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• Selling Starnames • Fireball Observations 2011 - 2012 •
• Daytime Bolide of 12 March 2013 • African Star-Lore •
• Margaret Thatcher (1925 – 2013) • Book Review •

Cover: The Southern Pinwheel

One of the first light images of the three new LCOGT 1-m telescopes was, very fittingly of M83, the Southern Pinwheel Galaxy. This face-on spiral galaxy is located in the constellation of Hydra, some 15 million light years away. Nicolas Louis de Lacaille discovered this object on 23 February 1752 from the Cape of Good Hope. Almost to the day, 261 years later, this galaxy was imaged around 23 February 2013, while commissoning the LCOGT telescopes. (See article on p.53.)

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Who owns the rights to names?

In the past there has always been a problem with people "selling" stars – usually because there was no agreed central registry, which meant that ultimately more the one person became to sole proprietor of a star. Now with the discovery of large numbers of extra-solar planets, people are selling the rights to name these planets. But the question remains as to how you can sell, or name, something you don't own! The International Astronomical Union, IAU, has maintained that they are the only recognized international body control the naming of Moons, stars, planets etc.

The IAU released the following press release on 12 April 2013 in Paris in response to a recent name-selling campaign:

Can One Buy the Right to Name a Planet?

In the light of recent events, where the possibility of buying the rights to name exoplanets has been advertised, the International Astronomical Union (IAU) wishes to inform the public that such schemes have no bearing on the official naming process. The IAU wholeheartedly welcomes the public's interest to be involved in recent discoveries, but would like to strongly stress the importance of having a unified naming procedure.

More than 800 planets outside the Solar System have been found to date, with thousands more waiting to be confirmed. Detection methods in this field are steadily and quickly increasing – meaning that many more exoplanets will undoubtedly be discovered in the months and years to come.

Recently, an organisation has invited the public to purchase both nomination proposals for exoplanets, and rights to vote for the suggested names. In return, the purchaser receives a certificate commemorating the validity and credibility of the nomination. Such certificates are misleading, as these campaigns have no bearing on the official naming process. They will not lead to an officially-recognised exoplanet name, despite the price paid or the number of votes accrued.

Upon discovery, exoplanets and other astronomical objects

receive unambiguous and official catalogue designations. While exoplanet names such as 16 Cygni Bb or HD 41004 Ab may seem boring when considering the names of planets in our own Solar System, the vast number of objects in our Universe, galaxies, stars, and planets to name just a few - means that a clear and systematic system for naming these objects is vital. Any naming system is a scientific issue that must also work across different languages and cultures in order to support collaborative worldwide research and avoid confusion.

To make this possible, the IAU acts as a single arbiter of the naming process, and is advised and supported by astronomers within different fields. As an international scientific organisation, it dissociates itself entirely from the commercial practice of selling names of planets, stars or even "real estate" on other planets or moons. These practices will not be recognised by the IAU and their alternative naming schemes cannot be adopted.

However, the IAU greatly appreciates and wishes to acknowledge the increasing interest from the general public in being more closely involved in the discovery and understanding of our Universe. As a result in 2013 the IAU Commission 53 Extrasolar Planets and other IAU members will be consulted on the topic of having popular names for exoplanets. The results will be made public on the IAU website. Meanwhile, astronomers and the public are encouraged to keep using the existing accepted nomenclature - details of which can be found on the Astronomy for the Public section of the IAU web page, under Naming Astronomical Objects.

The un-named organization mentioned above is probably Uwingu. It is a space-education company based in Boulder, Colorado, who recently launched a public contest, asking for people to submit names for extrasolar planets. Suggesting a name cost US$4.99; voting cost 99 cents. Most recently the naming of alpha Centauri B was focussed on and raised in excess of US$10 000, which according to Uwingu, will be donated to space exploration and education projects, after expenses have been deducted.

But what happens if more than one such company does the same thing? Who will be the final arbiter to say which exoplanet has which name? And whilst public participation is to be welcomed, should any financial rewards accrue to any one organization? After all, what constitutes expenses?

The IAU should, as the officially recognized body on matters astronomical, administer this process, and by all means invite public participation, but not for financial gain for the IAU or loss to any individual. ☆

MNASSA and the SAO/NASA Abstract Service

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A resource for all!

Some readers may not know that practically all the astronomical journal literature is freely available to them using the SAO/NASA Abstract service. This can be accessed at http://adsabs.harvard.edu/abstract_service.html.

Items can be searched for under authors' names or words that occur in titles, abstracts or full texts. The result of the search gives full bibliographic references and abstracts. In most cases it is possible to download the full text of an article in pdf form. It is also possible to see what other papers have referred to the item being looked at. This reveals who else may be working in the same field.

Many authors submit preprints to an organization called arXiv before they appear in print and these show up in SAO/ADS searches. They can also be useful in cases where a journal restricts access to recently published material, as many do for commercial reasons.

MNASSA and the SAO/NASA Abstract Service

For quite a few years, *MNASSA* articles were digitized by the SAO/NASA Abstract Service but in recent times this has not been the case, although the titles of articles have continued to be listed by them. However, particularly since *MNASSA* became all-digital, there has been a gap in coverage. Consequently, in order to make sure our articles reach the maximum possible readership, we have since provided SAO/ADS with listings that include links to pdf-files of the full articles.

More about the SAO/NASA Abstract Service

[Quoted from the website] *The SAO/NASA Astrophysics Data System (ADS) is a Digital Library portal for researchers in Astronomy and Physics, operated by the Smithsonian Astrophysical Observatory (SAO) under a NASA grant. The ADS maintains three bibliographic databases containing more than 10.1 million records: Astronomy and Astrophysics, Physics, and arXiv e-prints. The main body of data in the ADS consists of bibliographic records, which are searchable through highly customizable query forms, and full-text scans of much of the astronomical literature which can be browsed or searched via our full-text search interface. Integrated in its databases, the ADS provides access and pointers to a wealth of external resources, including electronic articles, data catalogs and archives. We currently have links to over 9.8 million records maintained by our collaborators.* ☆

Southern African Fireball Observations 2011–2012

T P Cooper – Director, Comet, Asteroid and Meteor Section

Catalogue of Recent Sightings

This article continues the sequential numbering of reported fireball sightings from southern Africa, and covers fireballs observed during 2011-2012. By definition, a fireball is any meteor event with brightness equal to or greater than visual magnitude -3. The following events were reported to the author and details are reproduced as given by the observer. All times were converted to UT, and all coordinates are for epoch J2000.0.

Event 232 – 2011 May 6 – Waterberg, Limpopo

Observed by Simon Walsh and others at 22h31. Passed through zenith in direction SSE, m_v = -5 when first seen, fragmented into about a dozen orange fragments near Antares. Duration was said to be about 10 seconds for a path length of ~20 degrees. At 22h34 heard distant rumbling like thunder or blasting at a quarry. Observer's location was 24º12'16.3" S, 28º19'38" E .

Event 233 – 2011 July 20 – Estcourt, KZN

Observed by Louis Piovesan at 16h28. Brightness was a little brighter than Venus (not visible at the time) so m_v perhaps about –5. The fireball was first seen near Arcturus, and passed through Crux before disappearing behind trees and a neighbouring house. Colour was yellow, with a distinct yellow tail, fragmenting at several points along its path. No sound was heard.

Event 234 – 2011 August 18 – Makhado, Limpopo

Observed by Sarah Coronaios at about 16h25. m_v = about –7. She had just finished feeding horses and was walking home, looking northwards when she spotted it out of the corner of her eye, about 40° above the eastern horizon, moving northwards and burnt out 15° above the northern horizon. The object fragmented during its flight, but left no train and no sound was heard.

Event 235 – 2011 August 19 – Limpopo, and Tuli Wilderness, Botswana

Observed by Andrew Morgan at Tuli Wilderness at location 22°13'51.0''S, 28°56' 56.4''E. Time was about 19h07. Duration 4-5 seconds. Colour initially blue-green, becoming white. Andrew, who has experience as a game ranger with the stars, described 'the meteor fell directly in line with beta Centauri and traveled through beta Crucis in a SW direction'. The fireball disappeared below nearby mountains, followed by a blue-turquoise flash which lit up the sky in the vicinity. Approximately 30 seconds later Andrew heard a sonic boom. Lourens van Niekerk said he and several others witnessed a very bright fireball passing overheard from east to west just after 19h00. They live in Limpopo, close to the Botswana border between the Saambou Bridge and Zanzibar border posts. It appeared to be traveling very low.

Event 236 – 2011 August 23 – Seapoint W Cape
Observed by Peter Herbert at 20h15. Colour said to be bright blue with very thin orange tail. Looking from Seapoint towards Cape Town, direction from right to left (roughly south west toward north east) at about 45° altitude.

Event 237 – 2011 August 27 – Barrydale, S Cape
Observed by Laurence Matthews at 04h00. Moving from just east of south to just west of north, the meteor appeared about 2.5-3 magnitudes brighter than say Sirius, m_v about -4. It had a white centre with blue outer and an orange tail, and the path stretched across about 90° of the sky. It took several seconds to traverse the sky, before disappearing over a hill towards the north.

Event 238 – 2011 September 23 – Observatory, Gauteng
Observed by Constant Volschenk at 17h13, while at Old Republic Observatory. Direction was from south to north through Sagittarius. He was facing north and the object was seen directly overhead, burning out at an altitude of 55°. Duration was 2.5-3 seconds. Colour was bright white. No persistent train or fragmentation was noted.

Event 239 – 2011 October 21 – Cape Town, W Cape
Observed independently by Jessy de Kock and Brandon Talbot. Both were driving when they observed the fireball. Brandon gave the time as just after 9 15 pm (SAST) because he left at that time and he saw the fireball while driving. He was driving on the M3 from the Tokai onramp to the Westlake offramp and the fireball was descending due south over the Muizenberg mountains directly in front of his windscreen. It moved slightly east to west. Brightness definitely more than five times as bright as Venus (which set earlier in the evening), so m_v probably about –6 or brighter. Colours described were pale green and blue (Brandon called it cyan). Long tail, same colour as the fireball. Duration about one second or a little longer. There was no sign of disintegration before the fireball disappeared below the mountains. Jessy was driving south on Campground Road, Rondebosch and gave the time as between 19h15 and 19h30. Brighter than Venus, m_v probably brighter than –5. Duration 5-6 seconds. She reported seeing orange, white and red, and at some point green colours. There was no sign of disintegration and the fireball faded out at the end of its path. From a sketch Jessy provided I determined the start point at azimuth about 200°, altitude 30°, passing from left to right, ie east to west, and descending to azimuth about 240°, altitude 20°. This corresponds to start and end points (RA/Dec) of approximately 16h30, -72° to 16h36, -35°, a path from near alpha Triangulum Austrini to epsilon Scorpii, and an arc of travel of about 37°. Plotting the apparent path and tracing it backwards does not coincide with any known meteor radiants active at

this time of year, and thus I conclude the event was a sporadic fireball. Due to the convenient time and brightness of the event, I am very surprised to have only received the two reports.

Event 240 – 2012 March 20 – Ashton, W Cape and Zeekoegat, Riversdale, Cape

Observed independently by Bennie Coetzee and Wim Filmalter. Bennie reported at about 21h00 while driving from Ashton to Swellendam, about 2.1 km from the T-junction on the R60 (just past Zolani). Duration was about 1 second and the object traveled from alt/az 25°/158° to 17°/186° [Bennie returned to the scene afterwards to measure the angles more accurately] where it disappeared below a distant hill. This gives a path from just below Triangulum Australis, directly towards Achernar, which was probably below the line of hills Bennie refers to and hence not visible at the time. The body of the fireball was green and the tail was white. Wim reported at about 20h50. Brightness about four times that of Venus, mv about –6. The fireball was seen in direction azimuth 165°, where the altitude was about 7°, path length at least 10°, descending left to right at about 45° to the horizon. Duration not more than three seconds. Colour was very bright green, with a trail of reddish sparks. Based on the details provided by both observers the event was most probably a fireball from the Virginid complex of radiants, known to produce the odd very bright meteor at this time of year.

Event 241 – 2012 May 4 – Benoni, Gauteng

Observed by Peter le Roux at 17h08, standing outside during a Scout meeting. Much brighter than Venus, so mv probably –5 or brighter. Colour was white with some orange noted towards the end of path as it started to disintegrate. Duration 3 seconds. The azimuth and altitudes of start and end points were 320°, 30° to 350°, 20°. No persistent trail.

Event 242 – 2012 September 28 – Cape Town, W Cape

Observed by three individuals who reported the sighting somewhere between 18h07 and 18h15. Duration about 4 seconds. Colour white tinged with red, bright green trail. Direction approx north towards west. Jacques Cronje reported seeing the fireball to NW of Cape Town, moving from north to westwards, with a bright greenish yellow colour, with bright greenish tail. Burnt out abruptly a short distance above the horizon. Henry Atkinson reported seeing the fireball from Oranjezicht looking north towards Table Bay at 18h07, bright white light into greenish and pinkish hues around the edges and so appearing to be multi-coloured, traversing perhaps 120° during 4 seconds. Its path was nearly horizontal, in a direction from east to west and disappearing in the direction of the Atlantic Ocean, disappearing behind Signal Hill. No sound was heard. Andrew Freeborn reported 'saw what I suppose was a spectacular meteor over

Blouberg. The sighting occurred at about 18h15, as I was driving North on Marine Drive. Shortly before passing Dolphin Beach, I noticed a very bright fireball streaking across the sky from East to West. The fireball had a bright head and visible flames for a tail. I perceived it as being at a relatively low altitude and it seemed to pass through some clouds before burning out over the ocean'.

Event 243 – 2012 December 9 – Cederberg, W Cape

Observed by Cliff Turk at 00h53 during a watch on the Velid meteor shower. m_v = -3. Colour white, medium speed, duration 0.5 seconds. Based on its observed path Cliff identified the fireball himself as a Geminid. ☆

The Daytime Bolide of 12 March 2013

T P Cooper – Director, Comet, Asteroid and Meteor Section

In the early afternoon of 12 March 2013, a meteoroid, probably weighing several hundred kilograms, entered the Earth's atmosphere over the Western Cape. The resulting fireball was widely seen despite its passage in broad daylight. Based on a few eye witness accounts, Tim Cooper attempted to reconstruct the event.

Following on from other recent bright meteor events, such as the daytime Chelyabinsk bolide and consequent meteorite over Russia on 15 February 2013, South Africa witnessed its own very bright bolide (the correct term for a very bright meteor seen to explode) just after mid-day on 12 March 2013. This too was a daytime event, and was widely observed from the Cape Town metropole, and the western Cape as far north as Lutzville. This latest event was the brightest since the very bright bolide which crossed the country around 23h00 on 21 November 2009 (see *MNASSA* Vol. 70, June 2011 pp 109-110). There are also similarities between this event and that of 21 July 2002 (see *MNASSA* Vol. 62, August 2003, pp 156-157), which was also seen during daylight, including by an experienced amateur astronomer who estimated the brightness as magnitude -10, and by two airline pilots. That bolide resulted in a meteorite fall near the village of Thuathe in Lesotho, with over one thousand fragments being found with a combined mass of over 30 kg, the largest weighing 2.4 kg.

The 12 March 2013 event was widely observed over the Western Cape, reported on Facebook, Twitter, and various Internet sites, and reported by at least two radio stations. The best set of reports, enabling the author to reproduce at least a probable path, were those reported to the SAAO website, and provided to the author courtesy of Nicola Lauring. These consisted of nine

reporters, each of which was sent a report form requesting as much detail of the sighting as possible, and which were used in the preparation of this article. With these reports to hand, a check was made to see if any decays of space debris occurred at about this time over the area of visibility. There were none recorded, and based on this fact, and the short duration of the path as reported by eight of the nine reporters, I concluded the event was meteoric in nature.

Eye-witness locations and accounts

The locations of the nine reporters are shown in Figures 1 and 2. The most southerly report was from Anwar Sasman in Retreat, Cape Town. The most northerly report was from Rena Rall, near to the town of Lutzville on the Cape west coast. Seven of the nine reports were from the City environs of Cape Town, and only two from outside. The eye-witness reports are summarised as follows, from the most southerly to the most northerly:

1. Anwar Sasman saw the bolide from 10th Avenue, Retreat. He saw the object move above, and on the ocean side of Table Mountain, descending left to right, roughly from the direction of Hout Bay to Camps Bay, that is in a northerly direction and in the general direction of Melkbosstrand. Duration was given as 15-20 seconds, and colours were white and then orange.

2. Alison Sussex was driving towards Cape Town on the N2 freeway and was just approaching the airport off-ramp at the time. She reported the fireball seen directly in front of her, and slightly to her right, in the direction of Signal Hill. Duration was about 4 seconds, left a 4 seconds persistent train, and disappeared in a small cloud of smoke which persisted for more than 15 minutes. The colour of the fireball was given as orange.

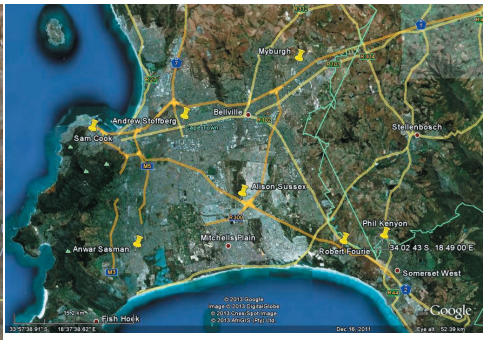


Figure 1 (left) Map showing general visibility of bolide from Cape Town to Lutzville.
Figure 2 (above) Map showing location of reports from Cape Town environs.

3. Phil Kenyon saw the object at descending at an angle of about 20° from vertical, slightly left to right towards azimuth 293°, where it exploded at an altitude of about 19°. Duration was about 3 seconds, colour was silver and after the object exploded, it left a cloud which was still visible an hour later.

4. Robert Fourie was about ten minutes out of Somerset West, also on the N2 towards Cape Town when he saw the object, initially in the one o'clock position from his vantage point, and descending at a steep, near vertical angle, before bursting into a cloud of smoke and several bright fragments, which burned out almost immediately. The colour was bright green, then turned orange.

5. Samantha Cook was in Wale Street in the city centre. She reported 'I was stationary at the robot [traffic light] in Wale Street, facing Signal Hill. All off a sudden I saw a bright fluorescent ball with a tail behind it heading towards the Waterfront'. The start point was above Signal Hill, heading northwards. The colour was given as white, duration 1 second, and left a 1 second persistent train.

6. Andrew Stoffberg observed the object from Kimberley Street in Goodwood, noting it moved from a high altitude in the south towards the north, descending all the while until it disappeared. Colour was given as bright sharp white and had the appearance of a bright twinkling star or a small sun. No disintegration was noted.

7. Myburgh (sic) was located in Kraaifontein and reported the bolide moved from the south-east above him towards the north west. Duration was 2-3 seconds, and disappeared leaving a smoke cloud which lasted 10 minutes. Colour was given as very bright green. No disintegration was noted.

8. Christene Labuschagne observed the bolide from near Theronsberg, and was the eastern-most reporter. She estimated the altitude as about 20-30° above the horizon and moving very roughly towards the north while facing west.

9. Rena Rall observed the bolide from Uitsig Farm between Lutzville and Strandfontein on the West Coast. Duration was about 2 seconds. It exploded, leaving a round cloud which turned into four downward-pointing lines, all of which disappeared after 30 seconds. The direction it exploded was over the mouth of the Olifants River near Strandfontein, towards the south-west of her. Colours appeared as gold, silver, blue and red. The event was also seen by two farm workers, who saw the fireball moving from left to right with a curved angle.

Time and Duration

The times of appearance and durations of the bolide are given in Table 1.

Note the times given appear to be accurate to about 5 minutes, but the overall consensus seems to be that the time of

appearance was around 12h35-12h40 SAST. There is a greater variation in the travel time of the bolide, from as little as one second, to as high as 7 minutes. The latter duration of passage is physically impossible for a meteor, and thus the spread can be taken as 1-20 seconds. This wide spread is probably due to the fact that not all observers witnessed the entire duration of passage, and some included the visibility of the persistent train. The true duration is probably in between the two limits, and is likely a few seconds.

Brightness and colours

The brightness of the event is indeterminate, seeing that it occurred during broad daylight with no useful objects with which to compare, apart from the sun, and the fact that most observers are not versed in brightness estimation. Clearly the object was bright enough to be noticed by whomsoever was looking in the right direction at the time, and so was very much brighter than m_v = -4 to -5, which is about the brightness of Venus, and which is already difficult to see during broad daylight. The bolide was probably also brighter than the aforementioned Thuathe event, estimated as m_v = -10, and which was seen by fewer observers in broad daylight, despite having passed over the densely populated Gauteng area. In the absence of any more clear evidence, the only assumption I can make is that the object was brighter than magnitude -10, consistent with a pre-atmospheric mass of several hundred kilograms or more.

Colours seen in meteors are influenced by the composition of the meteor and its effects on atmospheric gases, with the overriding colour determined by whether the compositional spectrum or atmospheric plasma emission predominates. The range of colours reported are shown in Table 2. The perception of colours in meteors is somewhat observer-dependent, and also depends on the air-mass through which the light has passed as seen by the observer (for the same reasons the Sun and Moon appear red when low above the horizon). However, most reported the passage started at high elevation above the horizon, such that the effects of air-mass can be ne-

Table 1 Time of appearance and duration reported by each site.

Site	Time SAST	Duration, seconds
1	12h40	15-20
2	12h40	4
3	12h35	3
4	12h30	1
5	12h40	--
6	12h20	5-10
7	12h35	2-3
8	12h35	7 minutes ?
9	12h40	2

Table 2 Colours reported from each site.

Site	Colours reported
1	White, becoming orange
2	Orange
3	Silver
4	Bright green, becoming orange
5	White
6	Bright white
7	Bright green
8	
9	Gold, silver, blue, red

Figure 3 Rena Rall's sketch of smoke trails left after explosion.

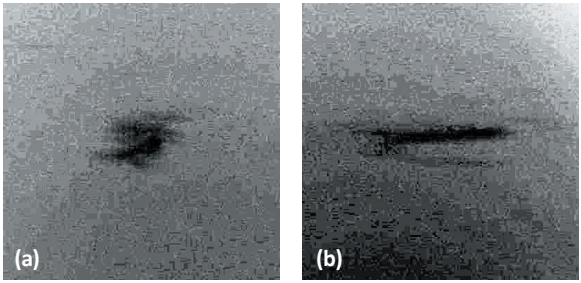


Figure 4 Phil Kenyon's images of smoke trail after explosion.

glected. The perception of colour will also have been affected by contrast effects, having been seen against a bright daytime sky background. However, the general trends from bright white and green to orange and red is consistent with the object rapidly losing energy in the few seconds it descended in the atmosphere. The two reports of bright green in the case of Robert Fourie (site 4) and Myburgh (site 7) may indicate they witnessed the event early in its passage, as this colour in bright meteors is normally associated with the energetic excitation and recombination of atmospheric oxygen, with attendant fluorescence at 557.7 nm in the green region of the spectrum.

Sounds heard

Despite the reports of audible sounds posted by a number of individuals on certain Internet sites, none of the nine respondents included in this article reported any sounds heard. In the absence of information to the contrary, I assume that any reports of sounds reported on the aforementioned sites are unverified, and may have been from entirely coincidental terrestrial sources.

Photos of the smoke cloud

Several reporters observed the object to explode, leaving a persistent cloud which was visible up to one hour after the passage of the bolide. The most detailed reports came from Phil Kenyon and Rena Rall. From Lutzville, near the West Coast, Rena reported seeing the object explode, following which the resultant circular cloud split into four lines, pointing in a downward direction, and one of which was swirled. These distinct lines lasted for about 30 seconds. Her original sketch is reproduced as Figure 3. Phil provided several images of the resultant cloud, which I have image processed to enhance the detail and reproduced as Figure 4. The two images were taken at 12h43 and 13h00 SAST, or approximately eight and twenty five minutes after the explosion, which Phil noted as 12h35. Figure 4a was taken shortly after the explosion, as seen from Phil's location at Site 3. He commented it appeared to disperse into an S-shape from the train.

Some minutes later, the cloud had been considerably dispersed as shown by Figure 4b.

Probable trajectory

It is not possible to give an exact description of the path of the bolide, since the event occurred during broad daylight, so that no celestial reference points were visible to enable an exact determination of the co-ordinates of start and end points. Also, no CCTV images of the bolide were submitted and the trajectory could only be based on visual descriptions. However, at least a tentative path can be inferred, albeit with a wide margin of error, from the reports already given in this article, and is shown in Figure 5.

The most southerly point of entry into the atmosphere can be estimated from the reports of Anwar Sasman, Alison Sussex, Phil Kenyon and Robert Fourie, who all gave a direction of the start point consistent with direction A. This point must also have been to the west of Cape Town, as indicated by the reports from the City area that the object was first seen at high altitude over Table Mountain or Signal Hill. Most reports indicate the object was at high altitude, and descending steeply, probably indicating the bolide entered the atmosphere at an oblique angle. Phil Kenyon indicated the object was descending left to right at an angle of about 20° to the vertical to altitude 19°, azimuth 293° as seen from his location at Site 3. Rena Rall gave the direction of movement as left to right, before exploding in direction B. She was sure the bolide did not pass her location and that it probably fell into the ocean after exploding. Based on these reports the possible path is shown as a white arrow in Figure 5, and probably falls somewhere within the confines of the red triangle.

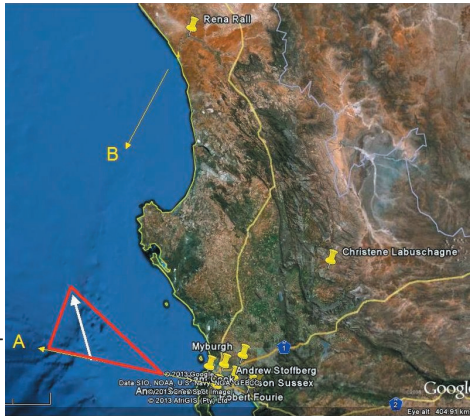


Figure 5 Possible trajectory of the fireball.

Conclusions

A very bright bolide entered the atmosphere on Tuesday 12 March 2013, at about 12h35-12h40 South African Standard Time, that is during broad daylight. Nine eye-witness reports were collected, which would seem to indicate the bolide entered the atmosphere at an oblique angle, and after a passage of perhaps a few seconds, exploded leaving a persistent cloud visible up to one hour after the explosion. The possible path constructed from the accounts indicates the object most likely exploded offshore and any debris probably fell into the Atlantic Ocean, off the west coast. ☆

LCOGT News

The Las Cumbres Observatory Global Telescope (LCOGT) network has come a significant step closer to completion with the installation and first light of three new 1-metre sized telescopes at the South African Astronomical Observatory's (SAAO) observing site at Sutherland.

The telescopes are part of a network of telescopes spread around the world used to study time domain astrophysics. This branch of astronomy is concerned with the study of objects which vary intrinsically with time or which change their appearance with time due to interactions with other objects. Examples of the types of objects which will be studied with the new telescopes at Sutherland include exoplanets, supernovae, gamma-ray bursts and minor planets in our solar system. In order to study these types of objects in detail astronomers need to be able to observe them over long periods. With a single telescope this is not possible as daylight interrupts observations. However, placing several telescopes around the world in different time zones means that once daylight approaches at one observing site astronomers can switch seamlessly to using a telescope located at another site where it is dark. The addition of the telescope node at Sutherland is crucial as it will allow astronomers to conduct observations over long time periods in the South without interruptions.

The weather played along beautifully on the morning of 18 February 2013 for offloading the telescopes and equipment from their shipping containers.

A team of LCOGT engineers and technicians, and LCOGT/SAAO astronomy postdoctoral fellow Abiy Tekola, convened at Sutherland for three weeks during February and early March 2013 to install and test the new telescopes. The telescopes arrived on site on 18 February and were lifted by cranes into the domes the next

At the crack of dawn (picture taken at 07:15, to be exact), the first telescope was being installed into its dome.

Only 45 minutes after the first one, the third telescope was carefully guided through its dome-slit by engineer Annie Hjelstrom.

day. The first of the three telescopes was fully assembled by the end of 20 February and went on-sky for the first time that night. The second and third telescopes followed over the next two days.

Annie Hjelstrom of LCOGT, the project engineer responsible for the successful installation, commented: "We had a great installation team, SAAO and SALT staff were very helpful, but this is also the culmination of eight years of design and development. Each telescope is built, configured, tested, and then dismantled at the Goleta, California headquarters before we put them back together on site."

To date LCOGT has installed four other identical 1-metre telescopes around the globe: an operational prototype at the McDonald Observatory, Texas, US (April 2012) and three science-grade telescopes at the Cerro Tololo Inter-American Observatory (CTIO), Chile (October 2012). The trio of telescopes at Sutherland brings the observatory's total of operational 1-metre telescopes to seven. Two more will be installed mid-year at the Siding Spring Observatory, Australia to complete the southern ring. A second telescope will be installed at the McDonald Observatory before the end of the year.☆

First light image of Trumpler 14, an open cluster and star-forming region near the bright star eta Carina, located about 7050 light years away.

First light image of M104, the Sombrero Galaxy in the constellation of Virgo, located 28 million light years away.

Edmund Zingu (Prof)

Simon Connell (President - SAIP Council)
(with thanks to Nithaya Chetty for his contributions)

It is with a deep sense of sadness that we note the passing of Prof Edmund Zingu on 20 April 2013. Whilst he was not an astronomer, he had many friends within the astronomical community and was a supporter of astronomy in South Africa.

Edmund Zingu served on Council of the South African Institute of Physics (SAIP) in the eight year period from 1999 to 2006, and was President of the SAIP Council from 2003 to 2004. In fact, Zingu was the first black SAIP Council President in the history of the SAIP. He played crucial leadership roles in many projects, more recently particularly in physics related development issues.

He was Vice President of the International Union of Pure and Applied Physics (IUPAP) and chair of C13 *Commission of Physics for Development*. He was primarily responsible for bringing to South Africa the iconic 'Physics for Sustainable Development' Conference in 2005 as a part of the International Year of Physics. This cast a distinct spotlight on physics as an instrument for development in Africa.

I would like to specifically mention his tremendous contribution to two very important projects of the SAIP. The first was the very successful Shaping the Future of Physics Project, where he contributed to the design of the project and also served as chair of the Management and Policy Committee which oversaw the international review in 2003. Physics in South Africa has grown significantly since then largely because of the implementation of many of the recommendations from the Review.

The second was the Review of Undergraduate Physics Education. Once again he contributed to the design of the Review and chaired the Management and Policy Committee. He led the development of the South African Draft Benchmark Statement for Physics Training, and guided the Review process, including the partnership with the Council for Higher Education. The Review of Physics Training is well advanced but still in progress.

Zingu began his Physics career at the University of the Western Cape (UWC), he had a period of employment at Turfloop, QwaQwa Campus, then as Head of the Physics Department and later Dean of Basic Sciences (1990-1993) at the Medical University of South Africa (MEDUNSA). He later returned to UWC and served as Head of the Physics Department (1994-1998) there, and finally Vice Rector of Mangosuthu University of Technology in Umlazi, Durban until the time of his

retirement. His leadership and contributions were characterized by sensitivity, perceptiveness, vision, ethics, wisdom, global standards and great industry.

Edmund Zingu was a pioneer for physics in post-apartheid South Africa, a visionary, a tireless campaigner for strengthening the discipline of physics and, above all, a true gentleman. He will be sorely missed.

His funeral service was held on Saturday, 27 April 2013. ☆

Margaret Thatcher (1925 – 2013)

Willie Koorts

In March this year, we celebrated the 40th anniversary of the official opening of SAAO Sutherland. On 8 April 2013 Margaret Thatcher passed away. You may wonder what is the relevance of these two facts. Fewer and fewer people nowadays remember that Margaret Thatcher was present at the opening ceremony of the Sutherland Observatory on 15 March 1973, almost to the day, 40 years before her death.

It was her third year in office as Secretary of State for Education and Science of the British government and still six years before becoming Prime Minister. She actually delivered the fourth of the five speeches that day, representing the SRC (Science Research Council), the British equivalent of the CSIR (Council for Scientific and Industrial Research). The South African SCIR was the appointed agency for operating the SAAO who made an agreement with the British SRC who contributed towards the running funds of the Observatory in exchange for telescope time to British astronomers.

In the introduction of a souvenir brochure

on the occasion, issued by the SCIR, recognised Thatcher's presence as follows: "The presence at this opening ceremony of the British Secretary of State for Education and Science, the Rt. Hon. Mrs Margaret Thatcher, lent both elegance and distinction to the occasion. More significantly, it reflected, at Government level, the bipartite nature of the event." She was referred to in all the speeches of the day. Dr C. vd M. Brink, President of the SCIR, pointed out that she was the first British Minister of Science to visit South Africa and was also warmly welcomed by Mr JJ Loots, Minister of Planning and the Environment. The then Prime Minister of South Africa, BJ Voster, reiterated Minister Loots' statement that it is primarily a scientific occasion, involving two governments. He also referred to international collaboration and welcomed the party of oversees astronomers who attended a symposium in Cape Town the previous week. Sir Richard van der Riet Woolley, first director of SAAO, gave the final speech. After thanking Mrs Thatcher for attending, he referred to South Africa's 150 year old connection with British astronomy and concluded: "I hope that you think that the operations which have been inaugurated today give every promise that the connection will be maintained in a very creditable manner."

Mrs Thatcher's complete speech and pictures, as published in the SCIR souvenir brochure, are given here. Note her amazingly visionary statement regarding future robotic observatories, which is quite remarkable considering that pocket calculators only started appearing at that time!

The Rt. Hon. Mrs Margaret Thatcher

Secretary of State for Education and Science
of the United Kingdom

Mr Prime Minister, Cabinet Ministers, Your Excellencies, Dr Brink, Ladies and Gentlemen,

I am delighted to be here today, as British Secretary of State for Education and Science, for the inauguration of this most important observing outstation.

I was fortunate enough to be travelling down in the helicopter with your distinguished Minister who represents you in Parliament in this part of the world, so I was thoroughly indoctrinated about all the pleasant aspects and beauties of Sutherland before we arrived here. It was not described as the nicest and best *remote* spot in South Africa, but quite the nicest and best spot in any event, and its people the most wonderful in the whole universe. So I was expecting something very wonderful when we arrived, and we certainly

have got it. And I am very pleased that this joint venture is able to make such an excellent start. I know that the negotiations which led up to the establishment of it went very smoothly and this does augur well for the future.

Mr Prime Minister, I think both you and I have had to do a good deal of historical research in order to make our speeches. I listened with great interest to everything that you had to say, and I confess to you that I *too* have done Aristotle, Ptolemy, Copernicus, Kepler, Galileo and Newton (who happened to come from and be educated in my home town of Grantham in England) and then Einstein.

i was rash enough at one time to ask if I might, before I came, have a tutorial on the fundamental significance of the theory of relativity. I confess that I was quite relieved when time was not forthcoming, and I have some doubts whether if time had been forthcoming, I would have been any much the wiser before speaking to you today.

But it is indeed a remarkable procession of scientists and I think it shows that the mysteries of space stimulate not only astronomers but many of our most creative scientists in other spheres – the physicists, the chemists and the mathematicians. And it does not stop with the pure scientists because the demands that you are making upon those who produce the equipment really require the very highest standards that our ablest technologists and engineers are able to provide; and stimulate them too to do work every bit as intellectually exacting as the very astronomy you do with the instruments they supply.

Mr Prime Minister, you pointed out that astronomy today is a big science, in the sense that it does require big facilities and co-operation on an international scale, and Britain does indeed welcome the opportunities for co-operation. I have had the pleasure of visiting a number of installations which are the result of co-operation between nations and between scientists, and it does show not only that spirit which pervades the scientific world of co-operation, but also is, I think, a great tribute to politicians and the people who elect them, that we too can give such an important place in our budget to the continuation of fundamental research for itself as well as for the greater and enlarged benefits that it brings to mankind by virtue of its discovery.

In my researches I did discover one person – the Earl of Rosse, who in the 1840's actually was able to build his own 72-inch telescope without official help. Naturally I envy anyone with such resources, but of course it was a very much simpler telescope than we could provide now. And it is the taxpayers who have now collectively replaced the private patrons of earlier years. In Britain the Science Research Council, to which I am answerable in Parliament – and it is one of my very happy duties – has given astronomy priority and it

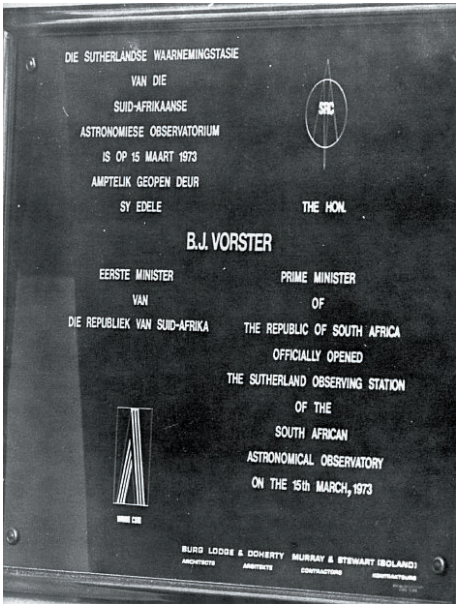
has also given nuclear physics a good deal of priority. It is interesting to see the discoveries of one in the energy sphere linking up with the significant discoveries in the other. And in astronomy of course several projects have been undertaken through the Science Research Council.

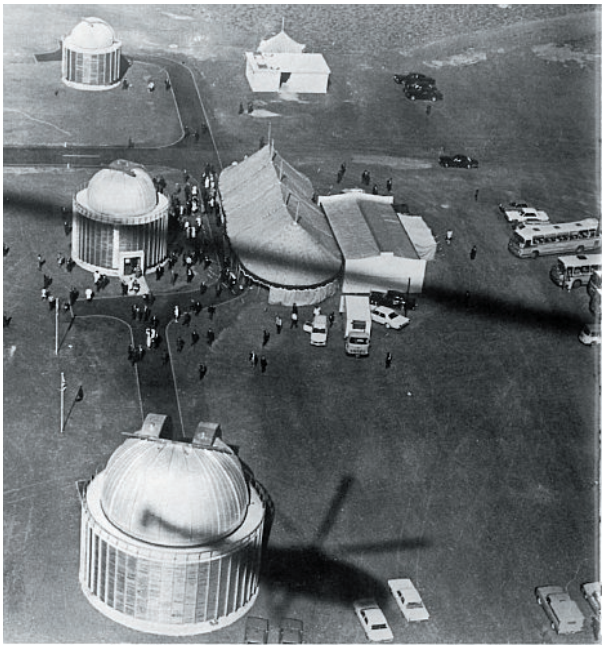
We joined you in South Africa, with the Council for Scientific and Industrial Research, and a number of other countries e.g. Australia, Europe, Hawaii and South America. Most of our astronomical projects are in the Southern hemisphere where the skies are much less well explored than in the North and where there is still much of great interest to observe. Southern hemisphere astronomy began here in South Africa and the work of high repute carried out by the Royal Cape Observatory over some 150 years and of the Republic Observatory over some 67 years provides a sound basis on which to build.

We are told that some thousands of years ago the men who built the great stone circles such as Stonehenge did so for astronomical purposes and did so for accurate forecasts of eclipses. The year 1973 is the 500th anniversary of Copernicus whose almost posthumous publication removed the earth from the centre of the universe only a few decades before the telescope was invented. Less than 100 years ago the photographic plate was first used by astronomers. Radio astronomy, which has so extended man's understanding of the universe, began after World War II, some 25 years ago. Space satellites since Sputnik in 1957, i.e. in 15 years, have extended astronomical research outside both ends of the visible part of the electro-magnetic spectrum. In the past few years sophisticated electronic devices such as Wamplers have been coming into use. In the same brief time scale of the last few years has come the discovery of many complex molecules mostly at the galactic centre which is overhead from Sutherland.

The last discovery is of particular interest to chemists – and, if I may be permitted a personal note, I was once a chemist. Each extension of research to new wavelengths has produced a major increase in our knowledge. Astronomy is increasingly involving people of other disciplines – high energy particle physicists, instrumentalists, chemists etc – yet compared for example with the particle physicists, astronomers have scarcely begun to automate their researches. But this must come, perhaps even to the extent that astronomers already well established or indeed even present will cease to spend long watches of the night in telescope domes and leave computers to run their observing programmes. I am not sure whether that is today's heresy, but, if so, it is probably tomorrow's practice.

We must expect proposals in due course for developments in the South African Astronomical Observatory which must be considered against other





(top, left) Mrs Thatcher and John Voster at the opening ceremony.

(above) The plaque revealed that day displays both the logos of the SRC (top, right) and the SCIR (bottom, left).

(left) An aerial shot of the Observatory, consisting of only three domes in 1973. As can be seen from the shadow, this was taken from one of the two helicopters which transported the guests to Sutherland, as mentioned in Mrs Thatcher's speech.

competing claims on the resources that can be made available. Whatever developments the future holds, the observing programmes and the consideration of the resulting data will continue to depend on the astronomers, both those already established and students now or not yet at universities.

I am glad to note the emphasis given by the South African Astronomical Observatory to providing access for, and co-operation with the Universities. I know there are many astronomers in Britain, both in our universities and in the two Royal Observatories, who are looking forward to fruitful use of the facilities already here and such further ones as may be added as resources permit. At the same time I am conscious that the sky continues to offer much of interest to the individual or the school with relatively little equipment, and I think that throughout time it has been interesting to note how those who eventually became famous in astronomy found a fundamental fascination in the subject at a comparatively early age.

You mentioned Mr Prime Minister, the importance of kindling the interest of the young in science. I think astronomy and its wonders and mysteries is a subject which helps us to do that because the young have a very natural interest in the marvels of nature, and often if one could talk to them about these subjects, it would help them to go through some of the duller scientific work which they have to do in the early years, before they go on to the marvels of space and astronomy, and of fundamental science, and it is my belief that the work done here at this observatory will, in addition to its great intrinsic scientific value, contribute an extra stimulus to young people's interests in astronomy and science generally. As Secretary of State for Education and Science this is naturally of importance to me.

The brochure produced for this occasion shows the sound basis of planning adopted by Sir Richard Woolley and his colleagues. I am glad to be associated with this inauguration of what we can expect to be a rewarding joint venture of your Council for Scientific and Industrial Research and our Science Research Council.

And I thank you most warmly for letting me come and take part in this great occasion. ☆

African Star-Lore

Auke Slotegraaf

Editor's Note: There are very few, if any, astronomical artefacts in sub-Saharan Africa, but there is an extremely rich oral tradition. With the urbanization and industrialization of sub-Saharan Africa, many of these stories are not being retold anymore and need to be captured for posterity. Auke Slotegraaf's summary below, from his website, www.psychohistorian.org is a sort of summary of what is recorded. Further details can be found in the references at the end. Should any reader have stories that they know of, that are not in this article, please forward them to: mnassa@saao.ac.za

SAAO "Friends with the Universe" project poster, 1998.

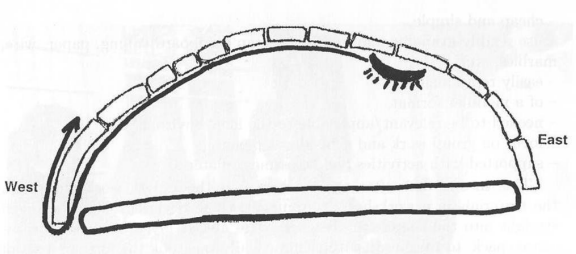
The sky and the stars

A wide-spread African concept is that the sky is a solid dome, perhaps made of blue rock, resting on the Earth, upon which the Sun moves. The traditional Tswana idea is that stars are holes in the rocky vault that is the sky. (see sketch)

The Nyae Nyae !Kung Bushmen saw the sky as the dwelling place of all the divine beings and spirits of the dead. The "things of the sky" generally do not influence or reflect the affairs of man, the !Kung taught, nor do they affect the weather, the growth of vegetation, or other conditions of the earth; they are in a realm of their own.

In Xhosa, a star is inkwenkwezi, inkanyezi in Zulu, nyenyedzi in Shona, dinaledi in Sotho, tinyeleti in Tsonga, maledzi in Venda, linaleri in Setswana, and nyota in Swahili.

While the /Xam Bushmen believed the stars were formerly people, some !Kung Bushmen taught that stars are, in fact, small creatures, and look like tiny porcupines – they have little legs, ears, teeth and are covered with tiny spines. Another !Kung account says that stars are actually ant lions, watching from overhead with their bright eyes. When they are hungry and see an ant, they quickly fall to the ground to



Stone vaulted Sky

catch it. Some say that all the stars fall to the ground each morning, and we see them on earth as insects. The Ibibio of Nigeria spoke picturesquely of the stars as "Sand of the Moon".

The Sun

The Sun is ilanga in Xhosa and Zulu, duvha in Venda, zuva in Shona, and letsatsi in Sotho.

The Nyae Nyae !Kung Bushmen think of the Sun as a "death thing" because of its searing heat and the association with thirst, hunger, and exhaustion.

The /Xam Bushmen would ask the Sun, early in the morning before they set out to hunt, to steady the hunter's arm when aiming at game. The Sun was originally a man, the /Xam said, whose head shone brightly. But he was a lazy fellow and would sleep late, keeping his light to himself. So one day, out of desperation, the First Bushmen chopped off his head and threw it up into the sky so that his light could be shared with everyone.

On rare occasions, the Moon passes between the Earth and the Sun, resulting in a solar eclipse. If the alignment is exact, then the entire Sun is momentarily blacked out. Such a total eclipse was not a welcome sight to the Xhosa, who saw it as an ill omen. In Zulu, Sotho and Tswana traditions this was called "the darkening of the Sun", ukufiphala kwelanga and fifalo ya letsatsi respectively. The Venda spoke picturesquely of mutsha-kavhili, "the two dawns".

The Moon

The Moon – iNyanga to the Xhosa and Zulu, Nwedzi to the Shona and Venda, and Ngwedi to the Sotho and Tswana – is probably the most obvious feature in the night sky, because of its size, brightness, and changing appearance (phases). As the Moon orbits the Earth it goes through a sequence of phases, from New Moon (invisible) to crescent, half-moon, Full Moon, half-moon, and back to New Moon.

To the Kora KhoiKhoi, the Moon was kham, "the Returner"; the Nama KhoiKhoi spoke of khab. The KhoiKhoi also considered the Moon as "the Lord of Light and Life", and would sing and dance at times of New and Full Moon.

The Nyae Nyae !Kung Bushmen said that the crescent phases with sharp points was male, while the Full round Moon was female.

The Xhosa considered the time of New Moon as a period of inaction. When it reappeared as a crescent in the evening sky, it was cause for celebration. Important events were scheduled to take place around the time of Full Moon. Also at Full Moon the mothers would de-worm their children, believing that at this time the worms collected in one place and could be effectively treated.

The Naro Bushmen taught that when the crescent Moon slopes downward, it is said to be looking

into a grave and this is a sign that many people will die in that season. A crescent pointing upward was a favourable sign. The round Full Moon is a sign of satisfaction and that people will find plenty of food.

In /Xam Bushmen mythology, the Moon is a man who has made the Sun angry. The Sun's sharp light cuts off pieces of the Moon until almost the whole of the Moon is gone, leaving only one small piece. The Moon then pleads for mercy and the Sun lets him go. From this small piece, the Moon gradually grows again until it becomes a Full Moon. The /Xam also have another account of how the Moon came to be. In the old times, it was said, the Moon was one of the leather sandals of the Mantis-god /kaggen. The sandal was placed in water to soften it somewhat, but this angered the water spirit who then froze the water, locking the sandal in ice. When /kaggen saw the frozen sandal he discarded it, throwing it up into the sky, where it became the Moon. Whatever its origin, the /Xam considered the New Moon as being able to influence hunting and the gathering of ants' eggs, and when the crescent was sighted, they would ask for its assistance.

The surface of the Moon has dark and bright markings; flat lava plains and rocky highlands, respectively. In many African traditions these markings are said to resemble the figure of a man or woman carrying a bundle of sticks. When the Earth's shadow falls on the Moon, a lunar eclipse occurs. The Nyae Nyae !Kung Bushmen said that this was caused by the lion, putting his paw over the Moon to darken the night so he could have better hunting. Under certain atmospheric conditions, a "moon bow" can form, appearing as a large ring around the Moon. To the /Gwi Bushman, such a ring was a sign that food will be plentiful.

Bright southern stars

The Southern Cross (Crux) and the two bright Pointers (alpha and beta Centuari) are probably the most recognizable of the southern stars and they feature prominently in African star lore.

The Southern Cross or Dithutlwa, the Giraffe Stars. NASA-HST

In Sotho, Tswana and Venda traditions, these stars are Dithutlwa, "The Giraffes". The bright stars of Crux are male giraffes, and the two Pointers are female. The Venda called the fainter stars of the Southern Cross Thudana, "The Little Giraffe". They also say that the month Khubvhumedzi begins when the crescent Moon can be seen for the first time and, at the same time, the lower two giraffe stars are just below the horizon and the upper two are just visible. Sotho lore tells that when the giraffe stars are seen close to the south-western horizon just after sunset, they indicate the beginning of cultivating season.

The /Xam Bushmen saw the two Pointers as male lions; they were once men, but a magical girl turned them into stars. The three brightest stars of the Southern Cross they saw to be female lions. To the Khoikhoi, the Pointers were known as Mura, "The Eyes", of some great celestial beast.

The Coal Sack, a large dark nebula near the Southern Cross, is known as the "Old Bag of the Night" to the Nyae Nyae !Kung Bushmen.

The long axis of the Southern Cross points towards a bright star called Achernar. This star is called Senakane (Sotho, Tswana) and Tshinanga (Venda), meaning "The Little Horn".

Brighter still than Achernar is Canopus, one of the brightest stars in the night sky. It is widely known in southern Africa as Naka, "The Horn Star". In Sotho tradition, a careful watch was kept for Naka about the end of May. Sotho chiefs awarded a cow for Naka's earliest sighting. The day of the sighting the chief would call his medicine-men together. Throwing their bone dice, the doctors would judge whether the new season would be good or bad. The appearance of Naka also heralds coming of winter and browning of the veld. When Naka appeared before sunrise, the Tswana knew it was time to start breeding their sheep. In Venda tradition, the first person to see Nanga in the morning sky (in May, heralding winter) would climb a hill and blow the phalaphala (black sable antelope horn) and he would receive a cow as a prize. The Zulu knew Canopus as is Andulela, a messenger appearing at the end of Autumn, the harvest time, and also as inKhwenkwezi, "The Brilliant Star". The /Xam Bushmen believed that Canopus could influence the availability of ants' eggs, a rich source of nourishment, and they called it "The Ant Egg Star".

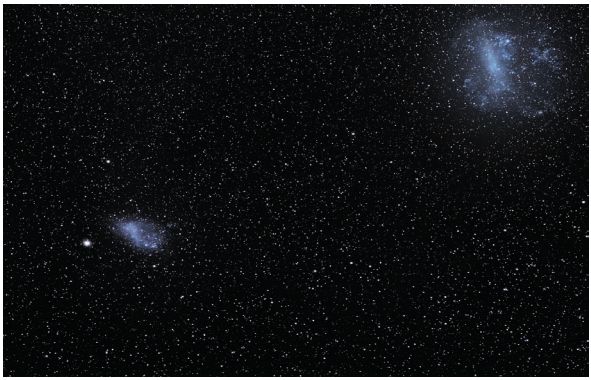
The beautiful constellation Scorpius with its slender curved row of stars is famous for the bright reddish star Antares. This star was called by the !Xu Bushmen "The Fire-Finishing Star" – not only does it have a reddish colour, but (at certain times of the year) it sets very late at night, when the camp fires have died down. (See also Arcturus and Regulus below.)

Along the curved body of the scorpion, just before the tail section, lies a close pair of stars (mu-1 and mu-2 Scorpii), which the Khoikhoi called xami di mura, "The Eyes of the Lion".

Near Scorpius is a conspicuous circlet of stars known as Corona Australis, the Southern Crown. The /Xam Bushmen had a tale about a group of men who sat eating together when a bewitched girl look upon them, turning them into these stars.

The bright star Fomalhaut lies in a rather star-poor region and is prominent in the summer sky. It is called Ndemara, "The Sweetheart Star", by the Shona, and Ntshuna, "The Kiss Me Star", by the Tswana. The visibility of this star was supposed to indicate the time for lovers to part before their parents discovered them. (Compare this with the tale about Venus the Evening Star, below).

Another prominent southern star is Peacock (alpha Pavonis); the /Gwi Bushmen call it "The Female Steenbok".



The Magellanic Clouds. ESO Brunier

The Magellanic Clouds

On a moonless night under a dark sky, two interesting "clouds" can be seen to the south, one cloud much larger and brighter than the other. These are the Magellanic Clouds, or the "Cape Clouds", and are actually entire galaxies, thousands of light years away.

The Ju/Wasi and !Kung Bushmen said that the larger cloud was a part of the sky where soft thornless grass grows, like the kind they used for bedding. One day, they say, God climbed onto the large cloud and went hunting. Several other Bushman groups saw the two clouds as male and female steenbok.

The Sotho saw the clouds as the spoor of two celestial animals. The large cloud was Setlhako sa Naka, "The Spoor of the Horn Star" (Naka, Canopus) and the smaller cloud was Setlhako sa Senakane, "The Spoor of the Little Horn Star" (Senakane, Achernar).

Tswana folklore tells that when the small cloud appeared more clearly than the large cloud, a drought would follow.

The Milky Way

On a dark night, the Milky Way can be seen, a dim band of light stretching

from horizon to horizon. Various groups (including the Venda, Setswana and Sesotho) described it as a supernatural foot path across the sky along which the ancestor spirits walked. Many peoples referred to it as "Night's backbone", "Sky's spine" and "God's back", suggesting the idea that the Milky Way held up the sky, or maybe held it together.

In /Xam Bushmen star lore, the Milky Way was created by a girl of the ancient race who scooped up a handful of ashes from the fire and flung it into the sky. This made a glowing path along which people could see the route to return home at night. She also threw bits of an edible root into the sky, the old (red) pieces creating red stars and the young (white) pieces creating white stars.

The stars around Orion

On summer nights, the brilliant constellation of Orion, with Taurus the Bull on one side, and bright Sirius on the other, graces the southern night skies. Orion is instantly recognizable by its three bright stars in a short line (Orion's Belt), and the brilliant orange star Betelgeuse. Rigel is the other bright star in Orion (opposite Betelgeuse from the Belt Stars). Roughly between Rigel and the Belt Stars lies Orion's Sword, which appear as three fuzzy stars.

Several cultures identify the Belt Stars as animals. They are seen as three pigs by the Sotho (Makolobe), Tswana (Dikolobe), and the Karanga of Zimbabwe (Nguruve). The Sotho called Orion's Sword Dintshwa, and the Tswana called it dintsa le Dikolobe, meaning "The Three Dogs are chasing the Three Pigs". The /Xam Bushmen said the Belt Stars were "Three Male Tortoises (hung on a stick)," and Orion's Sword was "Three Female Tortoises (hung on a stick)".

To the Nyae Nyae !Kung Bushmen, Orion's Belt was "The Three Zebras", a male animal flanked by two females.

The Songye of Zaire speak of the Belt Stars as aspibwe na mbwa na nyama "a Hunter with a Dog and an Animal". Similarly, the !Xu Bushmen saw "a Man, a Dog, and a Buck".

The Milky Way or the Fire Ashes in the Sky. NASA

Throwing ashes into the sky. Detail, SAAO Starlore Poster.

The Zulu referred to Orion's Sword as oNdwenjana; the meaning isn't clear because it can either indicate a tall object/man/tree, or a type of long-stemmed flower, such as a lily.

The Masai charmingly refer to the Belt Stars as "Three Old Men Pursued by Lonesome Widows"!

Nearby Orion lies Sirius, the brightest star in the night sky. Sirius dominates the morning sky in July, and it late winter is rises early. The Sotho knew it as Kgogamashego, "Drawer Up of the Night". To the Tswana it was Kgogamasigo, "Pulls the Night Across". The Venda called it Khohamutsho "Pulling Out the Dawn". The Zulu had various names for it, such as inDosa and inDonsemasuku, meaning "straining, or pulling". The /Xam Bushmen called Sirius "The Grandmother of Canopus", because Sirius rises after Canopus, and the elderly usually follow behind the more agile youths. In Xhosa, the star is known as iQhawe, "The Champion", presumably because it is the brightest star in the night sky.

Orion. Three Dogs are chasing the Three Pigs.

Taurus the Bull has its own bright orange star, Aldebaran, and not far off is the beautiful star cluster the Pleiades, also called the Seven Sisters.
The /Xam Bushmen saw Aldebaran as "The Male Hartebeest", with Betelgeuse as its mate.

The Pleiades is a prominent cluster of stars, of which usually six or seven bright members can be seen. To many pastoralist groups of southern Africa, the first visibility of the Pleiades in morning twilight (in August or early September) announced the start of the planting season, and usually also marked the beginning of the year.

The /Xam Bushmen said the Pleiades are one of "summer's things", and the Khoikhoi used the Pleiades to forecast the start of the rainy season.

In Kiswahili (East Africa & Zanzibar) they are Kilimia, "The Ploughing Stars" or "The Digging Stars". There is a Swahili proverb that says: "If the Digging Stars set in sunny weather they rise in rain, if they set in rain they rise in sunny weather." Similarly, they are Kelemera to the Nyabungu of Ruanda, Lemila to the Nyasa of Malawi, Selemela in Sotho, Shirimela in Tsonga, Selemela in Tswana, Tshilimela in Venda, and isiLimela in Xhosa and Zulu.

The Xhosa would watch for the first appearance of the isiLimela in June. It is said that the month of the Digging Stars, Eyesilimela, symbolized new life in man. The coming-out ceremony of the abakwetha circumcision school, when boys would become men, was determined by the appearance of this stellar

grouping, and it is the custom for Xhosa men to count their years of manhood from this date.

The //Gana Bushmen say that the Pleiades are the wives of Canopus and Sirius, and the men's younger brother is Achernar.

Aldebaran and the Pleiades are described by the Ibibio of Nigeria as "The Mother Hen and her Chicks".

The Sotho and Tswana had a rule for finding direction at night: if you want to travel west, keep the Southern Cross on your left hand, and Selemela (the Pleiades) on the right.

The Namaqua Khoikhoi spoke of the Pleiades as the "Stars of Spring" and called them the Khunuseti. They were the daughters of Tsui //Goab, the Dawn or Sky God. A beautiful mythical tale encompasses the remarkably bright stars of this region. One day, the story goes, the Khunuseti told their husband (Aldebaran) to go out and hunt the three zebras (Orion's Belt). Dutifully, the husband went out, but took only one arrow with him. He aimed and shot at the zebras, but missed. His arrow (Orion's Sword) fell beyond them, and still lies there today. Although he wanted to retrieve the arrow, he couldn't: there was a fierce lion (Betelgeuse) nearby who was also watching the zebras. So the poor man sat there, shivering from the cold and suffering from thirst and hunger, unable to return to his wives (who would be angry) or to collect his arrow. (The Ju/Wasi Bushmen have a similar tale.)

Near Orion and Sirius is the bright star Procyon. The /Xam Bushmen considered it "The Male Eland", who has two wives (Castor and Pollux, see below).

Rigel and Betelgeuse, with Sirius and Procyon, were known as Magakgala or Mahakala to the Basuto, Lobedu, Northern Sotho and Tswana. When these stars were visible in the early evening, they knew it was time to harvest the corn.

Bright northern stars

A prominent northern star is Arcturus, which various Bushmen groups called "The Fire-Finishers' Child", because it appeared in the early morning hours, when the camp fires had died down. In Swazi tradition, the star is Lweti, and is visible in the morning sky before sunrise in November, at the time when women begin their day's work.

Capella is a very bright star that never rises very high above the northern horizon as seen from southern Africa. The Zulu call it iNtshola, "The Cattle Thief". The Nyae Nyae !Kung Bushmen called it "Green Leaf Horn" and knew that when it was visible, the first flowers would bloom with the coming of the season of rains.

Altair is another bright star that lies toward the north. It is known as "The Female Steenbok" to the /Gwi Bushmen. Located lower than Altair is the bright star Vega, which they call "The Male Steenbok".

Castor and Pollux, the two bright stars of Gemini,

were considered by the /Xam Bushmen to be "The Female Elands", the wife of Procyon.

The small but striking northern constellation Delphinus the Dolphin is known in Setswana as gakgala, "The Mopane Worm".

Spica is a lone bright star in the modern constellation Virgo. The //Gana Bushmen knew it as "The Pig Star". In Zulu custom, it is known as iNqonqoli, "The Wildebeest Star", and its seasonal visibility coincides with the calving season of the wildebeest.

Regulus, the brightest star of Leo, was known to the /Gwi Bushmen as /edzini, "The Fire-Finisher" which only sets when the firewood has been exhausted.

Venus: the Evening and Morning Star

The Evening Star, usually Venus, is visible from time to time in the west after sunset. When this bright star appears in the evening sky, the Xhosa called it U-cel'izapolo, "One Who Asks for Milk from a Teat", because this would be the time when boys playing in the fields would rush home to milk the cows. The Evening Star was also known as Madingeni, "The Dating Star". In the olden days, boys and girls were not allowed to date each other in public, so they would arrange a secret get-together when Madingeni became visible. Many peoples linked the evening appearance of Venus with supper time. The Ndebele called it Lykwela mkobe, and the Zulu spoke of iCelankobe, meaning "Asking for Mealies". The Sotho knew it as Kopa-dilallo, the Tswana as Kopadilelo, and the Venda as Khumbela tshilalelo, meaning "Asking for Supper".

When Venus is visible in the morning sky just before sunrise, it is the Morning Star. The Herero called it okanumaihi, "Little Drinker of Sweet Milk", on account of its appearance at milking time. The Nyae Nyae !Kung Bushmen called it "Old Star" and said that it guided the Sun across the sky. In Xhosa tradition, the Morning Star is iKhwezi lokusa and is associated with diligence. Travellers, who sleep out in the open, would see it and know it was time to resume their journey. Young women and girls also wake up during this time to start doing their daily chores. Girls are often named after Venus and called nomaKhwezi, with the hope that they, too, will be diligent when they grow up.

Venus is, in fact, so bright that it can at times be seen in broad daylight. Xhosa boys, out in the veld herding, would try to spot it as part of the challenge to becoming a true shepherd.

Comets and meteors

In most cultures of the world, meteors (sometimes called shooting stars) are regarded as signs of important earthly events. Sometimes, these are good events. The San Bushmen of northern Namibia and the Masai of Kenya and Tanzania considered meteors to be favourable omens, foretelling good rains.

In Tswana mythology a very bright meteor is an indication of a good season ahead.

Sometimes, meteors are seen as a bad omen. To the !Xu Bushmen a meteor was an evil spirit racing across the sky to cause mischief among the people.

The /Xam Bushmen, however, said that the stars knew when a Bushman dies, and a falling star announces the death of one of them.

Other interpretations of meteors are neither good nor bad. The Zulu, for example, say that meteors resulted from celestial cattle hastening to new grazing in another part of the sky. When the cattle drag their hooves they break through the floor of the sky and create streaks which soon fill in with mud. The Karanga of Zimbabwe would shout "Li-i-I Thobela!" when they saw a meteor, thinking that a god or ancient chief was shooting across the sky.

Comets were also seen as important signs of earthly events. The Masai considered comets to be the embodiment of important gods. In Xhosa tradition, a comet, Uzatshoba, is associated with bad luck, calamity, wars and death. There was also a strong belief that comets predicted the death of a chief. To the Sotho, comets were naledi tsha mesela, and to the Zulu, inkanyezi enomsile, meaning "stars with tails".

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Astronomical Colloquia

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

Also included in this section are the colloquia/seminars at the SAAO, NASSP, 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: Activities of the IRSF
Speaker: Takahiro Nagayama
Venue: SAAO Auditorium
Date: 28 February
Time: 16h00
Abstract: IRSF is a Japanese 1.4m telescope with a near infrared JHK simultaneous camera, SIRIUS, which has been working from November 2000 at Sutherland. It is a joint project between Nagoya Univ. and SAAO. I review the activities of IRSF, the latest topics and the future plan for IRSF. The original purpose of IRSF was the simultaneous JHKs band survey of the southern sky, particularly of the Magellanic Clouds. The main survey was completed in 2005 and the photometric catalogue, containing 15 million sources for the LMC and 2.7 million sources for the SMC, was published in 2007. After completion of the Magellanic Clouds survey, we have added some unique capabilities to SIRIUS, as well as the continuation of long term monitoring of the Magellanic Clouds. The most unique capabilities of IRSF is a wide field NIR linear/circular imaging polarimeter. We also have ND (1% and 10%) filters and narrow band filters for Pa_Beta (1.28um), Br_ Gamma(2.16um), [FeII] (1.26um), and H_2 (2.12um). I present the recent data obtained from the above capabilities. As a future plan, we have two further developments for IRSF. One is a new low resolution spectrometer covering 0.45um - 2.5um. Another is an additional unit which enables simultaneous images of the current JHKs as well as an additional 2 or 3 optical bands. Finally, I also introduce our instrumentation for the SAAO 75cm telescope. Test observations of the simultaneous optical g'r'i' camera TRIPOL was successfully completed in October 2011, and it is commissioned as one of the SAAO instrument for the 75cm telescope now. In addition, we would like to propose a wide field i-band imaging polarisation camera for the 75cm telescpe, covering 15'x15' (goal 30'x30').

Title: Discovery of 23 min pulsations in an Ae star using the KELT telescope
Speaker: Thebe Medupe (University of North West)
Venue: SAAO Auditorium
Date: 7 March
Time: 16h00
Abstract: Herbig Ae stars are intermediate mass premain-sequence stars identified by significant infrared excess and emission lines in their Balmer lines due to circumstellar dust. They show irregular photometric variability due to variable dust obscuration. Observations by KELT of one such Ae star, HD 68695 revealed delta Scuti-like pulsations with a period of 23 minutes. This makes this star one of the few dozen known pulsating Ae stars and allows us to apply asteroseismic techniques to it, to determine its physical properties. In this talk I will present a review of these stars, and the data collected by KELT on HD 68695 and a low resolution spectrum of it.

Title: Galaxy Evolution and Cosmology Studies Using Radio Data and HPC
Speaker: Catherine Cress (Centre for High Performance Computing)
Venue: SAAO Auditorium
Date: 14th March
Time: 16h00
Abstract: I will outline questions in galaxy evolution and cosmology that can be addressed using surveys carried out with radio telescopes. Galaxies detected via their neutral hydrogen content and those which are detected via their radio continuum emission will both be considered. I will focus on measurements of the clustering of sources, presenting results from the ALFALFA and FIRST surveys, and discuss related science that will be possible with future surveys carried out by the SKA and its pathfinders. I will also mention Astronomy initiatives underway at the Centre for High Performance Computing.

Title: AGN Prospects for the Cherenkov Telescope Array
Speaker: Markus Böttcher (NRF SARChI Chair of Astrophysics and Space Physics, UNW)
Venue: SAAO Auditorium
Date: 11 April
Time: 16h00
Abstract: In this talk, I will present an overview of the science prospects for very-high-energy gamma-ray observations of AGN by the planned Cherenkov Telescope Array. Progress is expected in a variety of science questions, including the physics of particle acceleration in relativistic jets, the unification between blazars and radio galaxies and the blazar sequence, population studies and questions of cosmological evolution of AGN, and explorations of signatures of gamma-gamma absorption both by the Extragalactic Background Light and by IR - UV radiation fields intrinsic to the AGN.

ACGC

Title: Three-form Cosmology
Speaker: Tomi Koivisto
Venue: M111, Maths Building, UCT

Date: Tuesady 12 March
Time: 13h00:
Abstract: The possible role of three-form fields in cosmology as alternatives to scalar field inflatons or quintessence fields is considered. It is shown that three-form models can predict viable background dynamics and new signatures in cosmological perturbations. Three-form inflation nonminimally coupled to electromagnetism provides the only known model that generates the observed amount of magnetic fields while avoiding the backreaction/strong coupling problem.

Title: D-branes and the Disformal Dark Sector
Speaker: Danielle Wills (Durham)
Venue: M111 (UCT, Maths)
Date: Tuesday 19 March
Time: 13h00
Abstract: I will discuss a unified model of the cosmological dark sector in the context of Type IIB string theory, where the motion of a D-brane in the compact dimensions gives rise to dark energy from the four dimensional point of view, and the particles living on the world-volume appear as dark matter. This picture is a very natural embedding within a fundamental theory of so-called "disformal" gravity, an extension of Einstein's general relativity which entails a novel screening mechanism and provides a very promising framework for understanding the dark sector, and which can be efficiently constrained by its predictions for large scale structure.

Title: Dr Sidelobes - How I learned to stop worrying and love simulations
Speaker: Prof Oleg Smirnov, SKA Research Chair, Rhodes University
Venue: Room 304 Maths building, UCT.
Date: 9 April
Time: 13h00
Abstract: Radio interferometers are complex -- and above all counter-intuitive -- instruments, and we are constantly pushing the envelope of their performance with increasingly sophisticated science experiments. The combination of these two circumstances can produce some real surprises -- most of them of the unpleasant variety. I will present some examples of surprising observational limitations, both in real-world and simulated data (DDEs, calibration ghosts, sidelobe confusion, calibration noise) and discuss their possible impact on future radio surveys.

Title: Axiverse cosmology and the energy scale of inflation.
Speaker: David Marsh, Perimeter Institue
Venue: M111 Maths, UCT
Date: Tuesday 2 April
Time: 13h00
Abstract: Ultra-light axions (m_a<10^{-18} eV), motivated by the so -called "String Axiverse", can be a powerful probe of the energy scale of inflation. In contrast to heavier axions the isocurvature modes in the ultra-light axions can coexist with observable gravitational waves. Here it is shown that large scale structure constraints

severely limit the parameter space for axion mass, density fraction and isocurvature amplitude. It is also shown that radically different CMB observables for the ultra-light axion isocurvature mode additionally reduce this space. The results of a new, accurate and efficient method to calculate this isocurvature power spectrum are presented, and can be used to constrain ultra-light axions and inflation.

Title: Leptonic and Hadronic Modeling of Fermi-Detected Blazars

Speaker: Prof Boettcher, NWU, Potchefstroom

Venue: RW James Lecture Theater C

Date: Friday, 12 April

Time: 13h00

Abstract: We describe new implementations of leptonic and hadronic models for the broadband emission from relativistic jets in AGN in a temporary steady state. The new model implementations are used to fit snap-shot spectral energy distributions of a representative set of Fermi-LAT detected blazars from the first LAT AGN catalogue. We find that the leptonic model is capable of producing acceptable fits to the SEDs of almost all blazars with reasonable parameters close to equipartition between the magnetic field and the relativistic electron population. If charge neutrality in leptonic models is provided by cold protons, our fits indicate that the kinetic energy carried by the jet should be dominated by protons. We find satisfactory representations of the snapshot SEDs of most blazars in our sample with the hadronic model presented here. However, in the case of two quasars the characteristic break at a few GeV energies can not be well modelled. All of our hadronic model fits require powers in relativistic protons in the range 10^{47} - 10^{49} erg/s.

NASSP

Title: Aspects of Linear and Nonlinear Waves in Space Plasmas

Speaker: Dr Jeandrew Brink.

Venue : RW James Lecture Hall C

Date : 20 Feb 2013

Time : 13h00

Abstract: Space plasmas are often not in thermodynamic equilibrium, and examples such as two-temperature plasmas and non-Maxwellian velocity distributions (with a superthermal “tail”) are commonly encountered. The latter are well modelled by a so-called kappa distribution. Plasmas can support a rich variety of waves. Many satellite-based experiments show evidence of waves in space. These may appear, for instance, as small amplitude (linear) waves or as large amplitude solitary waves. We first outline some of the high frequency waves that can play an important role in typical multi-component space plasmas. Next we consider some effects of high-energy tails on wave behaviour, with applications to both Saturn’s magnetosphere and a dusty plasma environment. We shall then

discuss nonlinear solitary waves in multi-species space plasmas, and in particular illustrate existence domains and report on kappa distribution effects as well as some recent fundamental developments.

Title: Red Supergiants in Open Clusters
Speaker: Ignacio Negueruela from the University of Alicante
Venue : RW James Lecture Hall C
Date : 27 Feb 2013
Time : 13h00
Abstract: Red supergiants (RSGs) represent a crucial phase in the evolution of high-mass stars. Mass loss in this phase determines the ultimate fate of the star and its contribution to chemical enrichment. But the properties of RSGs are very difficult to study in isolation. Accurate stellar parameters depend on a good estimation of their distances, while comparison of these parameters to evolutionary models requires knowledge of their ages. Such information is only available for RSGs in open clusters. Unfortunately, given the rarity of RSGs, few clusters contain more than one RSG (if any). I will review the properties of open clusters rich in RSGs, such as chi Persei and NGC 7419, and introduce the RSG population of Stephenson 2, the second most massive young cluster known in the Milky Way, which contains the largest collection of RSGs. An analysis of their properties strongly suggests that the spectral types of RSGs represent an evolutionary sequence. These and other recent results suggest that we have to seriously reconsider what we thought we knew about RSGs.

Title: Strategies and Tools for a Literature Survey
Speaker: Andrew Collier from UKZN
Venue : RW James Lecture Hall C
Date : 13 March
Time : 13h00
Abstract: Most research projects start with a literature survey. What is already known in the field? Who is already working in the field? Where is the data coming from? What methods are being used? What are the open questions? How can I contribute? Solid strategies are required to make sense of the extensive body of literature and good tools are necessary to compile all of this information in a useful format. This talk will provide some suggestions for undertaking a literature survey and presenting the results.

Title: Cosmology and galaxy evolution from cluster surveys
Speaker: Matt Hilton from UKZN
Venue : RW James Lecture Hall C
Date : 20 March 2013
Time : 13h00
Abstract: Galaxy clusters are the most massive gravitationally bound structures in the Universe and are ideal places to study the effects of dense environments on galaxies. Focusing on recent results obtained by the Atacama Cosmology Telescope, in this talk I will describe how cluster surveys can be used to measure

cosmological parameters, such as the amounts of dark matter and dark energy in the Universe, and how they can even be used to constrain the masses of neutrinos. I will also briefly describe studies of galaxy evolution in clusters selected at X-ray wavelengths.

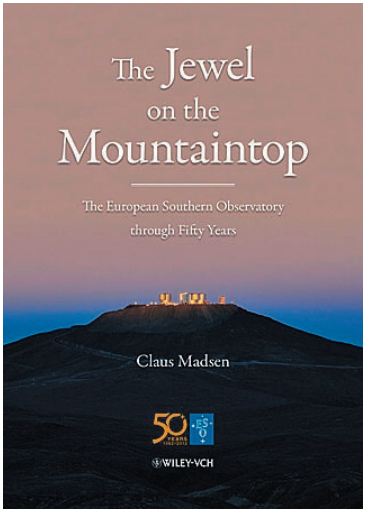
Title: The Hartebeesthoek Radio Astronomy Observatory
Speaker: Alet de Witt, HartRAO
Venue : RW James Lecture Hall C
Date : 10 April 2013
Time : 13h00
Abstract: I will give an overview of HartRAO as well as some introduction to radio astronomy and interferometry.

Title: Probing structure formation using CMB lensing
Speaker: Kavilan Moodley UKZN
Venue : RW James Lecture Hall C
Date : 24 April
Time : 13h00
Abstract: The cosmic microwave background (CMB) acts as a backlight that illuminates the distribution of dark matter and baryons in the low-redshift universe. In this talk I will focus on the effect of gravitational lensing on the CMB by the distribution of matter in the universe, which has recently been detected by the ACT, SPT and Planck experiments. I will first discuss how CMB lensing can be used to reconstruct the projected mass distribution on large and small scales. I will then illustrate a number of applications of the CMB lensing measurement that arise through its sensitivity to cosmological parameters and its correlation with tracers of the mass distribution.

UWC

Title: The Circumgalactic Medium: New Frontiers in Understanding Galaxy Evolution
Speaker: Professor, Romeel Dave
Venue: Room 1.35 of the Physics Department, UWC
Date: Wednesday 27 March
Time: 13h00
Abstract: The emerging "baryon cycle" paradigm of galaxy evolution suggests that galaxy growth is regulated by inflows and outflows from the galaxy's ISM, yet such inflows and ouflows are difficult to detect and are poorly understood. The circumgalactic medium is where such processes must be occurring, and hence characterizing the CGM is a forefront challenge for current galaxy evolution studies. I will describe observational and theoretical progress towards this, highlighting work from the COS-Halos project, a major effort using the Cosmic Origins Spectrograph on HST along with state-of-the-art hydrodynamical simulations to probe the CGM using targeted absorption lines through a carefully selected sample of low-redshift galaxy halos. Early results reveal the rich structure in density, temperature, and ionization that can be probed via multiple metal transitions, as well as some unexpected surprises for the ubiquity of cool gas in hot halos. ☆

The Jewel on the Mountaintop: Fifty years of the European Southern Observatory



By Claus Madsen
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Hardcover or PDF, 560 pages, approx. 150 illustrations and historical photos
Size: 16 x 24 cm
Available from http://www.eso.org/public/shop/product/book_jewel for €49.90
Available from http://www.eso.org/public/products/books/jewel/ as a free PDF download

Claus Madsen, who is from Denmark, joined the European Southern Observatory in 1980 to assist with the production of their Sky Atlas. He soon moved on to the essential field of public relations and outreach activities. More recently he has been involved in handling ESO's international relations. He is one of their longest-serving employees and has had an insider's view of its development over the past thirty years. I found the book well written and fascinating. It is a tale of how every kind of obstacle can be overcome in the pursuit of science, whether in the minds of people, in international relations or in the difficulties associated with remote sites.

At the time of the ESO founding convention in 1962, European astronomy, though holding its own in theoretical matters, had fallen behind the United States in terms of large telescopes. The Mount Wilson, Lick and Palomar observatories dominated the field. They had a near-monopoly in observational cosmology and in the investigation of exciting new objects that were being discovered by radio and space techniques.

European astronomers had not yet harnessed the power that international cooperation can bring to 'big science'. But this had become apparent to forward-thinking leaders in several countries and eventually led to the formation of ESO. It was by no means an easy matter to get individual national communities to work together. For example, when the new organization was formed, there were many special problems relating to salaries and conditions of service. It was necessary to adopt a model similar

to that of the CERN nuclear organization in Geneva, an international laboratory that had been established eight years earlier.

ESO started slowly. Adriaan Blauuw became its first Director. A site-testing programme soon revealed that the foothills of the Chilean Cordillera offered better sites than could be found elsewhere on Earth. By the late 1960s, observations had begun on La Silla, inland from La Serena, and plans were being made for a large telescope to be placed there.

I believe that it was the vision of Lodewijk Woltjer who became Director of ESO in 1975 that turned it into a first class organization. Watching him in action when I worked at their new headquarters building in Garching near Munich in 1980-81, I could see that he was fulfilling two clear aims. One was to make ESO into a truly science-dominated organization, and the other was to persuade each participating country that they were getting their money's worth (or more!). Running an international organization involves undreamt of levels of patience and protocols and it is to his credit and to that of the senior staff of the organization that these matters did not overwhelm their enthusiasm for science.

Madsen's book documents the many trials and tribulations of keeping the organization together and of moulding it into a highly motivated unit. By the early 1980s ESO had developed the technical capability to take on new initiatives in telescope and instrument design through its own team of instrument and optical designers. The alt-azimuth New Technology Telescope (NTT) offered a new approach to large telescope design that used the power of computers to control a thin primary mirror and a light-weight structure. It achieved images of a quality not yet achieved by any other ground-based telescope.

When the decision was made to go for the VLT (Very Large Telescope) array of four 8-m telescopes in the late 1980s, it had already been found that another mountain, Cerro Paranal, further to the north, offered even better observing conditions than La Silla. This remote and waterless mountain had to be developed before construction could start there.

ESO is now a large organization and its history is hard to summarize, but I found it fascinating to read of the many problems that had to be overcome. At times political relations with Chile became strained and at least once ESO's continued presence there was threatened. At other times, budget cuts in specific member countries threatened to derail major projects that were already under way.

Following the completion of the VLT, more recent projects have included the

VLT Survey Telescope (sometimes jokingly called the Very Small Telescope) and VISTA (Visible and Infrared Telescope for Astronomy). These were designed to make sky surveys using large array detectors to give high sensitivities appropriate to the era of large telescopes - the traditional photographic Schmidt survey instruments were no longer adequate.

ESO is now a participant in a giant radio telescope project - ALMA, the Atacama Large Millimetre Array, with the United States and Japan. This is situated on the Chajnantor plateau (also in Chile) at 5 000 metres altitude.

The next step in the race towards bigger and bigger telescopes, the E-ELT or European Extremely Large Telescope, has recently been approved by the ESO Council. It will be of about 40 metres in diameter. As with other recent large telescopes, the optics will be controlled actively to provide the best possible images.

Besides its several visionary Directors, ESO has had the services of some very able and dedicated astronomers, engineers and others. To them also must be attributed much of the success of this great European institution.

Ian Glass

Contents:

☆

Her name is Virgo

by Magda Streicher
magdalena@mweb.co.za

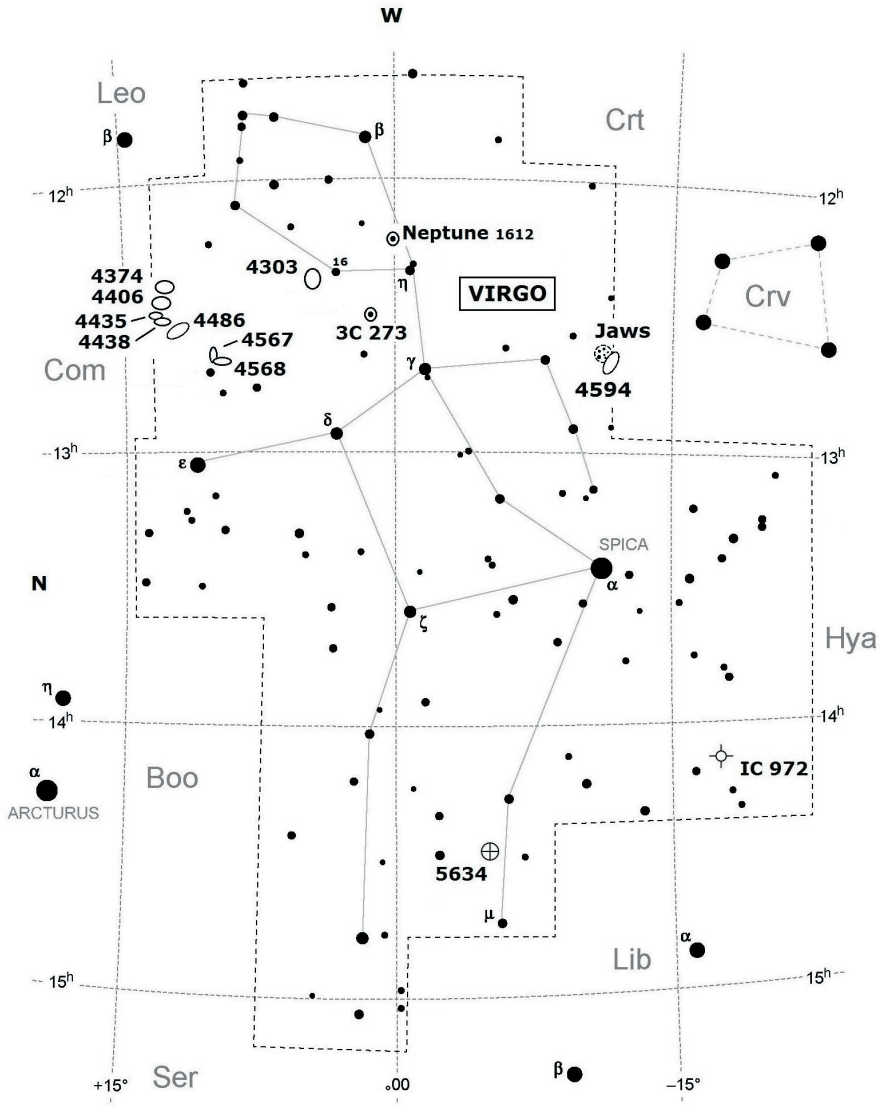
Image source: Stellarium.org

Late southern autumn is the best time to go galaxy-hunting. Not only is the Orion arm down in the west, but the Milky Way is still way down towards the east. The time slot gives us the opportunity for an intense look into the wide universe to observe the faint fuzzies, which are actually entire galaxies. You only need the use of a modest medium to larger telescope and dark skies. The constellation Virgo and most would agree, holds something mystical as it is filled with galaxies which are, in turn, also enveloped in a haze of unknown. Well, the truth is that the chaste young girl of the starry skies, so widely loved was regarded as the virgin daughter of Zeus.

In the Middle Ages Virgo was even known as the Virgin Mary, mother of the child Jesus. Nevertheless, whichever name or myth you prefer, she holds in her lap a very rich harvest of a variety of galaxies that will keep you busy for quite some time.

So let us fire off into galaxy world with an all-time favourite, the versatile **NGC 4594** (Messier 104), better known as the Sombrero Galaxy, which was discovered in May 1781 by the Frenchman Pierre Mechain. Messier 104 is possibly one of the brightest and biggest galaxies in the Virgo-Coma Super Cluster of Galaxies and is situated virtually on the boundary between Virgo and the constellation Corvus. This relatively bright edge-on galaxy with a slight tilt of six degrees towards our point of view displays a prominent dark dust lane running through the major axis with a very prominent bulge. The galaxy appears to lie in an east-west direction with slightly pointed ends.

Steve O'Meara, a well-known amateur living in Hawaii, notes that the galaxy displays a brilliant core that seems to illuminate the surrounding oval shroud from within, like a distant bonfire seen through thick fog. The sharpness of the telltale dark lane reveals the edge of the Mexican hat's brim. He goes on to say that with averted



vision the eastern portion of the Sombrero's brim breaks up and flares into a wide brushstroke of light, which shines more brilliantly than the western portion of the brim. Obviously Steve uses a large telescope

with high magnification in favourable dark skies, but agrees with me that the galaxy could not be described better.

Not only is Messier 104 approximately 65 million light years away, it is also about 135 000 light years in diameter and plays host to many globular clusters – many more than our own Milky Way.

A very fascinating asterism called Jaws accompanies M104 only 25' towards the west. About nine colourful stars between magnitude 8 and 10 portray this impression quite truly. The main focus is the brighter stars towards the southern end of the star string. A more familiar asterism, however, can be spotted jumping the border into Corvus, barely a degree south-west of asterism Jaws. Known as Star-gate, it is an almost perfect equilateral triangle of stars nestling inside another almost perfect equilateral star triangle. It is an outstandingly defined composition of stars between magnitude 6 and 9 against a bare star field. The two brightest stars in this breathtaking composition display a golden yellow colour.

Virgo is mostly popular for the Super Cluster of Galaxies situated mainly in the northern part of Virgo with the abundance overflowing into the constellation Coma Berenices. The heart of this unique area filled with several galaxies is without doubt the two elliptical star cities **NGC 4374** (Messier 84) and **NGC 4406** (Messier 86), which are only 15' apart. However, the giant galaxy M84 shines with an overwhelming round glow that is easy visible and situated only 25' from the Coma Berenices border. The galaxy displays a bright small nucleus and a snowy frosted edge and could be as far as 65 million light years distant.

At first M86 appears to be a twin to M84, with its apparently perfectly round shape, but closer scrutiny reveals a slight oval in a north-west to south-east direction with a nearly stellar nucleus. Because M86's light is spread over a larger area, it appears slightly fainter than M84, but is, in fact slightly brighter. It houses a large population of faint globular clusters orbiting the galaxy which serve as standard candles to determining galactic distances. The galaxy is about 53 000 million light years away, perhaps slightly closer to us than M84.

Several other galaxies in the area, including M84 and M86, stretch from north-east to south-west and have collectively been referred to as Markarian's Chain. The chain was named by the Russian Benjamin Markarian, who first noted this formation.

A very special pair of galaxies is **NGC 4435** and **NGC 4438**, situated barely 20' further east of M86. I remember very well the first time I laid eyes on this unique pair of galaxies during a visit

to the Kruger National Park. At the time, listening to all the animal sounds in the dark of night, I imagined the pair to be two eyes staring back at me through the telescope eyepiece, not withstand the lion's roars in the distant. The southern member NGC 4438 is slightly larger, with an even surface brightness and a very hazy edge. With higher magnification a broad central concentration can be glimpsed. Although the northern member, NGC 4435, is slightly smaller, it is a tad brighter, with an outstanding stellar nucleus. Both galaxies, nicknamed The Eyes, face in a north-eastern to south-western direction.

A much talked about galaxy and one hard to miss is **NGC 4486** (Messier 87), situated another degree further south-east (see picture). It is a lovely outstanding elliptical galaxy (also known as Virgo A) with a bright outstanding nucleus and is ranked as one of the largest visible galaxies with a dominant population of old stars. The nucleus contains a super-massive black hole with a strong radio-active source. A curious straight ray lies in the frosted nebulosity and extends from the core at a position angle of 260 degrees. This thin stream of matter and dust contains high-energy particles racing from the galaxy nucleus at close to the speed of light. Obviously there is no chance even to glimpse this strange sight, but a Hubble picture shows it quite clearly. A few stars settle on the northern edge of M87, and in the immediate field of view many galaxies can be spotted that indicate, more or less, the centre of the Virgo Super Cluster.

Still on your way, another 2 degrees further south-east, the merging galaxies **NGC 4567** and **NGC 4568**, also known as the Siamese Twins, portray the vastness of the universe in a very special way (see picture by Dale Liebenberg). The American deep-sky author Leland S. Copeland dubbed it as such in 1955. NGC 4568 the eastern and larger member appears to be surrounded by a hazy envelope and faces north-south. It gets gradually brighter towards a relatively large

M87-NGC4486 Virgo A, an elliptical galaxy. Dale Liebenberg.

NGC 4567-8, the Siamese Twins. Dale Liebenberg.

nucleus. NGC 4567, the slightly smaller galaxy in comparison, has a dense bright pin-point nucleus. The interacting spiral pair are gently joined at their north-eastern tips. Barely 10' towards the north is another spiral companion member, NGC 4564, in an east-west direction.

NGC 4303 (Messier 61) is one of the largest spirals, and is situated a degree north of 16 Virginis and 5 degrees north of magnitude 3.8 eta Virginis. The galaxy displays a barred face-on in a north-east to south-west direction with a stellar core and hints of mottling on the surface (see picture). With higher magnification and a relatively large telescope try to glimpse the dark streak between the eastern arm section and the nucleus. The galaxy is situated about 50 million light years distant and to me is one of the most outstanding deep sky objects.

With so many galaxies to explore, a sequel to this article will be necessary. This is only the tip of the proverbial iceberg, yet even this leaves a stunning expression on the observer. Sometimes people shy away from observing galaxies, but careful map work and summaries of brightness will make observation considerably easier.

The planet Neptune was seen in Virgo about 20' east of the magnitude 6 star HD 105374, and 2 degrees west of eta Virgini,

M61-NGC4303 barred galaxy. Dale Liebenberg.

by Galileo in December 1612. He also detected the motion, but probably could not believe it was a new planet. JG Galle of Berlin Observatory actually found and confirmed such a planet in the Aquarius constellation on 23 September 1846.

A very peculiar object is the quasar **3C 273**, the brightest example of its kind and situated about halfway between eta and gamma (Porrima) Virginis in a triangle towards north. The quasar is situated just 8' south of a pair of magnitude 10 and 11 stars and just 40' west of the galaxy IC 3474. The slightly bluish object appears brighter and hazier than the accompanying stars in the field of view. 3C 273 is a very luminous object with an enormous red shift discovered by Arp in 1966. With a magnitude of barely 13 it not easy to detect through ordinary telescopes.

On the night of 22 May 2002 I took part in an occultation of the star HIP 75185 by the asteroid (5) Astraea done by Albert Brakel, from Australasia, and myself from South Africa. It was successful and the asteroid diameter came to 162 km x 96 km. I laid eyes on (5) Astraea again on the night of 7 May, 2008 when this main-belt asteroid was drifting through Virgo about a degree west of the lovely yellow gamma Virgini. (5) Astraea was accidentally discovered by Karl Hencke in December 1845 while he was searching for the asteroid Vesta.

In ancient times the importance of harvest time was reflected in the Virgo constellation, which is also referred to as the Maiden of the Harvest. The bright white magnitude one star alpha Virginis, better known as Spica, is said to represent the germ of the wheat grain. It is also a variable star that changes its light output every 4.1 days.

In the midst of the constellation domain we find **IC 972,** a lonely planetary nebula in the far south-eastern corner of Virgo. IC 972 could well be a very faint galaxy by the looks of it, not at all easy to glimpse and probably, with a magnitude of fourteen, out of observational reach for most. Larger telescopes, however, and high magnification will reveal a slight defined edge around an out of focus star impression. IC 972 is the 37th entry in George Abell's catalogue with a nebulous structure.

Another surprise to be found is the globular cluster **NGC 5634** taking shelter at Virgo's feet half way between magnitude 3.8 mu and magnitude 4 iota Virginis. This globular cluster, the only one in Virgo as far as I know, is relatively easy to observe, and displays a soft glow that grows gradually brighter towards a very compressed unresolved broad centre. Towards the eastern periphery a magnitude 8 orange-coloured star dominates which changes it slightly to an uneven shape. A few faint star outliers, barely seen on the northern and southern edges, spiral out into the field of view. A

spaced triangle of stars can be seen towards the southern edge in the field of view (see picture by Dale Liebenberg).

Dress up snugly and warmly, make yourself a flask of coffee and sit down with the lady Virgo to seek out those faint, misty "clouds" that are, in fact – almost unbelievably – entire galaxies. ☆

NGC 5634 sheltering in Virgo's feet. Dale Liebenberg.

Object	Type	RA (J2000.0)	Dec	Mag	Size
NGC 4303 (M 61)	Galaxy	12^h21^m9	+04°28	9.7	6.5'x5.8'
NGC 4374 (M 84)	Galaxy	12 25 1	+12 53	10	6.5'x5.6'
NGC 4406 (M 86)	Galaxy	12 26 2	+12 57	9.7	8.9'x5.8'
NGC 4435	Galaxy	12 27 7	+13 01	10.8	3.2'x2.0'
NGC 4438	Galaxy	12 27 8	+13 01	10.2	8.9'x3.6'
3C 273	Quasar	12 29 1	+02 03	12.8	0.158"
NGC 4486 (M 87)	Galaxy	12 30 8	+12 23	9.5	8.3'x6.6'
NGC 4567	Galaxy	12 36 5	+11 15	11.3	3.1'x2.3'
NGC 4568	Galaxy	12 36 6	+11 14	10.8	4.6'x2.2'
Jaws	Asterism	12 38 5	+11 30	8.8	20'
NGC 4594 (M 104)	Galaxy	12 39 8	-11 37	9.2	7.1'x4.4'
IC 972	Planetary Nebula	14 04 4	-17 15	14.3	0.43"
NGC 5634	Globular Cluster	14 29 6	-05 59	9.4	4.9'

Errata

The image on page 13 of *MNASSA* Vol. 72 Nos 1 & 2, February 2013 has an incorrect caption. It should read: "The Pretoria Moonwatch team (Station 8575) which was set up on the roof of a building in the CSIR grounds. Source: Roy Smith."

The Editor apologizes for the error.

astronomical society of southern africa

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

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

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

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