

## Symposium 2010 report:

Assembled by Johan Smit, with assistance from Allen Versfeld, Danie Barnardo, Andrie van der Linde and Michael Poll.

The Pretoria Centre of the Astronomical Society of Southern Africa hosted the Biennial Symposium of the Astronomical Society of Southern Africa (ASSA) from October 7<sup>th</sup> to 9<sup>th</sup> 2010, at the Silverton campus of the Council for Geosciences. We wish to thank the Council for Geosciences for providing us with an excellent venue and facilities.

Although the theme of the Symposium was light and spectrum pollution, a wide range of papers was presented across topics as diverse as mining in space and the problems facing science journalism in South Africa.

The first day opened with a tour of the Council for Geosciences. We were introduced to the seismology department, and briefly discussed the seismic readings picked up from the meteor which streaked across Southern African skies late last year, and saw a real time read out from all the seismometers located around South Africa. We then moved to the other side of the building where the geologists showed us their laboratories, boasting some very impressive equipment, including an electron microscope that analysed rock composition.

Andrie van der Linde, Symposium organising committee team leader, informed delegates of the practical arrangements for the next three days. Michael Poll, President of ASSA welcomed everyone and opened the official proceedings.

Professor Phil Charles (Director of the South African Astronomical Observatory (SAAO)) delivered the first paper. The last 18 months have seen SALT "stood down" while major repairs were done, a process that was completed at the end of August 2010. Delegates were thus privileged to be one of the first audiences to hear this good news. Since the inauguration of SALT two major problems were identified, both of which could have rendered the telescope fairly useless for its intended purpose. The problems were:- a sharp drop-off in the sensitivity of the spectrometer in the ultraviolet region, and a focus gradient across the field of view of the optical camera. Professor Charles described how the problems were investigated, analysed and tackled, almost entirely by SAAO astronomers and engineers. The eventual causes discovered were that there was contamination of lens coupling fluid in the spectrometer and that there was deformation of the housing of the spherical aberration corrector which was caused by the way it was mounted. The description of how the investigations, tests and eventual repairs were done kept the audience spell-bound. A good thriller movie could not have been better. We all wish to congratulate the SALT team for a job well done.

Professor Charles also outlined major new developments in the other international facilities at Sutherland, which are shifting heavily towards robotic operation, thereby facilitating research, especially the search for extra-solar planets which is difficult by conventional telescope operation. Professor Charles also covered the implications and progress of a proposed new wind-electricity plant near Sutherland.

Prof Charles was followed by Dr Hubrecht Ribbens, who spoke on Techniques to Observe and Analyse Celestial Objects and Phenomena. This turned out to be a very large and ambitious topic and, even though he spoke for a full hour, there was only time to cover the topic lightly. All our discoveries create data which must be stored or catalogued. Currently there are several sextillion (Trillion-Trillion-Trillion) objects that are waiting to be catalogued. This alone is a challenge in itself and new discoveries continually create more data. Dr Ribbens described how celestial objects are catalogued and which techniques are used to detect them. He touched on the subject of the need for one all-inclusive catalogue of all celestial objects and phenomena. Anyone feel like a challenge?

The final speaker for the morning was Hendrik van Heerden, of the University of the Free State. Hendrik is involved in a project to build a museum at the site of the historic Boyden Observatory which has continuously produced valuable astronomical observations for over a century. The Boyden Observatory was the southern station of Harvard College Observatory. It was established in 1890 and was originally sited in Chile, but the station was moved to South Africa in 1927. Since then, Boyden has continuously produced valuable

astronomical work. In the 1950s, Harvard announced that they could no longer afford to run the observatory, so Boyden became the world's first international joint venture observatory. After providing a brief history of the observatory, Hendrik showed the proposed plans for the new museum, and presented a photographic tour of the facilities.

After an excellent lunch, the afternoon session was opened by Percy Jacobs, who introduced Johan Smit, the Chairman of the Pretoria Centre.

*(Author's note: As the principal author of this Symposium report, rather than write the report on his own talk himself, Johan has used Allen Versfeld's report in "Urban Astronomer" to summarise his presentation).*

Johan presented a very entertaining talk on The Dark Side of Light - Light and Spectrum Pollution. While active campaigners against light pollution would have been familiar with much of what Johan had to say, he managed to present the material in a compelling way, and made excellent use of photographs to demonstrate the negative effects of light pollution. He was also able to illustrate counter-intuitive aspects of light pollution: for example, security lights are more likely to aid criminals by providing conveniently located shadows in which to hide, while dazzling the eyes of home-owners and security staff! He finished off by giving some pointers on how to raise the subject with local government and neighbours who insist on directing high-powered lights into our gardens and bedroom windows at night.

Adding to Allen's report, Johan stated that the main argument to present to perpetrators of light pollution is that it is a symptom of wasted energy. Light that shines where it is not needed costs money to generate. Light that shines only where it is needed use energy efficiently and always uses less energy.

Prof Charles showed some before and after photos of towns in Chile that went "dark sky friendly". The effects were dramatic, and one fact that came across was that these towns saved back the initial cost of upgrading to "sky friendly lights" within 3 years. This is why Chile is probably the richest country in the world in terms of world class observatories. South Africa has some way to go. The scariest fact pointed out by Prof Charles is that brightest spot on the horizon at Sutherland is Cape Town's light bubble.

Remember: Light pollution is the only pollution that costs more to perpetuate than to eliminate.

Next on the agenda was Michael Poll, President of ASSA. Astronomical events and phenomena are frequently depicted in cartoons and cartoon strips in newspapers and magazines. The moon, stars and comets are often seen, as are illustrations of space travel, and cartoons also reflect public perceptions of the sky. The depictions and descriptions are sometimes accurate and sometimes not. Michael took us on a visual and entertaining tour through examples of these cartoons and analysed the astronomy in them. While not many would admit that they learnt something new from astronomy in cartoons, this writer did. These cartoons can be used for educational purposes to explain concepts to the general public. Michael warns that we should not point out errors in these cartoons too often to too many people. He noted that it's very easy to come across as an irritating know-it-all in the process! But despite this side effect we as astronomers must use any familiar material to bring the concepts of astronomy to the public.

The final session for the afternoon was a workshop on laser safety and regulation in South Africa.

Background to the Workshop: Regulation 1302 identifies visible lasers with an output power over  $0.39\mu\text{W}$  as 'dangerous goods' under the HAZARDOUS SUBSTANCES ACT NO. 15 OF 1973

1. Importers who import these devices must licence the product at the Department of Health (DoH).
2. Any person using a laser device with an output power of more than 5 mW has to register as a Laser Safety Officer (LSO) at the DoH.
3. There is concern that laser pointers are used irresponsibly. This may increase the risk that green laser pointers may become 'overregulated' by the Dept. of Health.

How this affects the astronomy community:

Powerful green laser pointers have become freely available on the market and are often sold without regard to licensing requirements. Any visible wavelength laser with a power output of more than 5mW is dangerous enough to require registration of the owner/operator with the DoH. The laser pointer itself must also be licensed by the importer at the DoH. These licences are easy to obtain, but the DoH lacks the expertise to be able to evaluate applications for "Astronomy Use", which is the standard justification for owning a high-powered green laser.

This is the base line from where the discussions of the workshop started.

Some basic principles emerged upon which all attendees agreed.

- 1) A 5mW laser is powerful enough for one-on-one and small group demonstrations.
- 2) Presenters to larger groups find 20mW lasers adequate, and only in exceptional circumstances ~~are~~ is a more powerful device needed.
- 3) 50mW was agreed to be the maximum power ever needed.
- 4) ASSA does not support the use of devices more powerful than 50 mW. Any laser more powerful than 50mW would need to be handled on a merit basis directly with the DoH.

In summary the following guidelines were accepted:

1. ASSA members are encouraged to register their unregistered laser pointers (Registration is currently free.)
2. The organisers of events such as star parties, Scope-X, viewing evenings, etc, will be liable in accordance with the Occupational Health and Safety Act (Act 85 of 1993) for any incident during the event. The organisers therefore have to define the 'laser rules' for the event and act accordingly.
3. The organisers have the right to confiscate (and store in a safe place) any non-compliant laser pointer used at the event.
4. There is no necessity for anyone (except presenting astronomers) to use a laser pointer with an output of more than 5mW for astronomy purposes.
5. Presenting astronomers (those who do astronomy presentations to groups of people) may justify the use of stronger laser pointers. The suggested laser output in these cases ranged from 10mW to 50mW. The delegates agreed that 20mW should be suitable for most applications. The use of 50mW lasers would only be necessary on very rare occasions.
6. Approved organisations should be identified (e.g.: ASSA branches; Universities; SAAO; SANParks; etc). These organisations should recommend applications for LSO's.
7. The following 'safe practices' are a good starting point when presentations to groups are done:
  - Lasers should be used by knowledgeable astronomers under controlled circumstances:
  - Do not point lasers at people, aircraft or animals
  - Keep a suitable distance from audience
  - Warn the audience that lasers are being used.
  - The area should be clear of obstacles
  - Avoid pointing lasers at surfaces that can give specular reflections
  - Minimise the use of lasers (and do not play with them)
  - Keep lasers away from children
  - Do not use mechanisms that keep the pointer switched on.
8. The outcome should be posted on a website and comments requested.

Additional comments from discussions after the workshop:

1. There was a notion that 'approved organisations' (ASSA; SAAO; Universities; etc) should appoint personnel to train users of green laser pointers in the safe practices.
2. Aspiring LSO's should have to pass a laser safety test.
3. ASSA should have a LASER safety section (to liaise with the DoH)

The proposed set of guidelines was subsequently posted on the website of the ASSA – Pretoria Centre at: <http://www.pretoria-astronomy.co.za/laser.htm> and continuing feedback is invited from the community.

The day was concluded with a "formal", but informal, dinner at Mohka Restaurant at the Pretoria Botanical Gardens. Much was eaten and much was talked about, old friendships were renewed and new ones made.

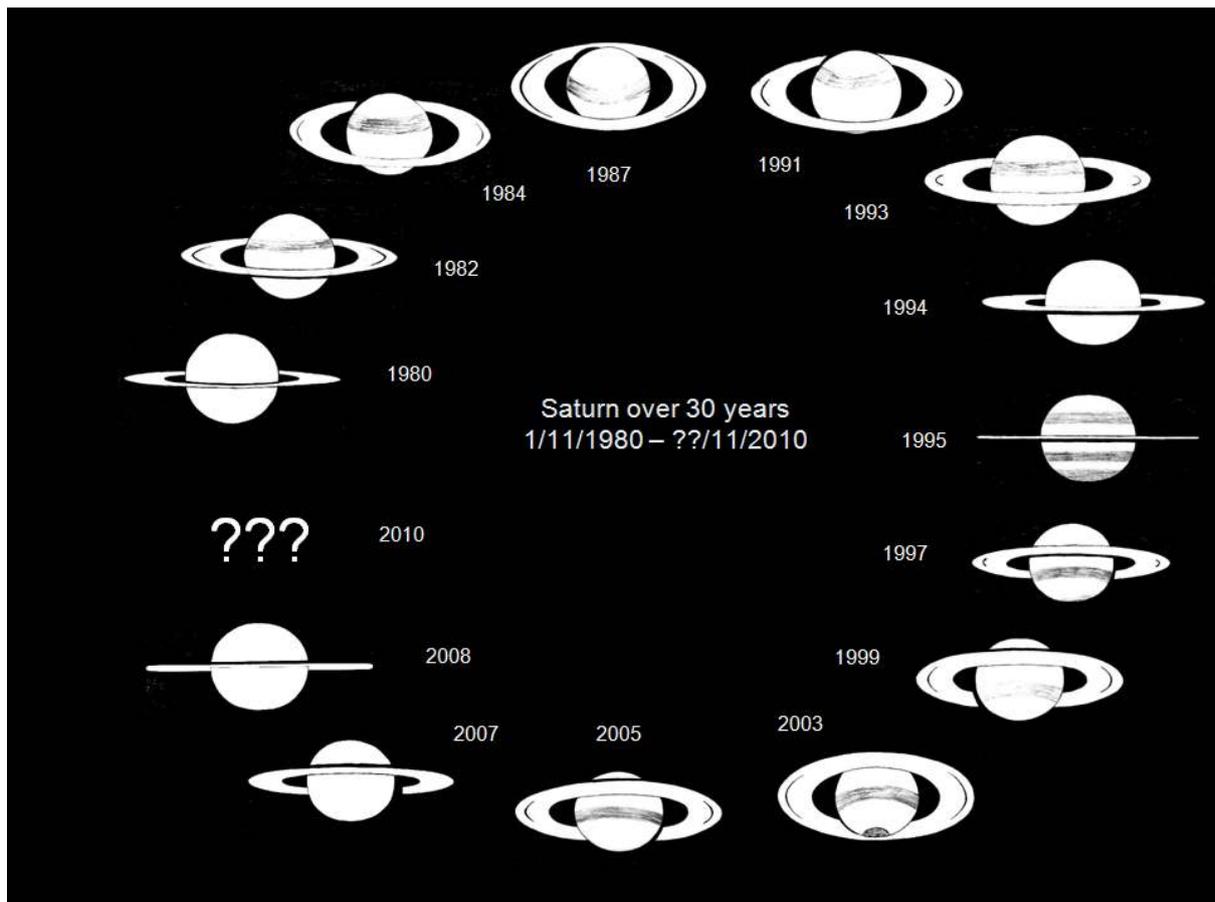
Danie Barnardo, Vice-Chairman of the Pretoria Centre of ASSA, controlled the morning session of the second day of the symposium. The day started with a presentation by Prof Barbara Cunow, which showed us that even

professional astronomers also like to do amateur astronomy. By amateur astronomy we mean doing it for the love of the subject. Prof Cunow started observing Saturn in 1980 and has continued this right through to the present. She has followed Saturn through a full Saturn year, and recorded all four seasons on Saturn. The detail captured in her drawings showed that this was definitely a labour of love and perseverance. We salute a true professional amateur.

She explained how the viewing angle from Earth changes due to Earth's rotation around the sun as well as how the angle of illumination from the sun changes during Saturn's orbit around the sun. The combination of these two factors causes many interesting visual phenomena that will only be noticed by an experienced and conscientious observer like Barbara.

Her well illustrated talk took the audience on a tour of discoveries. It truly felt like groundbreaking work was being done. I will never look at Saturn again without thinking of Barbara and her observations. I myself will try and notice some of the many features she described. No words can truly describe the sheer volume of observations she did, and the hours that she must have spent making sketches. She displayed some of her sketches alongside Hubble pictures of Saturn and it was amazing how accurate her sketches were and how they captured the essence of what was to be seen.

The only thing that will sum up her talk is a picture. Below is a collage of her sketches summing up 30 years of observations.



Allen Versfeld was the next speaker, presenting a paper on Astronomy Outreach in the Digital Age.

Allen reports:

Traditional outreach methods are here to stay, but the Internet is beginning to take their place as a default first-choice for more and more people. Unfortunately for those wishing to use the Internet to bring astronomy to the public, there are no hard and fast rules - the medium is too young and changes too fast. I introduced

[Urban Astronomer.com](http://UrbanAstronomer.com) as an example of my own work in the field and discussed where I had gone wrong, and what lessons could be learned.

Allen was followed by Case Rijdsdijk, who spoke briefly on the topic of stellar evolution. Case walked us through a very massive star's lifecycle, and looked at various possible endings, from neutron stars to black holes to quark stars and other even more exotic possibilities. Thanks to Case most of the delegates will now have to update most of their own presentations about stars to include these previously impossibly large stars.

After the tea break, Professor Matie Hoffman (University of the Free State) took the podium. He spoke on *The Assessment of the Expected Impact on Observing Conditions at Boyden Observatory of Light Pollution Associated with the New Developments in the Area*. As discussed the previous day by Hendrik van Heerden, Boyden is a working observatory with a long international history. Boyden is actively involved in work on accretion disks, and in making multi-wavelength observations. Proposed new housing developments and the Maselspoort resort near the observatory threatened to increase light pollution levels to the point where they would severely impact on the observatory's usefulness. Professor Hoffman spoke at length on the report compiled by his department as part of the Environment Assessment Report required for construction of new projects.

What was very interesting were the methods used to “plot” light pollution and its effects, from simple observations—“look and see”, to asking landowners to switch off lights and see what the effects were. Use was also made of satellite imagery and what surprised this author was how bright green grass reflects light. Everyone that hates mowing the lawn as much as I do must thank Prof Hoffman for providing us with a scientific reason not to cultivate one.

One very interesting point was that only a small number of the lights installed at the Maselspoort resort were responsible for the greatest amount of the light pollution from that site. Very small changes can thus be made to have a marked effect. Making a site “dark sky friendly” does not mean that all lights must be changed. A little time spent studying the problem will provide an economical solution. Thanks to Prof Hoffman for reminding us again that we are scientists and that we must use science to fix our problems.

Prof Hoffman was pleased to report that the developers were receptive to the report and were eager to follow through on his suggestions on how to mitigate the effects of light pollution and light trespass.

He also took a few minutes to announce the plans to build a new planetarium / dome theatre on the site of the observatory.

The next speaker was Heinrich Bauermeister from MMS Technology, the company contracted to build the antennae for the MeerKAT radio telescope array. He gave a detailed technical presentation on how the antenna dishes were designed and fabricated. Moulds were prepared on site and the dishes were then constructed one layer at a time using modern aerospace technology. In reply to a question as to how quickly these dishes could be made, Heinrich replied that production could be increased to one dish per week, which raised the question as whether the three thousand dishes of the SKA could be constructed on time!

After lunch Johan Smit introduced Danie Barnardo, of the Pretoria Centre of ASSA, who is also a geologist at the Council for Geosciences. Danie spoke on “Meteorites, Impacts and the Tswaing Impact Crater”. Danie explained the geological makeup of the various types of meteorite found on Earth, and discussed the formation of impact craters. After a description of the different rock formations found at various well known impact sites around the world, Danie then focussed on the Tswaing impact crater, which is near Pretoria. After a detailed description of the history of the crater, he showed a number of photographs and maps of the area.

Danie also discussed the effect of impacts and - everyone's favourite topic—what are the chances of something like this happening again. Some interesting statistics were highlighted: Meteors of more than 1 metre in diameter enter the atmosphere about once a week. Most break up in the atmosphere (as a result of friction with the air molecules) and never reach the Earth's surface. Of the ones that do reach the Earth's surface, about three quarters fall into the oceans. So, only worry about the other quarter!!! About 7 reasonably large craters (about 100 meters in diameter) were created during the last 10 000 years. Expect something bad to happen once every 1500 years.

The next speaker was Michael Neale, from the University of Pretoria's Department of Mining and Engineering. Michael recently returned from the Space Resources Roundtable XI / Planetary & Terrestrial Mining Sciences

Symposium at the Colorado School of Mines. He spoke to the delegates about the need for South African involvement in "*In Situ Resource Utilisation*" (ISRU), which means the mining and collection of resources from space, for use in space. The most challenging aspect of space flight is lifting material out of Earth's gravity well. This is a hugely expensive enterprise, which severely limits the amount of tools, resources and materials which astronauts can take with them. The principle of ISRU is that the mineral wealth of the Moon, Mars and the Asteroids vastly exceeds that of Earth and should be much cheaper to harvest in space. He reported that there is a lot of interest from the mining industry internationally, and it seems likely that the next stage of human expansion into space will be led by miners and prospectors.

Case Rijdsijk then returned to deliver a second paper: "Reporting Science". Case discussed the rift in South Africa between journalists and scientists, and considered various causes. The primary issues seem to be that there are practically no journalists with science training in South Africa (so that they usually don't understand the scientist's work, and end up misreporting it), and that scientists don't appreciate the journalists' position regarding deadlines, trust, etc. Bad science reporting is a problem because the general public usually lacks the scientific background to be able to spot mistakes and people are fooled by headlines like "AIDS vaccine on the way". A particularly troublesome case was the attempt by the press to present a balanced case on Thabo Mbeki's stance on AIDS and the HIV virus -- crackpot AIDS denialists were given the same prominence as real scientists who have done valuable work, leading many to take the crackpots seriously. Case then showed a few other examples of bad science reporting and suggested ways for scientists to improve their relationship with the press.

The final paper of the symposium was presented by Professor Derck Smits, from Unisa, on the topic of Cosmic Masers. Although 2010 was widely celebrated as the 50th anniversary of the laser, the maser was discovered first, seven years earlier, in 1953. After briefly explaining how masers are formed, through the stimulated emission of photons from excited atoms, Prof Smits gave us a bit of history about the first discovery of a cosmic maser. In 1965 astronomers found a highly compact source of OH emission radiation, which was eventually identified as a maser occurring naturally in a vast cloud of ionised OH gas. Cosmic masers have also been identified as coming from the atmospheres of red giant stars and the cores of active galaxies. Derck then discussed some of his own recent work in trying to identify the sources of some interesting cosmic masers which so far remain a mystery.

After thanking all the speakers for their time and effort, Johan Smit then formally closed the symposium. Delegates met up later for a casual evening's stargazing at the Pretoria Centre's observatory. The 12.5 inch f9.8 reflector in the Bennett observatory entertained us with splendid views of Jupiter. This long focus Newtonian telescope with its excellent optics is particularly suitable for planetary viewing. Some viewers reported seeing up to eight cloud bands on the surface of Jupiter.

The following day, some of the delegates were given a tour of the Hartebeeshoek Radio Astronomy Observatory (HARTRAO) in the morning and the Tswaing impact crater in the afternoon. We were joined by Doug and Andy from the Blackburn Leisure Astronomy Society [BLAS] in Brough, England, giving the symposium some international flavour.

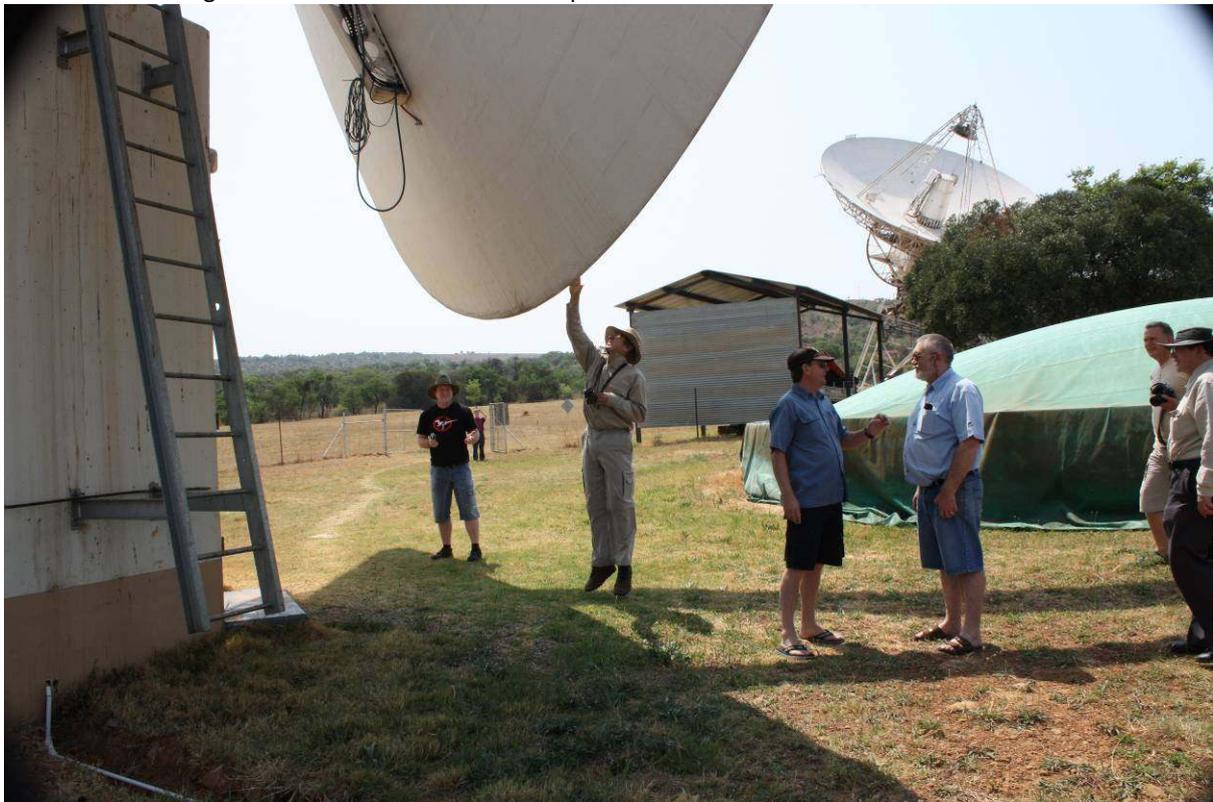
At HARTRAO we were met by Dr Marion West who guided us through this very impressive facility. A slide show introduced the delegates to the facility and astronomy in the radio frequency range. A guided tour through the observatory, including the control room was conducted. Watching the 200 ton 26 meter telescope move was very impressive, especially for the technically inclined delegates. What impressed me most was the fact that they are doing observations in bright sunshine.

We were fortunate to see the telescope move as one of its main equatorial bearings seized some time ago and was only recently repaired. The fact that these repairs were done by South African expertise is more evidence that we as a country have much to be proud about.

Outside we were shown the mould from which the Meerkat prototype dish was made. The operational dish next to the mould was admired and was the cause of a very funny moment. Pierre Lourens, from Pretoria could not resist tapping the composite dish. After he did that, he was reminded by Tony Viljoen, also from Pretoria, that he probably spoilt the whole observing session by disturbing the dish. Pierre was very worried and it took much explaining to convince him that Tony was only joking with him. A much better behaved Pierre continued with the rest of the tour through the visitor centre where all the nice educational "toys" are situated. Even though the "toys" are aimed at children, the adults enjoyed it equally much, if not more.



The broken bearing from the 26 meter radio telescope.



Pierre Lourens tapping the Meerkat dish with the mould behind him and the 26 meter telescope in the background. Pierre promised never to do this again.

All too soon it was time to drive to Tswaing.

Danie Barnardo met and guided the delegates through the crater. Danie writes:

On October 9<sup>th</sup>, 15 delegates accompanied me on a trip to the Tswaing Meteorite Impact Crater. We arrived at Tswaing at 13:00 and drove to within 400m from the main lookout point on the Tswaing hiking trail. The total length of the trail is 7 km, but by driving to near the look-out, we reduced the distance we had to walk to about 4 km. The main look-out point is also known as the Shoemaker Viewpoint, where there is a plaque in honour of Eugene Shoemaker, co-discoverer of Comet Shoemaker-Levy, which slammed into Jupiter in July 2004.

Most of the participants had not seen Tswaing before and everybody was suitably impressed by the 1.13 km diameter, 60 metres deep impact crater that can be seen in all its glory from the Shoemaker viewpoint. Afterwards we ventured onto the hiking trail, which leads into the crater and along the way I could explain various aspects and we got more views of the crater.

Tswaing has a brine lake, rich in soda-ash, in its centre, which makes this impact crater unique. According to impact scientists, the crater was formed 220 000 years ago by a 40 – 50 metre diameter stone meteorite, which slammed into the earth at a velocity of about 16 km per second, resulting in an explosion with 500 times the magnitude of the Hiroshima nuclear device. Most living things within 40 km from the site would have been destroyed.

At about 15:30 we emerged from the Crater, impressed by the wonderful experience of a “close encounter” with this “extraterrestrial” phenomenon. Everybody agreed that it was an extremely worthwhile experience.



Delegates inside the crater.

Lastly, Allen Versfeld summed up the 2010 Symposium in these words: "Overall, the symposium was a great success, with a number of very interesting and informative papers presented. We all look forward to the next symposium in 2012!"

Johan says: "I am sure that all who were there would agree."

I wish to thank my colleagues, Andrie van der Linde and Danie Barnardo, who did most of the hard work in organising the Symposium. I also thank the rest of the Pretoria Centre Committee for their support. Special thanks go to the delegates, especially those who attended from as far away as Durban, Bloemfontein, East London, Garden Route and Cape Town. Thanks are also due to Allen Versfeld, Michael Poll, Danie Barnardo and Andrie van der Linde for their assistance in creating this report. And lastly thanks to the presenters of all the papers. And thanks also to those that submitted papers that were not accepted due to time restrictions. We could only fit so many speakers into two days.

Johan Smit

Chairman, Pretoria Centre of the Astronomical Society of Southern Africa.