Presidential address

Amateur Observations – Successes and Opportunities

Tim Cooper

1. Introduction

The term of ASSA President is served alternately by a professional and amateur astronomer. I belong very firmly to the latter, and I am very conscious of upholding the role of the amateur as a contributor to astronomy in Southern Africa.

Amateur astronomers in Southern Africa have developed a reputation as skilled observers over many years. Geographically, we reside in an important part of the globe, being in the southern hemisphere in a position to observe southern objects at time-critical moments when most other land areas experience daylight. Our observations are in demand. Despite these factors, the number of active observers today remains small, limiting the significance of our observations.

Tonight I want to highlight some areas where ASSA members have contributed meaningful observations, and list others where opportunities exist to contribute to an even greater extent, either by more people becoming involved in existing observing programs, or by participating in new programs already operating in other countries, thereby complementing the global observing network. I will list a number of specific requests that have been made of us by overseas professionals.

2. Variable stars

One of the areas where ASSA members have made a major contribution to science is the study of variable stars (Mattei 2002). The AAVSO database contains over 640 000 southern African observations by 111 individuals. This tradition extends back to H E Houghton, through Reginald de Kock, and in the recent past, to Danie Overbeek, who provided much impetus and the majority of southern African observations. However, with the passing of Danie in 2001, a gap has been left in the coverage of many variable stars, which are now not being observed. It is important that current ASSA observers include these stars in their observing programs, to ensure continued coverage.

Recently the observational records that Alexander William Roberts produced from 1891–1920 at Boyden Observatory were discovered (B van Zyl, private communication). A team headed by Brian Fraser and myself, in conjunction with the AAVSO and the University of the Free State, are in the process of reducing these for further study. This work will enable us to extend the AAVSO records back in time and allow more precise determinations of variable star behaviour.

There are a number of stars that the AAVSO lists as being in need of observation. Some of these desperately require observers, since they are observed so infrequently that it is impossible to make a proper study of the brightness variation through the construction of an accurate light curve. The list of stars for which observations are desperately required is given as Table 1.

3. Nova searching

ASSA members mounted a dedicated search for novae under the leadership of Jack Ben-

nett. His technique was to assign areas of the sky to visual observers who would search using binoculars or the naked eye every night. None were found and the program was abandoned. With modern technology for imaging and computer processing, the techniques for discovery of novae are well established, but no ASSA members are doing this work. There is a need to set this up via a dedicated section with its own Director. During 2002, there were 15 IAU announcements of new novae or outbursts of nova-like variables (Green 2003: 6).

One of the most prolific nova discoverers is Bill Liller, a retired astronomer living in Chile. He discovers novae through dedicated photographic searches. As a clue he states that most novae discovered in the 1980s were within 15º of the galactic equator, and nearly half within a 30º x 30º box

Table 1. Southern variable stars in need of observations.

Stars very urgently in need of observations

0003-39 V Scl	0707-72 R Vol	1046-28 RS Hya	2049-54 S Ind
0024-38A T Scl	0720-05 TT Mon	1115-61 RY Car	2051-40 RY Mic
0025-46 T Phe	0731-73 S Vol	1345-36 RX Cen	2120-30 S Mic
0044-35 X Scl	0813-34 TU Pup	1346-77 T Aps	2142-47 R Gru
0106-30 U Scl	0925-51 Y Vel	1656-36 RT Sco	2213-21 X Aqr
0109-57 RS Phe	0949-53 Z Vel	1913-31 SW Sgr	2327-46 V Phe
0346-25 U Eri	0955-63 RV Car	2007-47 R Tel	2352-65 R Tuc
0641-36 CH Pup	1032-70 RZ Car	2022-40 U Mic	

Stars urgently in need of observations

0018-62 S Tuc	0918-68 RW Car	1452-54 Y Lup	2034-29 R Mic
0257-51 T Hor	0940-23 RR Hya	1547-36 R Lup	2039-05 Y Aqr
0349-46 U Hor	1010-58A Z Car	1616-07 W Oph	2057-82 T Oct
0512-47 T Pic	1010-58B AF Car	1623-19 Y Sco	2102-21 X Cap
0536-04 Y Ori	1144-41 X Cen	1708-33 RW Sco	2158-28 S PsA
0543-31 S Col	1150-58 W Cen	1735-43 RU Sco	2212-30 R PsA
0556-86 R Oct	1302-12 RV Vir	1741-62 W Pav	2219-38 T Gru
0632-01 SY Mon	1342-36 RT Cen	1821-33 RV Sgr	2228-67 R Ind
0742-41 W Pup	1405-28 RU Hya	1855-12A ST Sgr	2234-62 T Tuc
0756-12 U Pup	1434-17 V Lib	1911-24 TY Sgr	2351-50 R Phe
0824-76 R Cha	1437-19A SX Lib	2008-22 W Cap	2352-09 V Cet

The stars listed here need additional observations. Please be aware that many of these stars are difficult to observe, and should be attempted only by experienced observers. Taken from *AAVSO Bulletin 66: Predicted maxima and minima of long period variables for 2003.*

centred on the star 3 Sgr (Liller 1992: 28). With the proper equipment and dedication, there is clearly scope for ASSA members to follow in Bill's footsteps and contribute to this field.

4. Supernova searching

The first supernova discovered from South Africa was that in the galaxy M83 by Jack Bennett on 1968 July 16 (IAU Circular 2085). Thirty three years later, Berto Monard discovered the first of his ten (to date) supernovae, in the galaxy NGC 1448. His initial discovery was visual, after hundreds of hours of painstaking searching, but since then all his discoveries have been made using CCD imaging on a SCT telescope and computer processing, and have come in quick succession. There is clearly scope for both methods, but Berto is currently the only one searching for supernovae. He gave us an insight to his search techniques with a paper presented at the 5th ASSA Symposium (Monard 2003). There were 292 discoveries of extra-galactic supernovae during 2002 (Green 2003: 7) so there is plenty of opportunity for more ASSA members to become involved in this field.

5. Comets

During recent years, the apparition of several bright comets has led to a resurgence in southern African comet observation. These observations include the study of brightness behaviour, coma morphology, and tail development. This resurgence was certainly fuelled by the appearance of comet Hale-Bopp, with nearly 400 separate observations recorded. Mention must be made of Mike Begbie, who contributed over 80% of these observations. However, many other amateurs are becoming skilled in these observations, and still more observations are required.

There are still areas where ASSA can make a larger contribution. For one, only the brighter comets are being well observed; we need more data on the fainter comets as well. Secondly, Daniel Green has requested CCD photometry of even fainter comets, not visible visually, especially of far southern comets which are out of reach of our northern colleagues.

I commented on the history of comet discovery at the ASSA Symposium (Cooper 2003a). The last comet discovered from South Africa was in 1978. Needless to say, dedicated searching for comets from South Africa is desperately required. The discoverer is able to share in the Edgar Wilson award for a successful amateur discovery. This annual prize of US$ 10 000 is shared amongst the amateur comet discoverers for the previous year. There were five amateur recipients for comets discovered in 2002 (Green 2003: 7).

6. Meteors

ASSA also has a rich past of meteor observation. There was a very active group during the 1950s when S C Venter was Director of the Meteor Section. One observer, J H Botham, was particularly active, logging over 100 hours of observing in one year. In recent years, ASSA members have again started to contribute to this field, but there is still much scope for expansion in three key areas:

- monitoring the behaviour of major annual showers. Useful work has been done on the eta Aquarids (Cooper 2003b), but several other showers can be well monitored from here using only the naked eye;
- elucidating the activity of minor showers, mainly by accurate plotting to determine

annual activity and radiant structure; and
- determining the frequency and nature of short-lived meteor outbursts.

There are two recorded instances of short-lived meteor outbursts (Jenniskens 1995). On the night of 1964 November 25/26 Brian Warner observed 25 meteors in 10 minutes from a radiant near omega Orionis. In 1979, Tim Cooper observed abnormally strong activity from a radiant in Pyxis. Based on the reported observations, Jenniskens and Lyytinen (2003) predict possible outbursts from these in 2012/2035 and 2038/2039 respectively.

In addition, Cliff Turk, Bill Hollenbach and Tim Cooper have reported bursts which have not been further analysed. The latter case occurred most recently, on the morning of 2003 May 4, when 15 meteors were seen from a radiant at $\alpha = 22{:}20$, $\delta = -27.5°$ in Piscis Australis. What is clear is that these types of outbursts are probably more common than originally thought, but that most are missed since there are too few observers watching the sky on a continual basis. Many such visual outbursts could be confirmed using forward-scatter radio techniques. A global network has been set up, and virtually the only area on the globe for which a station is missing is South Africa.

It is clear that meteor observing is practiced by too few observers, and often for various reasons those few are not out observing at the same time. We require more observers to join these programs and fill in the gaps left from our location.

7. Planetary occultations

An occultation occurs when a solar system body passes in front of a star. This body can be the Moon, a major planet (of which obviously eight such possibilities exist), or one

Table 2. Successful minor planet occultation observations by amateurs.

Seq. No.	Date	Minor planet	Diam. (km)	Observer(s)	Chords
26	1982 Mar 30	15 Eunomia	>309	Overbeek	1
38	1983 May 05	65 Cybele	>150	Hers	1
48	1984 Aug 08	87 Sylvia	>249	Strobos, Hirsch	1
56	1985 Apr 21	12 Victoria		Van Ellinckhuyzen	½
80	1988 Apr 21	139 Juewa	164±20	Cooper, Wakefield	2
82	1988 Jul 09	250 Bettina	>97	Cooper, Fraser, Overbeek, Wakefield	3
100	1990 Jun 15	3 Juno		Overbeek	1
113	1991 Jun 15	356 Liguria		Lund	1
137	1994 Dec 15	336 Lacadiera	>52	Overbeek	1
182	1998 Jun 27	248 Lameia	62 x 53 or 55 x 52	Overbeek, Cooper, Fraser, Smit, Lund	5
222	1999 Oct 14	48 Doris		Overbeek, Cooper, Fraser, de Jager	4
247	2000 Jun 11	345 Tercidina		Overbeek, Smit	2
257	2000 Oct 05	135 Hertha		Turk	1
311	2002 Jan 07	712 Boliviana		Streicher	1

Extracted from a list of 334 positive events observed globally up to May 2002, maintained by the International Occultation Timing Association. Also see Fraser & Overbeek (1998).

of the host of minor planets, for which the latest count is 208,572 (Marsden 2003: 8). There exists a core group of ASSA observers who observe the latter, and by timing the disappearance and reappearance of stars during such events, we are able to determine the size and shape of the occulting body. A list of successful observations is given in Table 2. In the past, the limited accuracy of the predictions meant that we might achieve success in perhaps 5% of the events observed. Nowadays, with much more accurate positional measurements of both stars and planets, the success rate is perhaps one in two or three.

Nevertheless, there are still too few chords generated by ASSA members to determine accurate minor planet profiles, simply because too few observers are taking part in this important program. A case in point will illustrate the importance of having many observers taking part. The most successful event so far observed from South Africa was the occultation of PPM 236753 by 248 Lameia on 1998 June 27 (Fraser & Overbeek 1998). Five chords were obtained across the profile of the minor planet, which enabled us to derive a size of 55 x 52 km. However, if we superimpose the positions of the five successful stations on a map of the Gauteng region, we realise that dozens of potential observers were in the path, and had these observed we could have defined the profile with much greater accuracy. And this was the most successful to date; most results are based on the chords of at most one or two observers.

8. Solar and lunar observing

The Solar Section languished for many years without direction. Now however, it is being rejuvenated under the leadership of its new Director, Braam van Zyl. I would urge interested participants to contact Braam, to ensure the long-term viability of observations by ASSA members. In the past, observations have been made in sunspot counting and drawing, and the monitoring of solar magnetic activity.

There has never been any coordinated approach to lunar observation. Despite the fact that many consider the Moon to be a sterile solar system body, there are important areas where observers with small telescopes can contribute, such as the monitoring of TLPs and micro-meteorite impacts. In the case of the Leonids, these impacts have been recorded with video recorders. In recent years, ASSA members have also submitted useful measurements of lunar eclipse darkness, which have been used to measure the dissipation of volcanic aerosols (Keen 2003). This series of observations needs to be continued in support of this long term project, and with three more total lunar eclipses in 2003/4 we have an ideal opportunity to make a valuable contribution to this program.

9. Double stars

The Double Star section under the directorship of Chris de Villiers is the newest observing section of ASSA. Little double star work has been done since the pioneering days of Innes, Finsen, van den Bos and Rossiter. The section desperately requires more observers to complement the work being done by Chris and Magda Streicher. Quoting from Chris' webpage [www.skywatch.co.za]:

> 'This branch of astronomy offers…a unique opportunity for the observer to engage in real astronomical research, rather than just admiring the colour differences

often found in a pair of doubles. In fact, this field is wide open to all interested observers, presenting a golden opportunity for serious scientific work. Scientific double star work consists of determining the angular separation between the two components, and the position angle of the (usually) fainter, secondary component with respect to the brighter, primary component. After many observations the apparent orbit may be plotted and the orbital elements calculated. Once the orbit of a pair is known, the masses of the stars may be calculated.'

10. Deep-sky observing

Virtually only Auke Slotegraaf and Magda Streicher are engaged in this work, but both produce a high output of quality observations which are used by the global community. These objects are also considered to be without change, but there are a surprising number of objects which are considered poorly known and for which visual observations are sought. Chief in this category would be uncertainties in the NGC; the Revised NGC (RNGC) listed a great number of objects as non-existent when they do, in fact, exist. With the establishment of the various Data Centres, the RNGC's mischief is largely undone, but there is nevertheless a nomenclature mix-up, which deep-sky observers are helping to sort out (A Slotegraaf, private communication).

11. Conclusions

The foregoing lists some of the major contributions and areas for expansion. But the list certainly does not end here. For the advanced amateur, there are fields of specialised study crying out for attention, especially for those equipped with CCD cameras on even small telescopes. These are fields which, not so long ago, were beyond the realm of the amateur, to which he or she can now make a serious contribution.

My Presidential Address intends to give some idea of the successes achieved by dedicated amateur ASSA observers in the past, and impetus for improving our contribution in the future. For many of these important observations it is not required to have a large professional telescope. All it takes is patience, motivation and dedication. I sincerely hope that our many members will take these comments to heart in the coming period. Clear skies to you all.

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... Occultation by Titan, continued from p.194

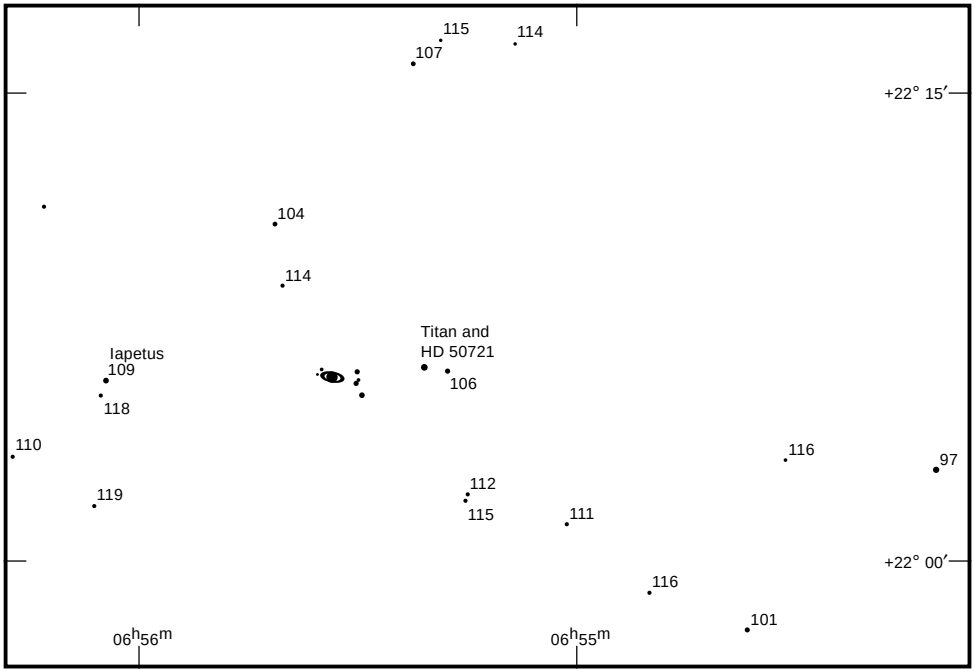

Figure 2. Saturn and its moons on 14 November at 02:11, showing Titan occulting the reddish star HD 50721. The separation between Saturn and Titan will be 2′56″. Some 7 hours later, Titan will occult the 10.6 mag star shown to its west. East of Saturn lies Iapetus (10.9 mag); several more moons are identified on the close-up diagram below. Stellar magnitudes, taken from the Tycho-2 catalogue and converted to *V*, are shown with decimals omitted.

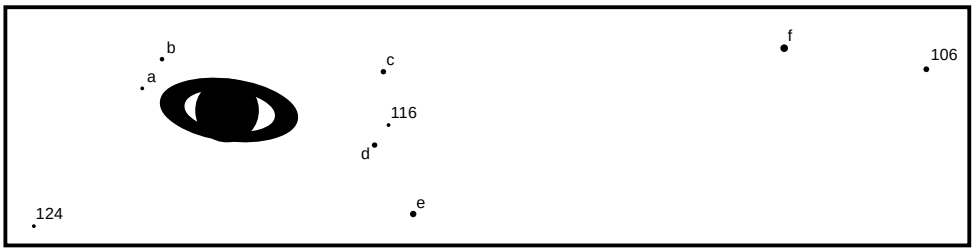

Figure 3. Close-up of Saturn on 14 November at 02:11, showing several of its satellites. The orientation of the diagram is identical to Figure 2, which has north up and east to the left. The satellites, and their visual magnitudes, are (a) Mimas, 12.7 mag; (b) Encelade, 11.5; (c) Dione, 10.2; (d) Tethys, 10.0; (e) Rhea, 9.5; (f) Titan, 8.4 and HD 50721, 8.6 mag.