buzani were exhausted.

**Abstract:** In this talk, Dr. Leitch will explore a decade of experimental work in cosmic microwave background (CMB) studies. These studies include early attempts to detect Doppler peak structure in the CMB power spectrum, the first detection of CMB polarisation with the Degree Angular-Scale Interferometer, and recent measurements with the South Pole Telescope. Along the way, we'll review how the CMB can shed light on the origins and nature of the early Universe and, via studies of galaxy clusters, on the subsequent evolution of structure.

**Title: Survey Astronomy: From metres to microns**

Speaker: Dr Chris Simpson, Liverpool John Moores University

Date: 25 October

Time: 10h30

Venue: SKA office - 2nd Floor Auditorium (CT)

**Abstract:** I will describe the advances in our knowledge of the radio source population over the last three decades, focusing on our understanding of the microjansky population and the phenomenon of AGN feedback. I will discuss how data at other wavelengths has been essential in these endeavours and, by looking ahead to projects such as the WEAVE/LOFAR survey, will continue to be so.

## ACGC

**Title: Einstein manifolds with 2-dimensional Killing leaves: Geometrical and Physical aspects**

Speaker: Prof Gaetano Vilasi (Dipartimento di Fisica, Università degli Studi di Salerno & Istituto Nazionale di Fisica Nucleare, Italy)

Date: 4 September

Time: 12h00

Venue: M111 Maths Building, UCT

**Abstract:** Solutions of vacuum Einstein's field equations, for the class of Riemannian metrics admitting a non Abelian Lie algebra generating a 2-



resolution with the RadioAstron orbiting VLBI telescope. At the extreme resolutions afforded by RadioAstron VLBI observations (corresponding to just a few schwarzschild radii in the nearest and largest Supermassive Black Holes), variability induced by scintillation in the Interstellar Medium has a strong influence on our observations. While complicating the interpretation of the RadioAstron observations, this scintillation induced variability can itself give us important information on the very small scale structures in both the AGN and the Interstellar Medium.

**Title: Diffuse radio emission: from the cosmic dawn ( $z \sim 30$ ) to our own backyard ( $\sim 100$  pc)**

Speaker: Gianni Bernardi

Date: 25 September

Time: 10h30

Venue: SKA office - 2nd Floor Auditorium (CT)

**Abstract:** I will review how observations of diffuse emission from neutral HI at high redshift ( $z > 6$ ) can teach us about the birth of the first luminous sources (stars and galaxies) opening up a new window on observational cosmology. I will then come closer to us and show how radio emission can tell us about the dynamic and history of clusters of galaxies and I will conclude by showing results from a recently completed 2.3 GHz all-sky polarization survey (i.e. looking at our surroundings). I will eventually offer a view about how future instrumentation (MeerKAT, HERA and the SKA) will advance/revolutionize these studies

**Title: Illuminating the Structure of the Universe with the Cosmic Microwave Background**

Speaker: Dr Erik Leich

Date: 22 October

Time: 10h30

Venue: SKA office - 2nd Floor Auditorium (CT)

## 7 Night viewing

No ScopeX would be complete without people bringing their picnic baskets and spend a few hours looking through the wide range of telescopes on display, and this year was no different, especially as this year the skies were nice and clear. This session brought to an end another wonderful ScopeX, attended by a little under 2 000 people – a remarkable achievement by a small group of remarkable people!

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## Obituary: Doc Jannie Smit

*Neville Young*

It is with a great sense of loss that we have to announce the passing of Dr Jannie Smit, affectionately known simply as “Doc”, long time member of the Pretoria Centre of ASSA and a noted variable star observer.



Fig 1. Dr Jannie Smit

Jannie was born in Reitz in the Free State on 22 September, 1924 and died in Pretoria on 7 September, 2014 - three weeks short of his 90<sup>th</sup> birthday. After he had qualified as a Mathematics and Science high school teacher, he lived in Swartruggens, followed by several of years teaching in Alberton. In 1962 he moved to Pretoria where, after teaching at Hendrik Verwoerd Hoërskool for a few years, he joined the staff at the University of Pretoria lecturing in Applied Mathematics.

By all accounts he was a highly motivated teacher, which explains his willingness to help those of us who were new to astronomy.

Astronomy must have been an interest of his from an early age because his daughter Sonja recalls, that she as a little girl was very proud of her



father for having built his own telescope, through which she had her first views of the stars and planets. His enthusiasm to share his own passion for astronomy was clear and he was always showing others how to do things, ranging from astrophotography to setting up grazing occultation trips and weekend observing camps. In order to view a transit of Mercury, he adapted a 4" reflector for solar observing viewing, enabling him to observe the transit at daybreak from his house.

Fig 2. Jannie with his adapted telescope.

Another achievement was that of being the first person to visually observe the occultation of a moon of an asteroid, long before asteroids were known to have companions.

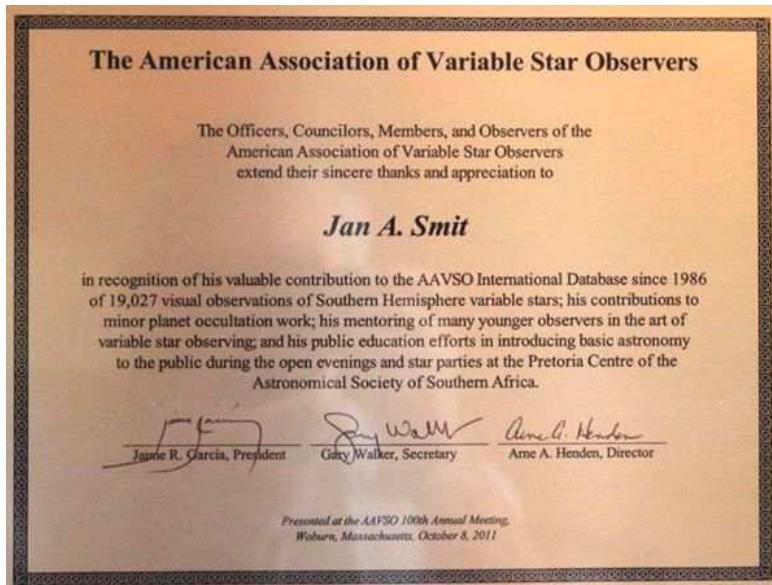


Fig 4. Plaque awarded to Jannie Smit

His enthusiasm and dedication led to Jannie becoming an avid variable star observer, eventually logging 19,027 visual observations. According to Brian Fraser "Jannie Smit was one of the most accomplished variable star

observers in South Africa." His efforts were recognised by the American Association of Variable Star Observers which extended its appreciation by

## Astro-Coffee

**Title: The Jets in Active Galactic Nuclei on Very Small Scales**

Speaker: Dr Cormac Reynolds (Curtin University)

Date: 19 September

Time: 11h00

Venue: SKA office - 2nd Floor Auditorium (CT)

**Abstract:** Black holes are prevalent throughout the Universe and play a fundamental role in its evolution. Supermassive Black Holes are thought to exist at the centre of every galaxy, and in Active Galactic Nuclei (AGN) are known to redistribute matter across inter-galactic scales and to regulate the rate of star formation in their host galaxies. Some of these AGN are observed to emit collimated jets that form very close to the central black hole and propagate at speeds more than 99% of the speed of light out to distances larger than the galaxies which host them. This dichotomy between the radio loud AGN with their energetic jets, and the radio quiet AGN which lack powerful jets is fundamental to our understanding of AGN physics. High resolution radio observations are among the best methods for probing this question.

In this talk I will present recent and ongoing work on the radio properties of radio quiet quasars, with particular reference to high resolution studies of the remarkable nearby radio quiet AGN, Markarian 231. At a redshift of 0.042 Markarian 231 is one of the closest radio quiet quasars to earth, and at high frequency has perhaps the brightest radio core of any radio quiet quasar. These features combine to make Markarian 231 the optimal radio quiet quasar for high resolution radio studies, and this has inspired a long term monitoring campaign, early results of which I will present. Recent improvements in the sensitivities of radio telescopes are allowing us to extend this work to fainter sources.

In addition I will present a developing project in which we aim to study the jets of the brightest radio loud quasars at the very highest angular



interior. This may indicate that the galaxies residing in voids are formed along these dark matter filaments, given that the simulations reveal that dark matter halos are forming along them.

In my talk, I will describe the Void Galaxy Survey (VGS) which is a multiwavelength survey of 60 void galaxies. Our sample is unique in its way of being selected geometrically therefore is not biased to color, morphology and any other physical properties. I will first present our sample and the VGS. I will talk about the gas content, structural parameters and star formation properties of the VGS galaxies. Then I will present a special case we have in our sample which is a candidate of a filamentary structure in a void. I will talk about what we learn about this system from observation and simulation.

#### **Title: Small bodies in the Solar System**

Speaker: David Trilling of Northern Arizona University, SAAO and UWC

Date: 23 October

Time: 14h00

Venue: SAAOP Auditorium

**Abstract:** There are millions of small bodies in the Solar System: asteroids, comets, and the like. Together, the ensemble properties of these small bodies can reveal the conditions under which the Solar System formed as well as the evolutionary processes taking place today. In this talk I will present recent results on several Solar System astronomy topics. I will present a summary of my primary sabbatical project during my year here in South Africa -- an outer Solar System project -- and some new results on the properties of Near Earth Asteroids. You will even get to hold a rock that fell from space!

way of a plaque awarded *in absentia* to him at the 100<sup>th</sup> meeting of the AAVSO in Massachusetts in 2011. At an informal ceremony attended by various representatives of ASSA and the Pretoria Centre and held at his home in 2012, the plaque was presented to him in person by Brian Fraser.



Fig 5. Standing left to right: Brian Fraser, Tim Cooper, Michael Poll, Johan Smit

After he retired, he decided to devote more time to astronomy and so he built an observatory on the roof of his house. This was accessed from a beautifully crafted staircase in the lounge, which meant that he did not have to go outdoors to observe. He was upset when he had to stop his regular attendance at the Pretoria Centre ASSA meetings, saying that he valued every clear sky opportunity to spend time in his observatory actually 'doing' astronomy as opposed to 'talking' astronomy!



Fig 6. Jannie in his observatory

Jannie was also a keen marksman and was for many years a member of the Springbok Bisley target shooting team. He and his wife, Bokkie, also enjoyed playing tennis and were both 'A' grade players in their club. He leaves his wife Bokkie, daughters Sonja and Estelle and son Jan.

## Irregularity observed in the Light Curve of the companion of PSR J1723-2837

Andre van Staden  
South Africa  
andre@etiming.co.za

**Abstract:** The author presents a phased Light Curve (LC) of the companion of PSR J1723-2837, a millisecond pulsar, from photometric measurements with a 30 cm telescope. Variation in the LC agrees well with the orbital period and provides supporting evidence for tidal distortion of the companion in the compact binary system. Short period irregularities in the LC were discovered around  $\phi \sim 0.25$ .

### 1. Introduction

It is generally accepted that pulsars lose energy through magnetic dipole radiation and that the rotation rate will decrease over time. When a pulsar's spin slows down sufficiently, the radio pulsar mechanism is believed to turn off (the so-called "death line"). However in the case of binary systems, the theory is that infalling matter transfer from the companion on to the neutron star can increase angular momentum to the neutron star to "recycle" it as a rotation-powered millisecond pulsar (MSP) [Alpar et al, 1982; Bildsen et al. 1997]

PSR J1723-2837 is an eclipsing 1.86 millisecond binary pulsar that was discovered in the Parkes Multibeam (PM) survey. The MSP follows an almost circular 14.8-hour orbit about a companion star (J17232318-2837571) of spectral type G5 that was identified using Infrared, optical, ultraviolet and spectrophotometry [Crawford, 2013]. X-Ray emission was also detected from PSR J1723-2837 and it is presumably a candidate for a radio pulsar/X-ray binary transition object (Bogdanov, 2014).

However, sparse orbital photometric data of the companion did not allow constraining the degree of tidal distortion to date, although suggestions

drivers communicate over a TCP/IP socket with a Python controller process, and on top of that is a Python/Flask driven web interface. We plan to adapt the framework to new instruments (such as a wide-field camera for the 1.9- and 1-m telescopes), under-development instruments (such as an upgrade to the Cassegrain spectrograph on the 1.9-m telescope), and retrofit to older instruments as feasible.

As a demonstration of the new framework, we will present our work of migrating the control software for the Sutherland High-speed Optical Camera (SHOC) from being a disparate collection of proprietary, Windows-based software, to a unified, open source, web accessible system. SHOC is a high-speed, accurately-timed, imaging instrument that can be mounted on the 1.9-, 1-, and 0.75-m telescopes in Sutherland, control of which includes that for a camera, a global positioning system (GPS), and a filter wheel.

### Title: The Void Galaxy Survey: A filamentary structure in the void

Speaker: Burcu Beygu

Date: 16 October

Time: 11h00

Venue: SAAO Auditorium

**Abstract:** Cosmic voids are vast regions occupying most of the volume in the universe with sizes in the range of 20 – 60 h<sup>-1</sup> Mpc, usually roundish in shape and largely devoid of galaxies. In the large scale structure of the universe we observe today, the most striking features along with the voids are clusters and filaments. In this picture, galaxies are distributed in a filament-dominated web-like structure. Filaments connect clusters to each other and, while tenuous, act like bridges. The very low density of the void regions, we do find a dilute population of galaxies in their interior. Void galaxies may be the rare probes of the faint and tenuous substructure that hierarchical structure formation theories predict to exist in voids. Cosmological simulations show how voids are filled by low-density dark matter filaments, creating a network of tenuous substructures within their



Time: 11h00  
Venue: SAAO Auditorium

**Abstract:** I will describe a deep imaging survey of selected regions in areas outlying the LMC and SMC, including the Magellanic Bridge and Magellanic Stream. We identify and use stars below the main sequence turn-off to delineate structures with effective surface brightness fainter than 33 mag per sq. arc sec. We are able to trace the disk of the LMC to 12 scale lengths, while failing to find a stellar halo. Our data are put in the context of the new paradigm that the Clouds are falling in to the Galaxy for the first time, and that structures such as the Magellanic Bridge and Stream have formed from the mutual interaction of the LMC and SMC alone.

**Title:** Python at the Observatory – Old telescopes, new instruments

Speakers: Carel van Gend and Briehan Lombaard

Date: 30 September

Time: 11h00

Venue: SAAO Auditorium

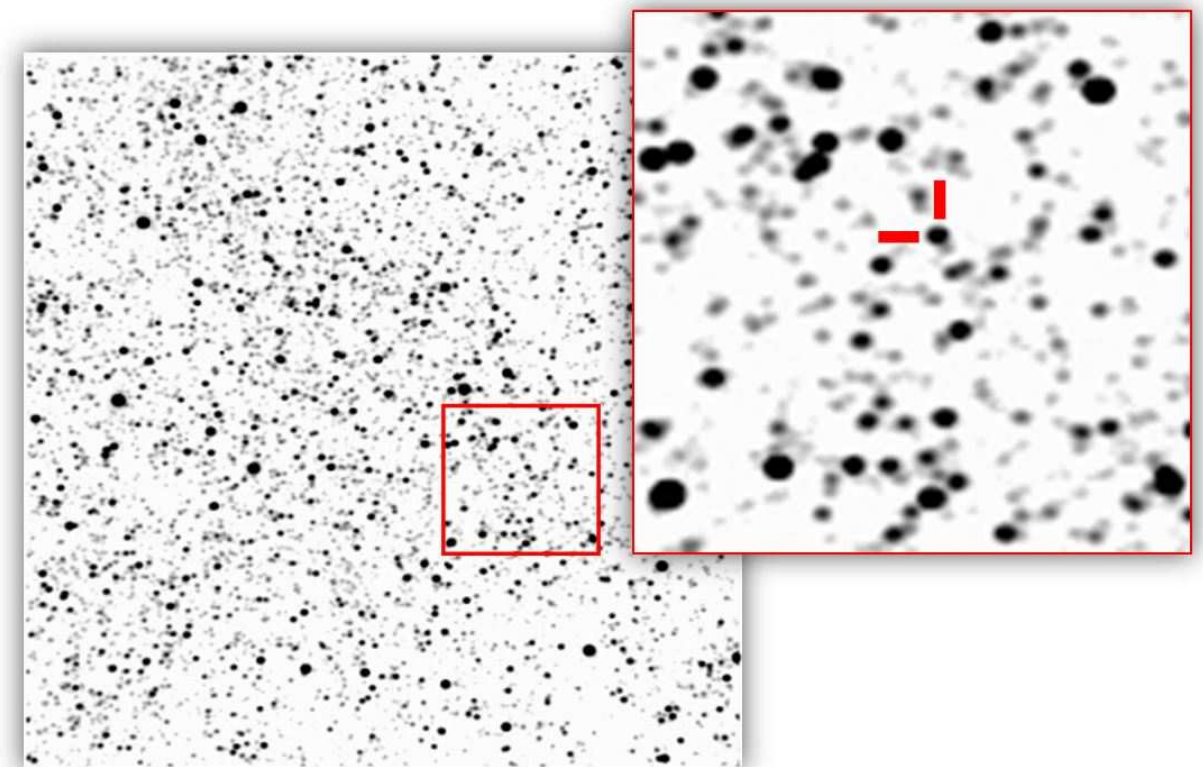
**Abstract:** In addition to SALT, there are a number of small- and medium-sized telescopes hosted at the SAAO that still produce a great deal of valuable data. We'd like to show how we're using new instruments and the nimbleness of Python to bring seventy-year-old telescopes into the 21st century.

Our long-term goal is to have the telescopes and associated instruments be remotely operable, easy to use, and robust enough that valuable data is reliably captured and stored. In addition, we want to make it as easy as possible to update and improve the software which controls the instruments.

We have developed a distributed framework to control the instruments. Drivers for individual components may be written in whichever language is most suitable (we've used C, C++ and Python where appropriate). These

were made that there are signatures of a strong tidal effects, for example; a large orbital period derivative; the pulsar is eclipsed for a significant portion of its orbit (~15%) and there is significant flux variability in the radio data (2000 MHz) which may be contributed by obscuration material from a mass-losing companion that could be a star nearly filling its Roche lobe.

In this report I would like to present a LC of the companion star that supports evidence for the expected tidal forces and will report on short period irregularities observed in the continuity of the LC.



**Fig. 1.** RA 17h 23m, Dec -28 37': The 300 second image (left) was made with a 30 cm SCT and ST9eCCD. The ~130 arc seconds "cut-out" box (right) shows the position of J17232318-2837571 marked with red bars and the corresponding position on the left image.

## 2. Observations and data analysis

Data were obtained with a 30 cm amateur class SCT and ST9e CCD (512x512) cooled to -15°C, located at code 641, South Africa. FWHMs were between 2 to 3 arcsec, and occasionally reached < 2 and >3 arcsec. The pulsar position is only 4.3° from the Galactic plane and this results in a crowded star field (see Fig. 1).

Light exposures were all 300 seconds, without filters. Measurements were made between 3 Aug 2014 and 13 Sep 2014 on 14 nights. A public photometric program, Muniwin, was used to reduce the time series photometry.

## 3. Results

A phased light curve was constructed (fig 2), with  $\phi \sim 0$  located at the ascending node [Time of ascending node,  $T_{\text{asc}}$  (MJD) = 55425.320466] and folded with the pulsar's orbital frequency [ $f_b$  ( $s^{-1}$ ) =  $1.88062856(2) \times 10^{-5}$ ] corrected with the 1<sup>st</sup> derivative [ $\dot{f}_b$  ( $s^{-2}$ ) =  $1.24(4) \times 10^{-18}$ ]. Therefore we see at  $\phi \sim 0.75$  the side of the companion facing the pulsar. The radio eclipses in the PM survey were observed at  $\phi \sim 0.25$  when the pulsar was behind the companion (at inferior conjunction). All photometric measurements were transforming to Heliocentric times. The Magnitude scale was derived from a virtual comparison star and is only an approximation for V mag.

The LC shows optical variability ( $\sim 0.12$  mag) with two maxima and two minima during each orbit of the companion that nicely correlates with the pulsar's orbital period, confirming variability is associated with the pulsar's binary motion. The observed light curve clearly shows two distinct minima, at phases  $\phi \sim 0.25$  and  $\phi \sim 0.75$  at the conjunctions and two maxima at quadratures,  $\phi \sim 0.0$  and  $\phi \sim 0.5$  when the distorted star presents the longest axis of its ellipsoid to the observer. Such a shape is a clear signature of tidal distortions induced by the Neutron Star's tidal field on a highly perturbed, bloated star (Pallanca, 2010).

## 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.

Editor.

### SAAO

#### **Title: Galaxy evolution since $z \sim 0.5$**

Speaker: Jon Loveday (GAMA collaboration)

Date: 16 September

Time: 14h00

Venue: SAAO Auditorium

**Abstract:** I will report on recent work to measure evolution in the type-dependent luminosity and stellar mass functions and clustering of galaxies since redshift  $z \sim 0.5$  using data from the Galaxy and Mass Assembly (GAMA) survey.

#### **Title: On The Outer Structure of the Magellanic Cloud Complex**

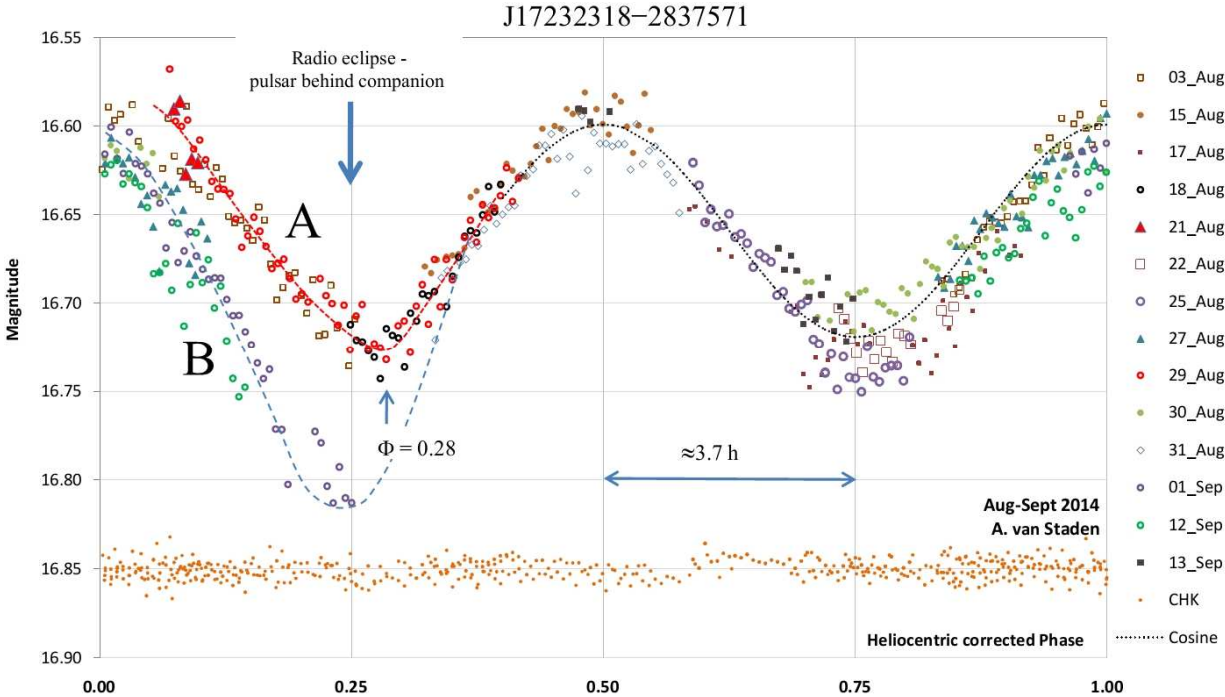
Speaker: Dr Abhijit Saha (NOAO)

Date: 25 September

**Table 1. Parameters for PSR J1723–2837**

Parameter	Value
Right ascension (J2000)	17:23:23.1856(8)
Declination (J2000)	−28:37:57.17(11)
Spin frequency, $f$ ( $s^{-1}$ )	538.870683485(3)
Timing epoch (MJD)	55667
Time of ascending node, $T_{asc}$ (MJD)	55425.320466(2)
Projected semi-major axis, $x$ (s) <sup>a</sup>	1.225807(9)
Orbital frequency, $f_b$ ( $s^{-1}$ )	$1.88062856(2) \times 10^{-5}$
Orbital frequency derivative, $\dot{f}_b$ ( $s^{-2}$ )	$1.24(4) \times 10^{-18}$
Orbital frequency second derivative, $\ddot{f}_b$ ( $s^{-3}$ )	$-2.6(3) \times 10^{-26}$
Spin period, $P$ (ms)	1.855732795728(8)
Orbital period, $P_b$ (d)	0.615436473(8)
Companion mass range ( $M_\square$ ) <sup>d</sup>	0.4–0.7
Orbital inclination angle range (degrees) <sup>d</sup>	30–41
Distance, $d$ (kpc) <sup>f</sup>	0.75(10)

$a_x = a \sin i/c$  where  $a$  is the semi-major axis and  $i$  is the orbital inclination angle.



**Fig. 2. Light curve of the companion to PSR J1723-2837. Measurements of a check star were plotted below the curve (Orange dots).**

Irregular patterns in the LC shape were observed around  $\phi \sim 0.0$  to  $\phi \sim 0.3$  as a function of time. Furthermore, it appears that the flux variation follow two distinct “tracks” (see fig.2, **A** and **B**), however more observations are necessary to confirm this.

If we consider “**B**” as integral part of the LC, then we have two asymmetric minima and the slight increase in signal at the pulsar inferior conjunction ( $\phi \sim 0.75$ ) suggesting that irradiation is enhanced by the pulsar flux onto the companion surface according to the current theoretical models. (See for example: “The red straggler companion to PSR J1740–5340”; (Orosz 2003)).

The heating effect in this case will be marginal while the optical modulation of the companion is dominated by ellipsoidal variations.



Surprisingly, on 3 nights the LC flux follows a slower decline from  $\phi \sim 0.0$  to  $\phi \sim 0.25$  (see “**A**”) with a minimum now at  $\phi \sim 0.28$  and then rapidly increases and merge with previous sampled data points.

In order to rule out some systematic errors, a check star was plotted below the LC (see fig. 2 – orange dots) and a standard deviation of 0.00535 magnitude was calculated. Overplotted is a cosine function,  $\cos(\phi 4\pi)$ , (see fig. 2 – black dots) that best resembles the LC data.

### Discussion

In the last few years, optical observations of binary millisecond pulsar systems have been used to great effect. PSR J1723–2837 is a very interesting object that could experience a switch to an accretion disk state. As the nearest such system it provides the best-suited target for studying the transition process of MSPs from accretion to rotation power (and vice versa) and the circumstances surrounding (Papitto, 2013). Additionally the companion star at  $\sim 16$  magnitude puts this within reach of many amateur telescopes which can then contribute valuable data.

In this report I presented a LC and clear evidence for tidal distortion in the compact binary system by comparing observed results with those of similar studies. Additionally, modelling of the LC can be utilized as a means to constrain system parameters including the mass of the neutron star [Schroeder, 2014].

The observed irregularities in the LC are spectacular but inconclusive. More detailed observations may better characterize the observed phenomena: for example, are the irregularities periodic and how does the period relate to other parameters; is there a progression between “track”- **A** and “track”- **B**; are there smaller anomalies in other parts of the LC? This in turn may help to resolve some of the outstanding issues in current research on binary millisecond pulsar systems.

### References

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### Related Titles

- X-ray and  $\gamma$ -ray studies of the millisecond pulsar and possible x-ray binary/radio pulsar transition object PSR J1723–2837.  
PSR J1723–2837: An eclipsing binary radio millisecond pulsar.  
The eclipsing millisecond pulsar PSR J1740–5340 and its red straggler companion.  
The optical companion to the binary millisecond pulsar J1824-2452H in the globular cluster M28.  
Swings between rotation and accretion power in a binary millisecond pulsar.  
Observations and modeling of the companions of short period binary millisecond pulsars: Evidence for high-mass neutron stars.