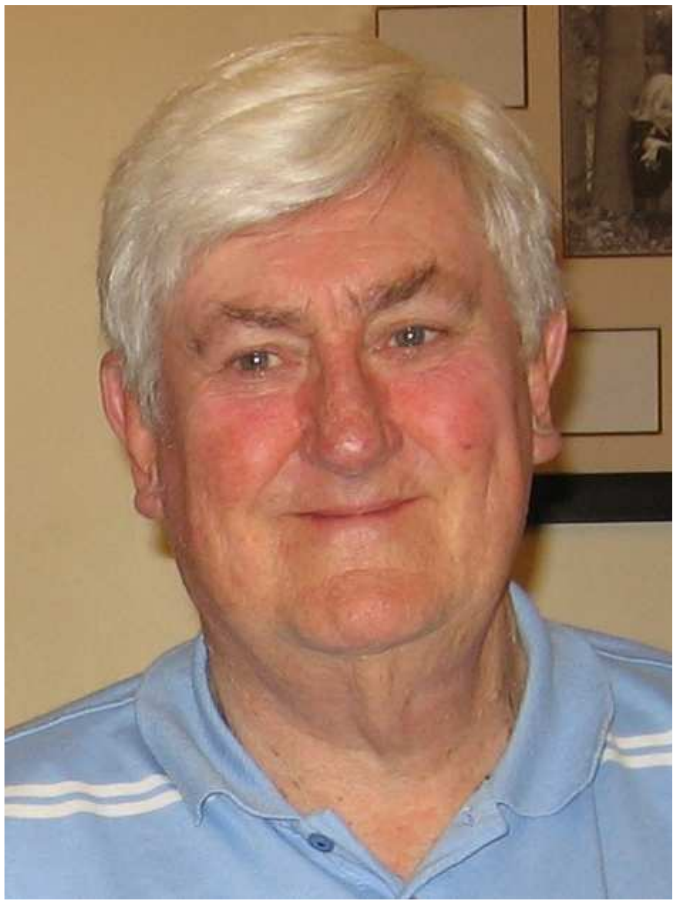
ISSN 0024-8266

mnassa

monthly notes of the astronomical society of southern africa

Volume 75 Nos 11 & 12 December 2016



In this issue:

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CONTRIBUTIONS	*MNASSA* mainly serves the Southern African astronomical community. Articles may be submitted by members of this community or by those with strong connections. Else they should deal with matters of direct interest to the community**.** *MNASSA* is published on the first day of every second month and articles are due one month before the publication date.
RECOGNITION	Articles from *MNASSA* appear in the NASA/ADS data system.

Cover picture: Anthony Barry Jones, ASSA stalwart, who died 23 November 2016. A full obituary will appear in the next edition of MNASSA.

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Vol 75 Nos 11 & 12 December 2016

Editorial

There was a time when enthusiastic, passionate and dedicated amateur astronomers, with modest, often 'home-made', equipment could contribute to 'real' astronomy through the discovery of Comets, Novae, SNe, work for the Minor Planet Centre, MPC and contribute to the American Association of Variable Star Observers, AAVSO. But the advent of a plethora of survey telescopes, digital technology and computer driven data reduction has all but nullified the amateur's ability to still contribute to such discoveries and data.

They can of course still contribute to, or discover, other random 'once off' events such as meteors, fireballs and bolides, in addition to the occasional occultation. Other activities that still involve some amateurs are that of monitoring double- and variable-stars, but the number of these is dwindling.

But amateurs can now also take advantage of this digital technology and readily available software, and are doing so, by producing some amazing images, able to do some really good photometry, and more recently spectroscopy as well. So it appears that the role that amateurs can now take has shifted from 'discovery' to 'monitoring'.

Often, major observatories make a discovery and study an object for some time, after which it could well need more continuous monitoring. A good

example of this is monitoring the jets of the micro-quasar known as SS433, through a worldwide network of small telescopes.

What this then requires is knowledge of the telescopes that are being used in South Africa; including some technical details such as what equipment and skills are available. It is becoming clear that at present photometric and spectroscopic capacity within the ASSA is rapidly expanding and improving and one is looking forward to these soon being able to contribute to science.

What is also required from the professional Astronomers and Observatories is input as to which objects need monitoring, how frequently and with what size of telescope and what other equipment is required.

It is accepted that many amateurs have particular interests such as astrophotography, observing the planets or deep sky objects on a regular/continual basis. But on occasion there may be an important occultation, or other significant observation, that requires a wide network of telescopes in a particular region on Earth, and hence knowing the position and capacity of the SA Amateur Observatories becomes important; it would enable many amateurs to contribute to astronomy.

So the long term strategy would for *MNASSA* to first 'catalogue' as many of the amateur observatories in SA as possible; i.e., what we are trying to do in this issue. This is not to exclude many outstanding observers who do excellent work without an observatory! It is intended that subsequent issues will be able to include these in the database as well, but one has to start somewhere!

Then follow that up with an edition that describes the sort of work that these amateur observatories have done, results achieved to indicate the skills that are available. And, as has been done in the past, future issues of

MNASSA will publish the work of these other observers as well: we need to create a database of ASSA observers.

But before any of this can be done, there needs to be an improved communication between professional and amateur astronomers. Professionals need to know what amateur equipment is capable of with modern digital technology. At the same time amateurs want to know what needs to be monitored and develop the required skills to optimise their telescopes and equipment.

With that in mind it is intended to plan, and hold, a Symposium, to bring together professional and amateur astronomers to describe their work and so hopefully find areas in astronomy where, and how, amateurs can contribute. There must be a way that the advance of modern, digital technology and readily available software, could be exploited for the benefit of astronomy by both amateur and professional astronomers.

SALT's excellence and achievements recognised by DST

Cape Town, 12 December - The Southern African Large Telescope (SALT) welcomes the 2016 Science Diplomacy Award given by the Department of Science and Technology as a result of the telescope consistently contributing to globally significant discoveries in astronomy. Science diplomacy is the use of scientific collaborations among nations to address common problems and build constructive international partnerships. The Science Diplomacy Awards recognise excellence and achievements in international scientific cooperation.

"This award recognises the scientific success of SALT, which is obtaining high-quality observations of the cosmos every night and distributing this information to partners around the world, expanding our understanding of the universe in which we live. This success is due to the ingenuity and dedication of a world-class team of South African and international

scientists, engineers, and technicians who designed, built, and operate SALT. The telescope inspires a generation of young South Africans to dare to dream big, and to have the confidence and skill to bring those dreams into reality", says Professor Ted Williams, the director of the South African Astronomical Observatory.

The Southern African Large Telescope has recently celebrated 11 years since its construction and inauguration in 2005. SALT is a 10 metre class telescope located in Sutherland in the Northern Cape. It has been in full science operations for 5 years, with its consortium of partners from South Africa, Poland, the United States, Germany, New Zealand, the United Kingdom and India who have made the building and operation of the telescope possible.

There are more than 150 international peer-reviewed scientific papers published thus far based on SALT data. Recent contributions of SALT to science include the discovery of the brightest supernova ever found and the unveiling of a massive supercluster of galaxies. The trend of SALT's science output parallels that of other large international telescopes. However comparing operation costs, SALT produces science more cost-effectively than any other 10 metre class telescope. Numerous students are getting trained locally and internationally.

Since the building of SALT, the South African Astronomical Observatory has been actively involved in astronomy outreach by sharing scientific discoveries with the communities across South Africa with particular focus in Sutherland and Cape Town which is where our operations are located. As such, both locations have a thriving community engagement programme involving schools, teachers and society. Additionally, many visitors to Sutherland get an opportunity to see the telescope during the day.

Mr Sivuyile Manxoyi, who is the head of SALT Collateral Benefits Programme says, "The building of SALT has not only contributed to science

research advancement, but to socio-economic development in Sutherland and nearby towns through tourism. The other major benefit is education and outreach in science, which we continue to implement nationally. SALT continues to serve as an inspiration and to instil confidence that our country and its people have the potential to excel in science and technology."

News Note: KBO Occultation

The note below is extracted from an e-mail sent to Willie Koorts by Dr Amanda Sickafoose, SAAO and MIT, after I had started getting the details of as many amateur Observatories in South Africa as possible (see Editorial). By coincidence this also ties up with a longer term strategy leading up to an ASSA Symposium in March 2018, whose theme will be:
Amateur Astronomy in the Digital Data Age: How Amateurs can do real Science.

The aim here is to try to find space for amateurs to contribute to/support professionals by doing observations for which they don't have time or are in the wrong place! I feel that the note below fulfils this role neatly. Something active ASSA members can look forward to. Obviously detailed information will be forthcoming – this is just to wet your appetite!

"The New Horizons spacecraft has been funded for an extended mission. They have identified a Kuiper Belt Object, KBO, by which there can be a close flyby on 01 January 2019. The target in question is known as $2014MU_{69}$. Obviously, between now and the flyby, everyone is interested in getting as much information as possible about this KBO. This is likely the one chance in our lifetimes to explore the outer Solar System in situ!

There are three stellar occultations by $2014MU_{69}$ that the New Horizons team has predicted for next year. These events are extremely challenging, with the angular size of the target being well under a tenth of an arcsec

(thus a very thin shadow path on the Earth) and a fairly large error in the predicted shadow path location. KBO 2014MU_{69} is so faint that they have only imaged it and measured a few positions using Hubble. The first predicted stellar occultation, in early June 2017 by a 15th magnitude star, falls over Southern Africa.

We are trying to put together a list of telescopes in Southern Africa that might be available to attempt to observe this predicted stellar occultation. Would you be able to help me compile such a list, and/or recommend people whom I can contact to add to the list? The larger the telescopes the better, but it wouldn't hurt to know of telescopes down to ~8-inch or so. We need to know their location(s), or whether they can be portable. The question of instruments and observers is separate — my MIT group combined with the French group and the New Horizons team has access to a significant number of portable camera systems, and we have many interested observers who should be available to work with local ASSA members".

Private Observatories in SA

What qualifies as a Private Observatory? Originally the idea was that any telescope (irrespective of aperture or type) that is housed in some sort structure and used for regular astronomical observational purposes does.

But then, as is always the case, there were the odd ones. Those who worked in a structure (a room) with an instrument outside, from where data was collected: in some cases a radio dish (antenna), in others a digital detector. Others stored their instrument in a shelter/cover and wheeled it out, or uncovered it, to do their work. Finally there were also mobile facilities, and since professional astronomers had these, (SOFIA, space telescopes, balloon borne instruments) why should amateur mobile facilities not qualify?

So this edition will start with the more “traditional” concept, along with a couple of uniquely different ones that have already made significant contributions to astronomy, and future editions will accommodate others, as and when they become known. There are also many “observatories” with fine instruments that are used primarily for tourists and casual sky watchers, but seldom do any “real” observing*. As I’ve mentioned before, there are always exceptions, and when I am informed about these and the work they do, they will of course be added.

* *These I will only mention without any further comment, as MNASSA cannot start promoting them, but to simply increase awareness of what instruments are available.*

Many of you have sent material to me, much of which I have kept back for the next edition, which will focus on the work these private observatories have done – a lot of which is quite remarkable. It has not been ignored it’s just that I found it more appropriate; there simply wasn’t space to do both in one issue.

It is hoped that in future, as more material comes in, this topic can be expanded. Remember time is there to prevent everything happening at once!

Klein Karoo Observatory

Berto Monard **(***bmonard@mweb.co.za)*

1 Location: Situated close to the R62 route near the small town of Calitzdorp in the Western Cape. Uses a Roll-off roof

Longitude: 21^{o} 40’ 47.3” E
Latitude: 33^{o} 32’ 04.0” S
Elevation: 230 m

2 Telescope: Uses two telescopes, a Meade RCX 400 of 30cm aperture and another Meade RCX 400 of 35cm aperture, both permanently polar mounted on piers.

3 Instrumentation: They both have attached SBIG ST8-XME CCD cameras and on the larger scope is an Optec filter wheel IFW with BVRI filters. Both observing systems are PC controlled in the observatory, and overseen by a main PC in the house via a cable connection.

Figs 1 & 2: Klein Karoo Observatory of Berto Monard.

4 Background: The Klein Karoo Observatory (KKO) is the successor to the Bronberg Observatory, which was located east of Pretoria and operated over the period 2001-2010. See *MNASSA* . **70** Nos 1 & 2, February 2011.

A new observatory was erected early in 2011 and SN searches were resumed from the new environment, one as it would turn out, with unpredictable weather and often bad seeing. At the Klein Karoo Observatory in Calitzdorp light pollution is minimal but open skies are less frequent with an average of less than 25% over the year.

5 Observing programmes

5.1 Time series photometry of cataclysmic variables (CV):

Time series are continuous observations by tracking a single star field, containing the object of interest, over several hours and is specifically of interest in the study of cataclysmic variables (CV). Most of these

observations are done in cooperation with the CBA and VSNET networks and in many cases triggered by sudden transients, often erupting CVs, reported in alert notes by one of the large survey groups. Specially mentioned must be the observations of bright microlensing events over peak in collaboration with the uFUN network from the Ohio State University.

5.2 Snapshot observations of magnetic CVs and symbiotic stars

Snapshots observations of objects and star fields (faint stars, deep sky objects) show the objects as they are on that moment. To get detailed and 'deep' views on those targets, many consecutive exposures are acquired, which are stacked to produce a deep resulting image. Snapshots at regular epochs will show gradual change in variable stars and other objects.

They are monitored once or twice monthly, unfiltered. The intention of the observations is to derive long term light curves and study possible periodicities of low and high activity behaviour.

This project started in 2004 with filtered observations in V only. I band observations were added in 2013. Observing cadence is weekly or monthly based on variability and perceived importance of the object. The symbiotic star monitoring project has now turned into one of the main priority observing programmes at KKO.

5.3 Discovery observations:

More than 100 supernovae were discovered from the Bronberg Observatory. Those were pioneering years for such discoveries and gave international recognition to that observatory.

After 2010 and the start of the KKO, many more observers and observing groups also got involved in SN searching using larger and automated telescopes. Sky surveys organised by Universities and professional groups

and in later stages the prompt automatic data processing via subtraction photometry shifted the discovery success nearly fully away from dedicated amateurs.

Despite this competition 35 more SNe were discovered from the KKO up to 2016, 20 of those in the first two years, 2011 and 2012. As surveys started their auto-productive searches, discovery tallies at KKO dropped and efforts gradually diminished and shifted.

Cederberg Observatory

Private Consortium

1 Location: High in the Cederberg Mountains, 240 km north of Cape Town, on the farm Dwarsrivier.

Longitude: 19^{o} 15' E
Latitude: 32^{o} 30' S
Elevation: 885 m

2 Telescope: A variety:

2.1 400mm Meade Newtonian in a Dome
2.2 300mm Meade SC
2.3 450mm, 350mm and 300mm Dobsonians
2.4 300mm Cassegrain and 100mm refractor in an Angular dome
2.5 Assorted other telescopes

3 Instrumentation: Most partners use DSLR cameras on their telescopes.

Fig 1. General view of Cederberg Observatory.

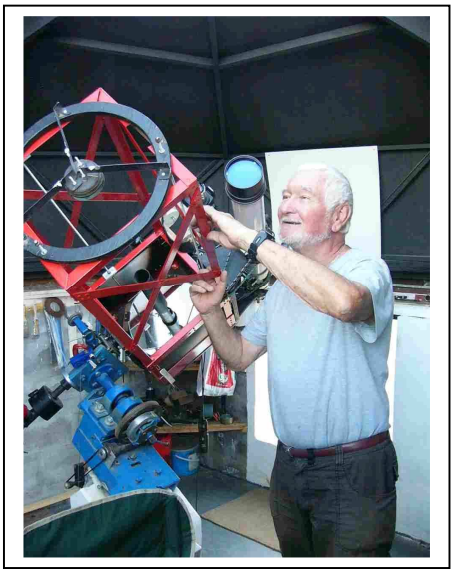


Fig 2. Chris Forder in his dome.

4 Background: The Observatory is privately owned and is a non-profit organization run by seven partners. The observatory was first established in 1984 by Dr Peter Mack and two friends who built the first dome, laid foundations for another two buildings and fenced the site which is located on the road to the Maltese Cross just north of Dwarsrivier Farm in the Cederberg Conservancy area. When Dr. Mack's contract at SAAO expired, he sold the Observatory to five amateur astronomers and this number was later increased to seven. The current Observatory buildings include 2 revolving domes, two accommodation buildings (one with a slide off roof observatory at one end) a store room and an ablution block. Additional development is being planned.

5 Activities: The partners' interests vary from astrophotography and CCD work to measurements of variable stars and occultations. A few hours are set aside each Saturday night for the general public to visit.

The seven partners now take it in turns to staff the Observatory at most weekends, omitting only those near to full Moon, although this can sometimes be consecutive weekends if full Moon is in the middle of a week. A public open night is arranged for the Saturday evening, usually starting at 20h00.

Centurion Planetary and Lunar Observatory

Clyde Foster (clyde@icon.co.za)

1 Location: Wierda Park, Centurion, Gauteng

Longitude: 28° 04’ 48” E
Latitude: 26° 16’ 48” S
Elevation: 1 470 m

2 Telescopes: Several:

- Celestron 14” Edge HD SCT, permanently mounted
- Celestron CGE Pro, German equatorial mount, polar aligned on pillar mount.
- Meade 12” LX200 ACF SCT
- Meade 10” LX200 Classic
- 110mm Williams Optics FLT F/7 refractor on ZEQ25GT iOpton mount
- 82mm Williams Optics F/7 refractor

3 Instrumentation:

- JMI PC Focus system, laptop controlled
- Xagyl slimline Filterwheel, with Baader Filterset, laptop controlled
- Various ZWO cameras: ASI 120MC and MM, ASI 224MC, ASI 179MM, ASI 290MM and MC
- Canon 60Da DSLR

(left) Fig 1. Observatory before observing. (right) Fig 2. Observatory with roof open.

4 Background: The observatory was first constructed in 2010 in the back garden of my property in Wierda Park, Centurion, to house a permanently mounted Meade 12” f/10 LX200 SCT. A 1 m^3 block of

concrete was initially set in the ground below the planned observatory area to provide the base for the pillar mount. A Keter garden shed was purchased with two extension sections to allow for additional space and this was erected on interlinking paving blocks set in a sand base. A hole was cut in the floor to accommodate the pillar mount and to ensure that floor movement did not create any movement on the pillar mount. Sections of the standard roof were removed and a manual roll-off roof structure was fabricated. This arrangement however did limit sky coverage.

The pillar mount was fabricated from an 8” pipe section with a plate as base, allowing for levelling on 3 chemical anchors set in the concrete base. Once in position, the pillar was filled with concrete in order to provide additional mount weight and stability.

With the purchase of a new Celestron 14” Edge HD SCT towards the end of 2013, a decision was taken to upgrade the roll-off roof arrangement using a carport type structure with a motorised pitched roof arrangement. The new roof allows for open sky above the walls of the observatory. The roof is powered by a standard gate motor system and activated by a normal remote.

An aluminium adapter piece was machined to accommodate the new Celestron mount onto the existing pillar mount. The telescope and auxiliary equipment are controlled by a laptop with auxiliary screen. A USB hub is utilised to connect auxiliary equipment to the laptop. The observatory has the capability to be remotely controlled, with the exception, at present, of the roll-off roof.

5 Observing programmes

Due to the fact that this is an urban/suburban location, the primary work done from the observatory has been high resolution Solar system imaging, with particular emphasis on Mars, Jupiter, Saturn and the Moon.

La Marischel Observatory

Lucas Ferreira (*lucas@lucasastronomy.co.za*)

1 Location: On the farm La Marischel in Blanco on the outskirts of George in the southern Cape.

Longitude: 22° 23' 24.6" E
Latitude: 33° 56.5' 55" S
Elevation: 130 m

2 Telescope: 300 mm Meade LX 200 ACF/GPS SCT mounted on a pier. It is fully computerized and able to track any object. The Roof is in two parts and slides open to the sides.

3 Instrumentation: ACF Advanced Coma Free Optics – Pin point Stars all the way to the edge, GPS equipped mount with GoTo, AutoStar II Controller with 145 000 object database, an ideal Astrophotographer's telescope. Meade UHTC, Primary Mirror Lock - locks the mirror in place preventing movement during long-exposure astrophotography. Accessories range from multiple eyepieces, adapters and filters to advanced CCTV camera and Astro photography equipment.

(left) Fig 1. Meade LX200 (300mm). (right) Fig 2. La Marischel Observatory, general view.

4 Background: Got permission from the farm owners to construct a simple “cube” with a split slide off roof. Because the Observatory is located just outside the city, there are good dark skies. The best weather is usually in the winter months, when the cold fronts sweep the sky clean of dust and particles, also bringing with it cold and dry air. A big problem because of the surrounding mountains and George’s location being so close to the coast, is dew! On the most stunning of clear night skies/evenings you can quickly be overwhelmed by the dew and the high humidity. This means you having to pack up early as to avoid any damage to your telescope and equipment. It also means that good dew caps are essential. Good weather days are rare in George, and a good clear evening is not put to waste when it does present itself. I am yet to find a weather site that can forecast George’s weather even close to what the actual conditions are on certain days. Clouds can sometimes hover around for days.

5 Observing programmes:

No fixed programme as such, but the main interest is in astrophotography. It serves as the main Observatory to the Garden Route Astronomical Society's Centre (GRASSA), as all paid up members has the privilege to observe the night sky free of charge at the Observatory thru the large telescope. Star Tours to the public are available, but strictly by appointment. Have done some International Collaborations on parallax measurements, see *MNASSA*, Vol 68 Nos 5 & 6, June 2009. Also:
D Cenadelli, M Zeni, A Bernagozzi, P Calcidese, L Ferreira, C Hoang and C Rijsdijk **An international parallax campaign to measure distance to the Moon and Mars**, *Eur. J. Phys*. 30 No 1 (January 2009) 35-46

Sterkastaaing Observatory

Magda Streicher (*magdalena@mweb.co.za*)

1 Location: In Polokwane, Limpopo province.

Longitude: 23° 28’ 18” E
Latitude: 23° 53’ 54” S
Elevation: 1 311 m

2 Telescope: 400 Schmidt-Cassegrain – Focal Length 4064mm (f/10) mounted on a fixed pier.

3 Instrumentation: A wide variety of eyepieces

- 2” Super wide 40mm, 101.6x magnification, 31.7 arc min.
- 2” Super Wide 32mm, 127x magnification 26 arc min.
- 2” Ultra Wide 14mm, 290x magnification, 17.4 arc min.
- 2” Ultra Wide 8.8mm 462x magnification, 10.9 arc min.

When observing double stars an Astrometric Eyepiece 16” is used. Length of scale is 315 arcseconds or 6.3 arcseconds for each of the scale divisions. The arcminutes of scale is 5.25

(left) Fig 1. 400mm Meade on pillar.

(right) Fig 2. Rooftop observatory with sliding roof.

Fig 3. Working space showing the wheeled desk holding eyepieces.

4 Background: The Observatory's name is "Sterkastaaing". It is a bushveld tree name in Afrikaans, but in English it means African Star Chestnut Tree. It was constructed in 2007 on top of our home, and the roof slides down by the means of an electric motor, making it user friendly**.**

5 Observing programmes

Mainly do deep-sky observations in depth to fill in on data basis to write reports and articles. Objects are sketched. A wheeled desk and chair are used so that the equipment can be wheeled into position around the telescope. The desk has been fitted with a red light, magnifying glass, holes for the eyepieces and a place for books, star maps and other working equipment.

Editor's note: Magda is well own for her excellent deep sky articles and her beautiful sketches; a regular feature in *MNASSA* for many years. See almost any edition of *MNASSA* and look for "Deep Sky Delights".

Henley on Klip observatory

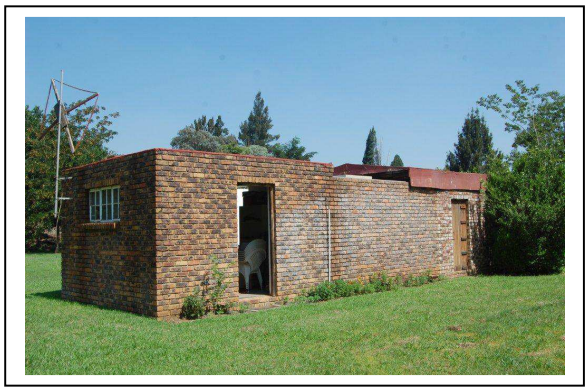
Brian Fraser (*fraserb@intekom.co.za*)

1 Location: Henley on Klip

Longitude: 28° 06' E
Latitude: 26° 32' S
Elevation: 1 478 m

2 Telescope: 300 mm Meade LX200

3 Instrumentation: Current observing is restricted to timing of lunar occultations through a webcam attached to the eyepiece of the telescope. The image is recorded on a computer together with the time signal and played back later at leisure. A time signal is obtained from a special short-wave radio receiver tuned to the WWV time service. The observatory also houses a solar flare monitoring receiver which runs 24/7. This station has detected many solar flares and at least one GRB.



(left) Fig 1. Meade LX200 300mm aperture. (right) Fig 2. Observatory.

4 Background: This observatory has existed for more than 30 years, in various guises and locations. It started out on the roof of some outbuildings of my home in Kensington. It then moved to Sunninghill into a custom-designed and built observatory on top of a garage.

For the past 15 years it has been in Henley on Klip (HOK) , in a specially built home consisting of two rooms each 4m square. One is the observatory with a roll-off roof and the second room serves as an office/study.

About 4 years ago the telescope was replaced with a 300 mm Meade LX200 in order to catch occultations of fainter stars.

5 Observing programmes

An 8 inch Celestron C8 with motor drives and electronic setting circles, was used mainly to observe one star, Delta Sco, photometrically, in a project that started when the star suddenly brightened in 2000. Other Be stars were also observed together with a sprinkling of variables and novas. Another observing activity was timing of lunar occultations and minor planet occultations and a few grazing occultations were observed.

Currently observing activities include Variable stars, mainly Be stars.
Novas, other variable stars in the AAVSO program, Lunar occultations, Minor planet occultations, Grazing occultations. In addition, other events of interest observed, and of course the transits of Venus and Mercury and various lunar eclipses and partial solar eclipses.

Numerous papers have been printed regarding observations made at this observatory. These cover mainly minor planet observations and photometric observations of Delta Sco. An article on the observed GRB was printed in *MNASSA*, Vol 72 Nos 5 & 6 June, 2011.

The observatory has hosted many school groups, church groups and adult special interest groups.

Archer Observatory

Barry Dumas (*bdumas@live.co.za*)

Location: Parow North, Western Cape.

Longitude: 18^{o} 34’ 57.8”
Latitude: 33^{o} 53’ 21.1”
Elevation: 75 m

Telescope: Meade LX90GPS 12” in Roll-off roof

Instrumentation: Canon 550D, Canon 60 DA, assorted filters and eyepieces

Background: The Archer Observatory is actually a combination of a study as well as an observatory and was completed in 2014.

Activities:

(left) Fig 1. Meade LX90GPS 12-inch (right) Fig 2. Study-Observatory

Overbeek Observatory

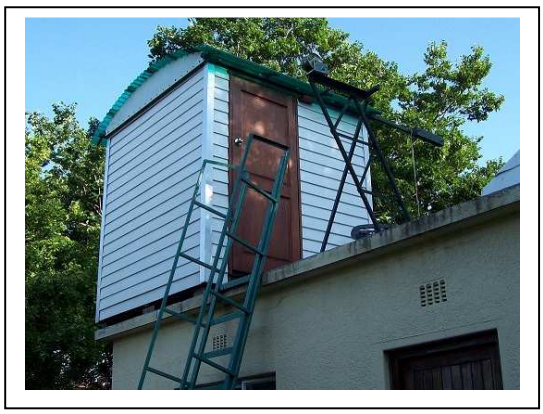
Andy Overeek (*a.overbeek@gmail.com*)

1 Location: 60 Edward Drive, Dowerglen, Edenvale, Gauteng.

Longitude: 21^{o} 40’ 47.3” E
Latitude: 33^{o} 32’ 04.0” S
Elevation: 230 m

2 Telescope: On an Orion Atlas Mount (EQ6) are an Orion 80 mm apochromatic refractor and an Explore Scientific 127 mm chromatic refractor housed in a cubic structure with a tip-off roof.

3 Instrumentation: SBIG ST-2000XCM CCD Camera



(*left) Fig 1. Orion 80mm apochromatic refractor. (right) Fig 2. Refurbished observatory.*

4 Background: When he inherited his father's (Danie Overbeek,) house in 2001, the observatory wasn't quite as trim as it was in 1972 when he built it. It was built on the flat concrete roof of an outside room and the observatory was accessible by a sturdy angle iron ladder. The Masonite walls had started to lift from the bottom and the observatory was looking a bit shabby and needed to be renovated. It had survived the elements very well for nearly thirty years. It could be repaired or rebuilt. The latter course was chosen, and it was decided to increase the cube from 2 m to 2.2 m. The old Dall-Kirkham Cassegrain and its mounting were removed. The new structure was built on ground level and then dissembled and it was reassembled on the roof! As the tip-up roof design had proved to be successful, it was decided to keep the basic design the same.

5 Observing programmes

Mainly astrophotography and recreational astronomy.

Overberg Observatory

(IAU Code 641)

Andre van Staden (*andre@etiming.coza*)

1 Location: Overberg Observatory is located in the Western Cape on the outskirts of the town of Bredasdorp,

Longitude: 20° 01' 37.2" E
Latitude: 34° 32' 08.8" S
Elevation: 82 m

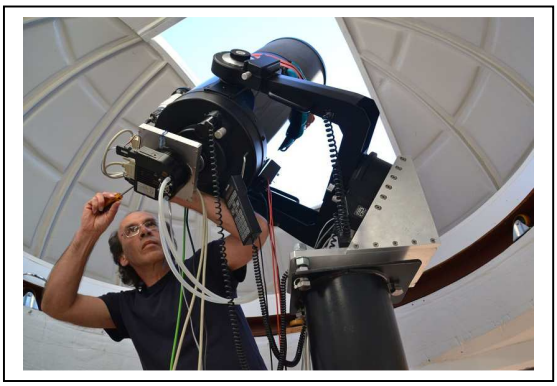
2 Telescope: 300 mm Cassegrain polar-mounted on a locally made latitude wedge. Operations are performed over a LAN network from an adjacent room where most of the observations can be performed autonomously during the night with Maxim DL software.

3 Instrumentation: a commercial SBIG ST9e CCD camera with 3-stage cooling normally operates at −15 °C on the sensor surface. Guiding corrections are performed with the integrated tracking CCD. A low-light Watec 902H Video camera and wide angle lens is mounted on the main tube assembly for real-time related views. A custom made shutter system is attached between the camera and the telescope, allowing for precisely timed strobing experiments.

Timing is normally derived from PC time which is synchronized to an international time server. For more time critical applications a GPS master clock was built, providing accuracies in the microsecond range.

Luminosity of stars is frequently determined by differential ensemble-type aperture photometry, computed with CMunipac/Muniwin, a public photometry program. Astrometry is computed with Astrometrica in combination with USNO-B1, URAT1 and ACAC-4 star catalogues.

4 Background: The new upgrade included polar mounting of the telescope, a water-cooled Cookbook camera (CB245), and the ST4 CCD configured as a star tracker with the capability to do astrometry measurements for the Minor Planet Centre (MPC). After producing consistent accurate astrometry measurement for some time, the IAU recognized the observing site in 1999 to be a "permanent" observatory site, designated as 641-Overberg.



(left, above) Fig 1. Fine-tuning the 300mm Cassegrain. (right, above) Fig 2. The home-made 2m dome.

Fig 3.

During 2006-2009, a permanent domed observatory was constructed that currently houses the 300 mm Cassegrain telescope. The observatory building is 2m x 3.5m and has access to the sky by means of a self-made 2m rotating fiberglass dome. The floor of the observatory was elevated by 1m in order provide a clear sky view avoiding nearby obstructions. To obtain the required telescope stability, a metal pier was cast inside a concrete pillar under the observatory floor, attached to a $1m^3$ concrete block below ground level. This replaced the earlier setup consisting of a 20cm SCT on a tripod with an SBIG ST4 camera that were used for observing comets (mounted on a trolley that could be wheeled out for observing).

5 Observing programmes

Due to the large coverage of sky surveys, astrometric work has been scaled down, with the focus now on photometry. There are many instances where amateurs are in favourable positions to contribute valuable photometry to professional astronomers or run their own observational campaigns. Some of the projects done at Overberg included:

- Astrometry measurements contributed to the Minor Planet Centre (IAU) with one credit for a MP discovery.
- Occasionally, newly discovered asteroids may have an orbit that results in a close fly-by to earth (known as NEO's). In 2002, we demonstrated with amateurs in Verona Italy (OBS 560) during a close approach of the newly discovered Asteroid 2002NY, that we can calculate the distance to the asteroid by means of the parallax method. We compare our results with RADAR measurements and data from JPL, finding them to be in surprisingly good agreement.
- Pulsars are very interesting objects but are unfortunately very dim in the optical band and are mostly studied in radio or shorter wavelengths above the atmosphere. However, the Crab pulsar is a fast rotating neutron star, producing bright optical flashes at 33 times per second. In an experiment at Overberg Observatory, it was demonstrated that a light curve of one rotation period from the Crab pulsar is measurable with a 20mm telescope and CCD camera.
- Another method of studying Millisecond pulsars is by measuring the optical light curve of the companion star from the binary system because of the interaction between the two stars. A few of these binary systems have companions with luminosities well in range of amateur equipment and amateurs can monitor these systems more frequently than professionals who have limited allocations of observing time. In a recent (and ongoing) observational campaign at Overberg, a study on one of these stars revealed much more activity than previously known, resulting in a number of articles and papers in preparation.

The Telescope at the foot of Table Mountain

St Cyprians School (*head@stcyprians.co.za*)

1 Location: At the foot of Table Mountain in the grounds of St Cyprian's School in Oranjezicht, Cape Town.

Longitude: 18° 24' 57.0" E
Latitude: 33° 56' 31.7" S
Elevation: 90 m

2 Telescope: 0.5 metre Ritchey-Chrétien reflector with special high reflectivity (97%) coatings.

(left) Fig 1. The dome (right) Fig 2. 0.5m Ritchey-Chrétien telescope (photos: M. Soltynski).

3 Instrumentation: The telescope is equipped with a high-throughput fibre-fed spectrograph which uses a Volume Phase Holographic (VPH) grating

A normal grating has a pattern of etched lines (alternately transparent and opaque) and the light passes through and diffracts in a clear way. A VPH grating instead has a pattern in refractive index, not in transparency, so while the same diffraction process takes place essentially none of the light

is lost. This means that the throughput of light through the instrument is consequently much higher.

4 Background: There are five Global Jet Watch observatories located around the world. Others are in India, Chile and Australia which means that objects can be monitored 24/7 – idea for short periodicity events.

5 Observing programmes

The Global Jet Watch project was instigated to explore the time-domain astrophysics of phenomena that vary on timescales of hours and days. One of our key science goals is to explore how matter behaves in the vicinity of the black holes that are at the hearts of microquasars in our Galaxy.

The telescope at St Cyprian's is also used occasionally for astronomy outreach for school pupils.

Fisherhaven Small Telescope Observatory

Johan Retief (*johanretief@gmail.com*)

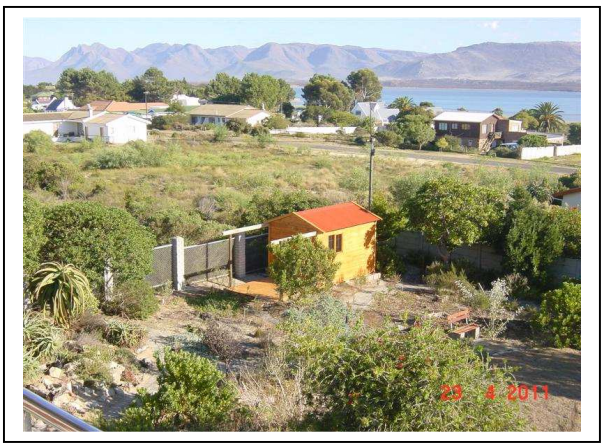
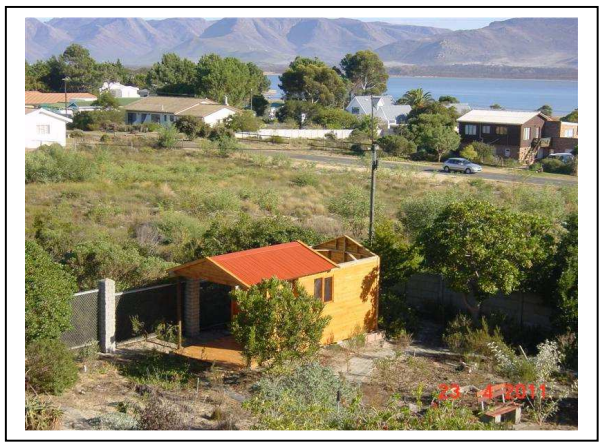
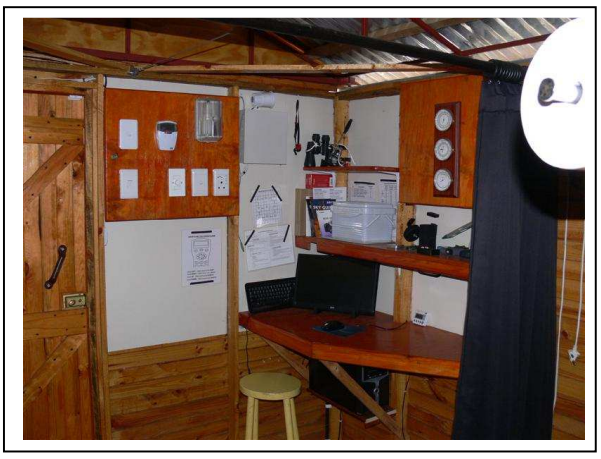
1 Location: Fisherhaven, near Hermanus

Longitude: 19^{o} 07' 48" E
Latitude: 34^{o} 21' 31" S
Elevation: 23m

2 Telescope: A 180 mm Maksutov and a 100 mm Refractor both can be fitted on the HEQ5 mounting with computer control.

3 Instrumentation: Canon DSLR The camera can be fitted piggy-back, in prime focus or in an afocal position on the telescopes as may be required for the image. Fields of view have been calibrated accordingly.

Figs 1-4. Views of Fisherhaven Small Telescope Observatory


4 Background: Having retired from the SA Navy, the move from Pretoria to Fisherhaven was about as far as one could get away from Pretoria and not fall off the edge of the RSA, and not be crowded in by mountains. Joined the Hermanus Astronomy Club and was the proud owner of an old 76 mm Polarex refractor. Found that this was inadequate and so bought some new telescopes. Observing in the open was cold and insecure, so it was decided to build an Observatory. A modified Wendy House with a roll off roof was the cheapest option. To avoid tripping over tripod legs, a 180 mm 2 100 mm machined pine pole was cast into large concrete block and topped with a SS fitting for mounting the telescopes. The height of the pier is such that I have a 360° view at an elevation of 30°, which I find to be sufficient for my purposes.

All power is distributed from the power board in the admin bay: 220V AC lines from the board's front and 12V from inside the power board where a 12V 17 Ah deep-cycle battery is housed as well as an intelligent battery charger. The 220V supply drives the observatory lighting, the computer and the external power supply to the camera. The 12V system is required to drive the telescope mounting as well as a 4 x 4 winch mounted in the roof to open and close the roof.

The bulkheads of the admin bay are shielded on the inside with galvanized flat iron sheets to keep the damp out, it is also handy for magnets to hold notes. The telescope bay is separated from the admin bay with a heavy black curtain to shield the telescope and camera from the computer's glow. Above the desk a small cupboard is fitted as stowage for all eyepieces, filters and camera adapters.

5 Observing programmes

Main interest is Astrophotography.

COSPAR 0433

(International Committee on Space Research)

Greg Roberts (*grr@telkomsa.net*)

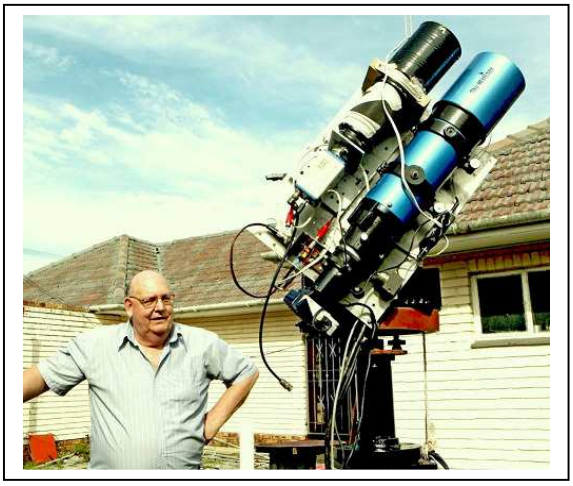
1 Location: 4 Willow Way Pinelands, Cape Town

Longitude: 18^{o} 30' 44.46" E
Latitude: 33^{o} 56' 26.25" S
Elevation: 10 m

2 Telescope: The optical equipment available includes numerous camera lenses and telescopes up to 10-inch aperture. For low altitude satellites a Nikkon telephoto lens with a focal length of 80 to 200mm and

working at a focal ratio of f/2.8 allows coverage down to about satellite magnitude +9. For higher, fainter satellites a 102mm f/3.17 refractor is used whilst for the more difficult ones a 200mm f/3.65 reflector is required. The telescopes are common place telescopes, fitted with home-made focal reducers. The 10-inch originally saw life with a Bird-Jones optical configuration which is well known for poor quality images, so the mirror was reground and polished by well-known amateur telescope maker Chris Forder. He also refigured the cheap 200mm reflector which originally had a spherical mirror.

3 Instrumentation:



(left) Fig 1. Greg Roberts with the optical tracker system. (right) Fig 2. Control station for the station COSPAR 0433.

2 Background: The station (Observatory) was opened in 1977 and has since been used almost exclusively for artificial satellite tracking of classified (secret) launches.

The main mode of operation is optical observations where the position of the satellite is determined using the celestial star background as a reference foundation and determined at an accurately known time. This is the classical technique used for celestial bodies and is known as ASTROMETRY.

Time is determined to better than 50 milliseconds using satellite GPS signals and positional accuracy is typically sub-arc second. Since there is a need for a large number of reference stars in the determination of the satellite position a reasonable field of view is desired - usually around 1 degree or even more. This then implies relatively short focus telescopes with as large an aperture as possible since aperture really determines the magnitude limit.

Editor's note: The next issue of *MNASSA* will carry full details of Greg's amazing work. This short piece is just to log Greg's unique Observatory. Much the same goes for Ian Roberts' work. By the way they are good friends, work together, but are not related!

COSPAR 0434

(International Committee on Space Research)
MPC Observatory Status as 24 Gauteng

Ian Roberts (*itmail2003@yahoo.com*)

1 Location: Randburg, Gauteng

Longitude: 27^{o} 55' 43" E
Latitude: 26^{o} 06' 11" S
Elevation: 1 650 m

2 Telescope: Radio Dish working at 714 MHz, and later 4GHz. Optical 200 mm Meade SCT and a short focal length Celestron 102 mm refractor

3 Instrumentation: Assorted Radio and TV receiving equipment. For Optical work a Canon 1000D and Canon 650D with Meade optical reducer.
(left) Fig 1.

*(right) Fig 2***4 Background:** If the satellite (EKRAN, or Stationar-T series) located at 99E longitude geostationary position produced sufficient power

on its rear lobes it was hoped that a high gain, low noise array could be home built and would provide reasonable TV pictures despite the elevation being only about 9 degrees at my home in Pretoria. This proved to be the case in 1979. In the 1980s he joined Greg Roberts in radio tracking satellites using software.

(left) Fig 1.

(right) Fig 2.

5 Observing programmes

Optical satellite tracking and with new software, APEX, it is possible to reduce data for both satellites and asteroids, the latter for the Minor Planet Centre, MPC, part of the Smithsonian Institute, tasked with maintenance of the world's asteroid (currently 706 483 objects) and comet (891 objects) databases

Editors note: The next issue of *MNASSA* will carry full details of Ian's amazing work. This short piece is just to log Ian's unique Observatory much the same goes for Ian Roberts' work.

Weltevreden Karoo Observatory

Doug Bullis (*douglasbullis@gmail.com*)

1 Location: Weltevreden Farm, 13 km west of New Bethesda, E. Cape

Longitude: 24º 26’ 25.1” E
Latitude: 31º 51’ 31.3” S
Elevation: 1730 m

2 Telescopes: A range, consisting of
Intes-APM MN86 8” f/6 Mak-Newt
Intes-Alter MN84 8” f/4 Mak-Newt astrograph
Intes MN61 6” f/5.9 Mak Newt
Bosma 24024 8” f/12 Mak-Cass
Santel 710D 7” f/10 Mak-Cass
Skywatcher 715 7” f/15 Mak-Cass
Intes MK 66 6” f/12 Mak-Cass
Astro-Telescopes 6” f/5.9 R35 (low-chroma) achromat finder
Celestron 4” f/6.5 achromat birder
Orion 80mm f/6.5 ED OAG guidescope

(right) Fig 1. Some of the telescopes available.

3 Instrumentation: The telescopes shown in the image are stored indoors at the site and can be rented by prior arrangement. Visitors bringing their own equipment are welcome; their equipment can be stored in locked rooms if visitors are away for extended periods.

Fig2. Weltevreden farm observatory site

4 Background: Weltevreden Farm is a private sheep ranch 13 km west of New Bethesda and 80 km along the road north of Graaf-Reinet. It is a very dark observing location, with no human-originated lights visible anywhere, and no light domes from nearby communities. There are two bungalows totalling eight bedrooms and two kitchens which visiting astronomers may rent for extended observing sessions. The observing areas are sheltered from the wind by tree lines. The site can be very cold in winter, –5° C or colder is not uncommon. Visitors are cautioned to bring ski or other cold weather gear in July and August.

5 Observing programmes: The Grahamstown astronomy writer Douglas Bullis keeps the equipment shown above at Weltevreden Farm and visits during dark-moon times to make visual observations. Douglas bridges the gap between hobbyist and professional by recording the observations typical of hobbyists, then researches the objects in the professional literature and writes technical reports of their properties for the astronomy forums Cloudy Night (USA) and IceInSpace (Australia). He has published ±10 articles a year since 2012.

Winobs

Mark Schafer (*m.schafer@ru.ac.za*)

1 Location: Winobs is situated in the middle of the Winterberg mountain range in the Eastern Cape, South Africa. It is nestled amongst rolling hills on a big dry mound adjoining a small wetland on my smallholding – a peaceful, quiet and remote retreat ideal for stargazing. The night sky is devoid of any light pollution making Winobs a very desirable spot for astrophotography.

(left) Fig 1. Winobs site.

Longitude: 26^{o} 23’ 12” E
Latitude: 32^{o} 17’ 46.62” S
Elevation: 1 446 m

2 Telescope: 8” Ritchey-Chrétien or a 90mm Stellarvue fixed on an iOptron SmartStar iEQ45 mounting

3 Instrumentation: I mostly image with my two DSLRs. One a NIKON D300 and the other, a full frame NIKON D750. There is also an ATIK 420 CCD camera which needs to be put through its paces until all the tracking processes lined up. A QHYCCD polemaster has just recently been acquired; the camera for precise polar alignment and hopefully more reliable tracking with the ORION 80 mm tracking scope.

Fig 2. Winobs.

4 Background: The observatory measures 5m x 6m. The permanent pier in the middle of the observatory is cast in a 1m x 1m x 1m concrete foundation. The roof slides off to the North with a manual winch. There are two beds in the observatory – these are useful when guests arrive, or for waiting for those long periods when photographing celestial objects using multiple or long exposures!

5 Observing programmes

Currently astrophotography only

Tourist Observatories

Note: These will be simply listed so that there is a record of what instruments are available, where they are and what their position is.

1 Sterland Sutherland

Location: Just outside Sutherland on the road to Matjiesfontein
Longitude: 22^{o} 39.6’ 47.3” E
Latitude: 33^{o} 32’ 04.0” S
Elevation: 1 620 m
Telescopes: 5 X Celestron CPC 1100 and 1 X Celestron GLX 1100

2 Leobo Private Reserve

Location: Waterberg Mountains, Limpopo
Longitude: 28^{o} 23’ 30” E
Latitude: 24^{o} 08’ 49” S
Elevation: 1 320 m
Telescopes: 500mm Dall-Kirkham and 200mm SCT with H-alpha filter

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: Estimating Redshifts from Distant HI Galaxies with Bayesian Statistics
Speaker: Michelle Lochner
Date: 27 October
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: The upcoming Square Kilometre Array (SKA) telescope will be the most sensitive radio telescope ever built, detecting the neutral hydrogen (HI) emission from up to a billion galaxies. However, HI emission from distant galaxies is intrinsically faint and easily lost in noise. Significant detection of the HI emission line is only expected for a small fraction of galaxies, making redshift estimation extremely difficult.
In this talk, I will discuss a new approach to redshift estimation from radio galaxies using Bayesian statistics. We perform parameter inference using

the well-known HI line profile as a model. Using Bayesian model selection, we are able to robustly distinguish between an emission line and noise or RFI. This method would dramatically increase the number of well-characterised galaxies in the SKA catalogue, as well as providing the full probability distribution for each galaxy's redshift. Preliminary results from a realistic SKA1-MID simulation indicate that we can recover the line profile parameters and a competitive redshift estimate for very low signal-to-noise lines, showing the promise of this new technique.

Title: Dusty Star-Forming Galaxies at High Redshift
Speaker: Prof Andrew Baker
Date: 10 November
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: Since the discovery of submillimeter galaxies in the late 1990s, we have come to appreciate that a complete picture of galaxy evolution must include the overlapping populations of obscured, dusty star-forming galaxies (DSFGs) that are much more prevalent at high redshift than in the local universe. Gains in our understanding of DSFGs have followed the deployment of new instruments that probe expanded ranges in wavelength, redshift, and/or observational efficiency, a trend that is continuing as the Atacama Large Millimeter submillimeter Array (ALMA) comes into its own. I will discuss recent results on the redshift distributions, evolutionary states, and detailed internal properties of DSFGs and comment on what we can learn from lensed DSFGs about mass distributions along the line of sight.

Title: SAMI Galaxy Survey: Spectral Mapping of Galaxies by the Dozen
Speaker: Prof Gerald Cecil (UNC)
Date: 17 November
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: SAMI deploys 13 photonic integral field units across 1 deg diam. FOV at the AAT prime focus to feed the AAOmega double-beam spectrograph. It is a common-user supported instrument available to all AAO users worldwide. For the past 3.5 years it has been used primarily for the SAMI Galaxy Survey (SGS, sami-survey.org/papers) led by Prof. Scott Croom (U. Sydney) to map 3400 galaxies over 15 arcsec diam. at ~2 arcsec resolution out to z=0.1. Spectra over 320-700 nm are recorded up to R=4500. Extensive multi-band ancillary data are available from the GAMA Survey, but the SGS also targets some clusters. I will review some SAMI insights on gaseous and stellar kinematics, shock excitation, and star formation. The first 900 galaxies will be in public DR1 by year's end.

Title: Observational Tests of SN Ia Explosion Models with a Complete Sample

Speaker: Prof Subo Dong (Kavli Institute for Astronomy, Peking University)
Date: 1 December
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: The explosion mechanism of type Ia supernovae is unknown. We argue that the direct white dwarf-white dwarf collisions in the field multiple stellar systems is the most promising mechanism to explain the SN Ia population. Not only do collisions explain several robust features across the entire SN Ia population, but also their predictions of the bi-modal Ni56 distributions in the ejecta are recently discovered observationally. I will discuss key observational tests on the collision models enabled by the All Sky Automatic Survey for SuperNovae (ASAS-SN) — the most successful bright supernova survey at present. With the unbiased supernova searches of ASAS-SN, we have also discovered ASASSN-15lh — a type I super-luminous supernova that is the most luminous supernova ever recorded.

Title: Puzzles in Galaxy Scaling Relations
Speaker: Stephane Courteau (Queen's University)
Date: 8 December
Time: 11h00 – 12h00
Venue: SAAO Auditorium

Abstract: Galaxies like our Milky Way can be described in terms of their structure, dynamics, and stellar populations. Some very robust correlations between galaxy structural properties, such as total luminosity, maximum circular velocity, and size display rather small scatter, hinting at well-regulated galaxy formation processes. A major challenge to understanding these scaling relations, their tight scatter, and ultimately galaxy formation and evolution, is the elusive interplay between visible and dark matter. I will present the latest constraints on galaxy scaling relations and their link with modern cosmological models.

UCT

Title: The Omega White survey for short period variable stars
Speaker: Prof Patrick Woudt
Date: 7 December
Time: 14h00
Venue: Astro-seminar room at the RW James building

Abstract: The Omega White survey on the VST is a wide-field survey for short-period variables. It aims to cover a total of 400 sq. degrees of two regions at low Galactic latitudes in the Milky Way [the Galactic Bulge and the Galactic plane at l and b = 250 and 0 degrees, respectively]. The survey is designed to cover each 1 sq. degree for 2 hours at 3 minute cadence, to provide a census and population studies of classes of Galactic short-period variables. Highlights from the first 4 years of the survey, covering 134 sq. degrees and including 12.3 million light curves, are presented. The importance and availability of appropriate follow-up facilities in the era of large surveys, is emphasised.

Sky Delights: Diamonds in Cassiopeia's Crown

Magda Streicher

In Greek mythology Cassiopeia was called the Queen of Ethiopia and Cepheus the king. Their daughter was Andromeda.

Cassiopeia's stars form an easily recognisable "W" or "M" shape as they move around the night skies' northern Pole through the year. What impresses the viewer is the clear image that stands out so strikingly against neighbouring constellations, which are much fainter by comparison. Poor Cassiopeia was punished because of her attractive appearance, as believed by ancient's poets, and remained tied down in a sitting position, sometimes upside down. But despite her punishment she displays the richest collection of open clusters in all categories.

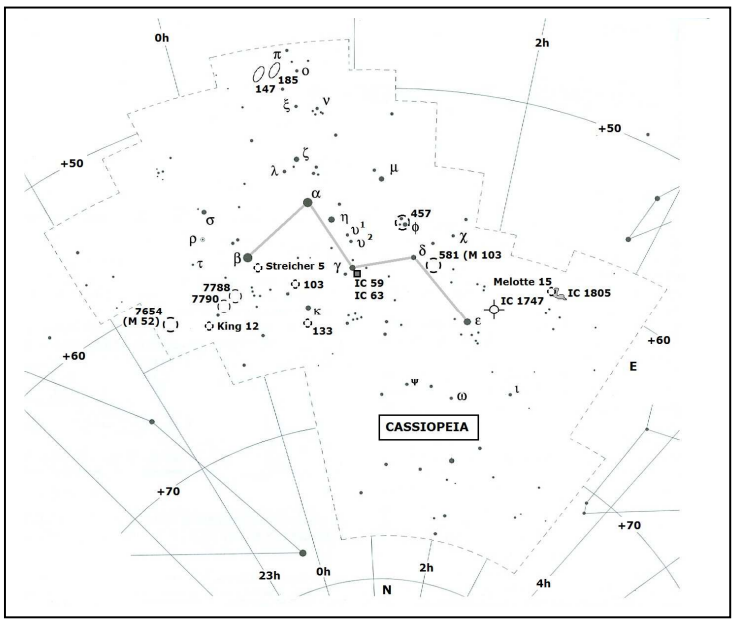


Fig 1. Cassiopeia map.

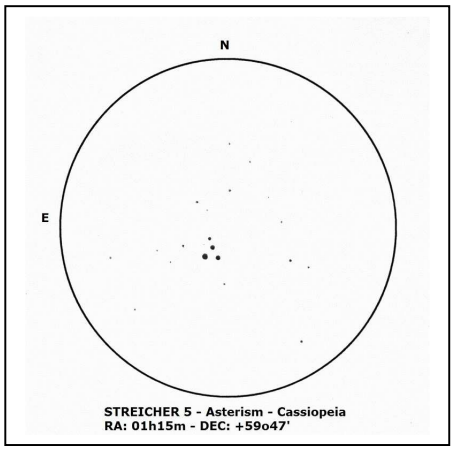
Unfortunately we can't see Cassiopeia in the southern hemisphere, but that takes nothing away from exploring it by reading about its beautiful objects and looking at them in astronomy books and the internet.

William Herschel and his sister Caroline obviously spent a lot of time searching for and documenting objects in Cassiopeia. One such object is **NGC 7654** or Messier 52, situated nearly on the border with Cepheus. Herschel discovered the cluster, which is about 4 000 light years distant, in 1774. The cluster is rich and bright with a few dozen super-white stars

which stand out beautifully against the background star field. On the cluster's south-western edge is a G-type giant star with its lovely yellow jacket. Several arcs and knots of stars mingle together and spray out into the star field.

In Cassiopeia various clusters have been discovered, and are known by names like Berkeley, Czernik, Collinder, Harvard, King, Melotte, Markarian, Stock, Trumpler and many more. Perhaps the most crowded area of clusters can be found just 2.5 degrees north-west of beta Cassiopeia – far too many to discuss, with the brighter **NGC 7788** the most obvious among them. The cluster contains stars mainly of magnitude 9 with a knot of a few brighter stars towards the middle area. **NGC 7790** to the south-east is slightly larger, with more or less the same impression. In this degree field of view are also the clusters Berkeley 58, Harvard 21 and Frolov 1. The Russian astronomer Vladimir Frolov discovered this last-mentioned group while studying the proper motion of stars in the nearby clusters NGC 7788 and NGC 7790.

King 12 is situated 12' further north-west from Harvard 21 and displays a lovely knot of stars with a notable double star on its eastern rim. The King clusters had a special flair about them, usually small with a story to tell in impression. Ivan King, a junior fellow at Harvard College Observatory in the 1940s, had access to plates of the sky surveys taken with the 16-inch Metcalf and 24 Bruce refractors at Harvard College Observatory. While looking at the plates King began to notice clusters that had never been catalogued and his first 21 objects, the first 13 marked by him, were published in the observatory's bulletin in 1949.



Forming a triangle with beta and IC 10 is the small group **Streicher 5** consist of only 4 stars but strongly reminded me of Messier 73.

Fig 2. The asterism Streicher 5.

Halfway towards the star gamma Cassiopeiae, **NGC 103** is perhaps one of the smallest clusters, but very distinctive. A hazy patch of faint stars, quite obvious with strings of fainter stars on both sides, give the impression of the letter "H". The brighter stars in these groupings, however, form a sort of horseshoe, with a different impression, all depending on the way you look at it. It was a feast to study all these different clusters when I visited an astro camp in Portugal – just sad that it is lost for amateurs down south.

The cluster **NGC 133**, which is situated 25' north of kappa Cassiopeiae, was the closest NGC object to the 1572 supernova explosion. The Danish nobleman Tycho Brahe spotted a brilliant new star in Cassiopeia close to kappa Cassiopeiae on 11 November 1572. In the following days it became brighter than Venus, shone through the blue daytime sky for two weeks and took 16 months to fade from sight. In September 2008 a team from Germany, Japan and the Netherlands observed Tycho's supernova exploding in 1572 via a 436-year-old light echo. The team was in fact able to model the outburst in detail. It's the first supernova in our galaxy to be classified by its outburst spectrum. The delayed signal or light echo allowed astronomers led by Oliver Krause of the Max Planck-institute for Astronomy in Germany to sample light from the original outburst. They concluded that a white dwarf star exploded in a so-called type 1a supernova to form supernova 1572. It became popularly known as Tyco's supernova.

The brilliant super-white magnitude 2 gamma Cassiopeiae plays host to **IC 59** and **IC 63**, two emission and reflection nebulae situated 20' north-east from gamma. But sadly, gamma's overwhelming glare just washed away the nebulae from any attempt to glimpse them. Perhaps with the utmost care and dark skies and the help of a UHC filter, averted vision and a lot of luck it is possible, if gamma is taken out of the eyepiece view. Both display sort of small flare-out pieces of nebulosity.

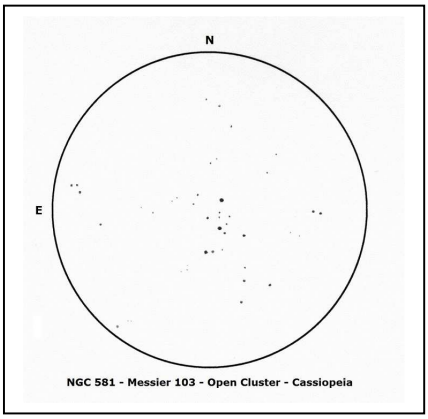
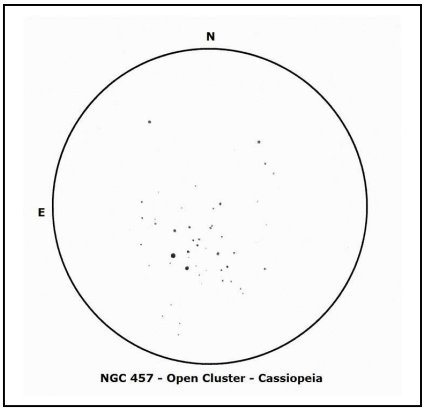


Fig 3. NGC 581 or M103, an open cluster in Cassiopeia.

One of the four stars prominent in showing the "W" or "M" shape is delta Cassiopeia, just a degree south-west of **NGC 581** or Messier 103. The area is very rich in clusters, all different in shape and size. However, M103 is easily seen in a triangle shape, quite outstanding against the background star field. The sharper arrow pointing north contains the double star Struve 131: two white-coloured stars, magnitude 6 and 9, with a separation of 28" in a PA of 145. Against the southern part of the grouping, embedded between a sprinkling of fainter members, is a lovely yellow/orange magnitude 8 star.

To complete the constellation shape is the magnitude 3 epsilon Cassiopeiae, barely half a degree east the planetary nebula **IC 1747** is playing hide and seek. Only 12" in size it is fairly smooth, round and perhaps not that difficult to spot in ideal dark skies, and with a fairly large amateur telescope. The planetary is surrounded by a few faint stars protecting its position.

Nearly 5 degrees further east a rich nebulous area is home to many clusters interspersed with nebulosity. **IC 1805**, perhaps the best known, is called the Red Heart Nebula. In well-documented pictures it looks like a heart with two chambers, with the close nebula IC 1848 as the baby embryo. Among amateurs its nickname then became The Heart and Soul Nebula. The much more outstanding group **Melotte 15** is covered in mist on the western edge of IC 1805, and been divided by a very faint string of stars running east-west. The brighter stars surrounds the wider field of view was noted in the 1690 star atlas of Johannes Hevelius as the Northern Fly. But 77 years earlier, Dutchman Peters Plancius had already devised a bee, which he called Apes, out of the same stars. The German Jacob Bartsch renamed the group Vespa, the Wasp. However, the stars



have now been assigned to the constellation Aries. The well-known double cluster situated in the constellation Perseus is 4.5 degrees south.

Fig 4. Open cluster NGC 457.

A cluster well-known and very popular among amateurs in the northern hemisphere is **NGC 457**, which needs no introduction whatsoever. It is a young star grouping, but is uncertain whether the stars are bound together. What is not debatable is that it is one of the prettiest clusters, outstanding, bright and special, popularly known as the Owl Cluster. The stars form a pair of wings extending east-west with the eastern wing slightly more prominent. The innermost body star shines with an attractive orange light. The two owl eyes looking back at the southern end are the magnitude 5 phi and magnitude 7 HD 7902. NGC 457 got its common name in 1977 when David J Eicher saw an owl figure formed by the cluster's two brightest stars and overall shape.

In the far southern part of Cassiopeia, 2.5 degrees from the border with Andromeda, are the two faint **NGC 147** and **NGC 185**, companion galaxies of the great Andromeda galaxy, Messier 31. Sadly, they are both fainter than magnitude 12, but I managed to glimpse NGC 147 as a ghostly blur lacking any central concentration and NGC 185 display only a faint glow.

When all is said and done, the Queen will not disappoint any observer as she shows off her jewels in the large variety of clusters glittering within the framework of the constellation.

Table 1. Interesting deep-sky objects in Cassiopeia

Object	**Type**	**RA**	**DEC**	**MAG**	**SIZE**
NGC 103	Open Cluster	0h25m.3	+61°21′	9.8	5′
NGC 133	Open Cluster	0h31m.2	+63°22′	9.4	5′
NGC 147	Galaxy	0h33m.2	+48°30′	9.5	15′x9.4′
NGC 185	Galaxy	0h39m.0	+48°20′	9.2	14.5′x12.5′
IC 59	Nebula	0h56m.7	+61°04′	Photo 5	5′
IC 63	Nebula	0h59m.5	+60°49′	Photo 5	3′
Streicher 5	Asterism	01h15m	+59°47′	9.5	3′
NGC 457	Open Cluster	01h19m.1	+58°20′.4	6.4	13′
NGC 581 Messier 103	Open Cluster	01h33m.2	+60°42′	7.4	6′
IC 1747	Planetary Nebula	01h57m.6	+63°20′	12	13″
IC 1805	Nebula	02h32m.7	+61°27′	Photo 6	8′
Melotte 15	Open Cluster	02h32m.7	+61°27′	6.5	22′
NGC 7654 Messier 52	Open Cluster	23h24m.2	+61°35′	6.9	12′
King 12	Open Cluster	23h53m	+61°58′	9	2.5′
NGC 7788	Open Cluster	23h56m.7	+61°24′	9.4	9′
NGC 7790	Open Cluster	23h58m.4	+61°13′	8.5	17′

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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.

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ISSN 0024-8266

mnassa

monthly notes of the astronomical society of southern africa

Volume 75 Nos 11 & 12 **December 2016**

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