PERTH OBSERVATORY
Department of Conservation and Land Management

PERTH OBSERVATORY VOLUNTEER NEWSLETTER

May 1998

Editor: Bevan Harris

Editorial

Last month, when commenting on how to calculate the date on which Easter is observed, I made a small error concerning the date of the Full Moon. This was kindly pointed out to me by an alert John Mills, who sent me an informative letter about the actual method used, as opposed to the rough approximation that I had given. This prompted me to investigate the matter a little further.

Without pursuing unnecessary detail, and writing from the perspective of Western Christianity, Easter is calculated from a formula (of which there are several to choose from) which is only loosely derived from actual astronomical events. Further information can be obtained from books available in the Observatory library or from the Internet at <http://cssa.stanford.edu/~marcos/ec-cal.html>. Given the complexity of current methods, there is a European proposal (which will likely succeed) to simplify the calculation of Easter from the year 2000.

My error? I miscalculated the moment of Full Moon in UT by deduction 8 hours from EST instead of WAST. This lead me to erroneously assume that Easter may occur on the day of the Full Moon, whereas it actually occurs on the following Sunday.

Highlights In The Sky

The mornings may be getting a little cooler, but the sky holds rich rewards for those who are willing to venture outside in the small hours this month. With the sole exception of Mars, all the naked eye planets are visible, producing two appulses and an occultation.

Being the closest planet to the Sun, **Mercury** is seldom visible out of twilight. Reaching greatest elongation West on the 5th, this month is 1998's best opportunity to view this shy planet. You'll need to be quick though, as it will fall back into the twilight later in the month. In doing so it will pass through appulse with Saturn (sep 0.8°) on 13th.

Venus continues to dominate the morning sky, though continuing to rise later as the month progresses. Near the end of the month (29th), it too passes through appulse with Saturn (sep 0.3°) as it climbs out of the twilight.

Mars is in conjunction with the Sun on the 13th and will remain out of sight until July.

Jupiter climbs steadily in the sky and at month end will be high in the NE as dawn approaches. On the 21st it will be in a dawn/daylight occultation with the 30% Moon. Disappearance is at 0606 (PA 68°) and reappearance at 0728 (PA 237°).

Saturn rises out of the morning twilight and into dark skies for its rendezvous with Mercury (13th) and Venus (29th).

Uranus and **Neptune** (both in Capricornus) will be stationary on the 18th and 4th respectively, while **Pluto** will be in opposition on the 28th.

Time Sheets - URGENT

Could all volunteers who work out of normal hours and/or personally retain there time sheets please send them to the Volunteer Coordinator (Jamie Biggs) **AS SOON AS POSSIBLE**. It is essential that we have an official record of the time you have generously donated so that we can reward you, keep the insurance people notified and show the rest of our department the extent to which the Observatory and CALM are benefiting from the volunteer programme. Would you please forward your time sheets each quarter (ie the end of March, June, September and December).

Phases of the Moon	FQ: Sunday 3rd	FM: Monday 11th	LQ: Tuesday 19th	NM: Tuesday 26th

Perth Observatory Open Day

The Observatory's inaugural open day held on May 3rd was a huge success with about 1200 public visitors attending. This success could not have been achieved without the hard work and dedication of both volunteer and full-time staff who assisted on the occasion. Sincere thanks are expressed for the generous efforts given by all volunteers who were involved.

Peter Crake, Bert Hollebon, Bob Taylor, Jacquie Milner, Trevor Dunn, Mark Eamons, Bevan Harris, John Morris, Nick Wright.

Volunteer Dinner - Attendance Compulsory

Well... not really, but all volunteers who have contributed some time to assist the Observatory over the last financial year are most welcome to attend. This dinner is provided free (you will have to pay if you want more than one drink) by the Observatory as a token of our appreciation for all the help you have rendered. Spaces are limited so book early (call Janet or Carmel). Note, this is a social gathering for volunteers and staff only.

Venue: The Pines Buffet Restaurant, Rendezvous Observation City, Scarborough.

Date: Monday 25 May 1998, 7pm.

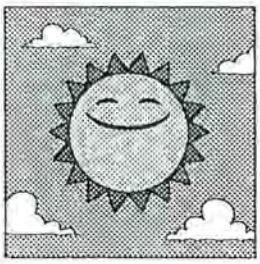
RSVP: ASA

Telescope Practice Nights

These have proved very popular with the Night Tour volunteers who need practice with the telescopes and with acquisition of targets of interest, as well as for those who just want to maintain their skills (particularly after a month of inclement weather and the attendant tour cancellations). After discussion and suggestions from volunteers and staff it has been decided that the these practice nights are to be continued year round. This is a very optimistic proposal for the winter months, but volunteers deserve the Observatory's support wherever and whenever possible.

An added feature of these nights will be the provision of a **30 minute talk** (with cheese and biscuits etc) on something astronomical or related to the Observatory's activities before the practice sessions begin. This activity is part reward, part social, part information dissemination that the Observatory will endeavour to provide for the benefit of **ALL volunteers**. It should be possible for volunteers or visitors to deliver a talk if it is appropriate.

There will be no practice night on 25 May 1998, because of the dinner. Government Astronomer, Jamie Biggs will initiate the talks on Monday 22 June 1998 with a slide show/talk concerning the "Basics Of Radio Astronomy".



Cloud Seekers From Sweden

Two Space Science students, Andreas Andersson and Per-Olov Eriksson, from Umea University in Sweden are currently working on a project at the Observatory. They are observing clouds in order to calibrate the cloud sensor system Technical Manager Arie Verveer has constructed. Eventually, after their two-month visit they will have created a computer program that will predict the cloud cover over the observatory given all the meteorological information available via the cloud sensor and the BoM's automatic weather station. (Note: They have also done some serious sun seeking at Rottnest, the Pinnacles and Monkey Mia!)

Feedback

As it is now approaching the end of the financial year it is appropriate that we review what we have attempted and/or accomplished over recent times. The dinner will be good time to exchange ideas and you are encouraged to do so, as well as have an enjoyable social evening. If you have any feedback or wish to make any proposals that furthers the mission of the Observatory please try to put it in writing and send it to the Volunteer Co-ordinator (Jamie Biggs). This rather formal approach just ensures that all feedback/proposals get a fair hearing and will aid you to think things through.

Iridium Satellites

Ever since Sputnik 2 first orbited the Earth with her unfortunate cargo a little more than forty years ago, ordinary people have probed the skies seeking a glimpse of these denizens of space. Today the passing of satellites overhead is commonplace, indeed it is a rare occurrence if an evening passes without at least one being seen. There are so many, in fact, that they pose a real nuisance in some areas of astronomy.

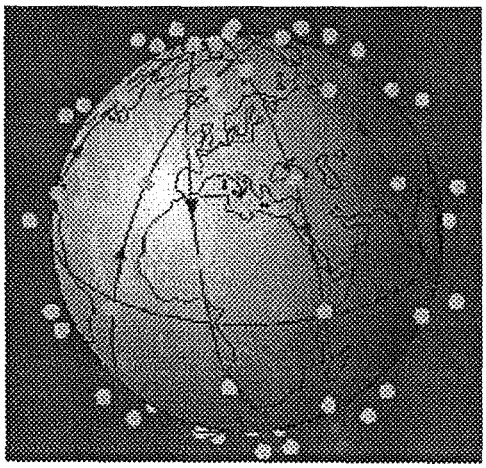
Yet still, these silent lights slipping across the sky evoke a sense of wonder and prompts the thought as to what their purpose might be. Could it be a weather satellite, or one of those secret spy satellites? Maybe it is Hubble, Mir, or even the Space Shuttle? Or perhaps it is just a humble disused rocket booster?

Now the quickening pace of the information revolution has brought with it a new generation of communication satellites (comsats). Over the next five years there are no less than twelve proposed systems comprising a total of more than 650 individual satellites slated for launch. Whereas previously just a few comsats were positioned in geosynchronous orbit, effectively out of sight to all but the most ardent observer, large numbers of these new satellites are being placed into low earth orbit (LEO) to service a burgeoning market for hand held communications devices.

For the last year, US communications company Motorola and their partner Raytheon have been steadily assembling the first "constellation" of these new networks in the sky, regularly sending aloft installments of new satellites aboard a variety of launch vehicles. The *Iridium* system is now almost complete, save for the somewhat delayed launch around mid-month of a Delta II rocket carrying the final five satellites. These launches have raised considerable interest amongst satellite observers as they provide rare opportunities to view multiple satellites together before they are maneuvered to their operational positions.

Launch Vehicles Used

Launch Vehicle	Launch Location	Satellites per launch
Delta II	Vandenberg Air Force Base, USA	5
Long March 2C/SD	Taiyuan Satellite Launch Center, China	2
Proton	Baikonur Cosmodrome, Kazakhstan	7



The Iridium constellation

Deriving their name from the atomic number for the element Iridium, there were originally intended to be 77 satellites in the completed system. These would have been configured in seven orbital planes of eleven satellites each (plus one in-orbit spare per plane for a total of 84 satellites), with each of the circular, 780km high orbits inclined at 86.4° to ensure complete global coverage. The final configuration will only contain 66 satellites plus spares (in six planes), but Motorola has perhaps understandably refrained from renaming their product Dysprosium.

Nominally, *Iridium* satellites are at the limit of naked-eye visibility (around magnitude +6) and would ordinarily pass almost unnoticed. As is now known however, these unassuming satellites are able to produce some magnificent flares, capturing the attention of satellite observers worldwide, as well as the general populace.

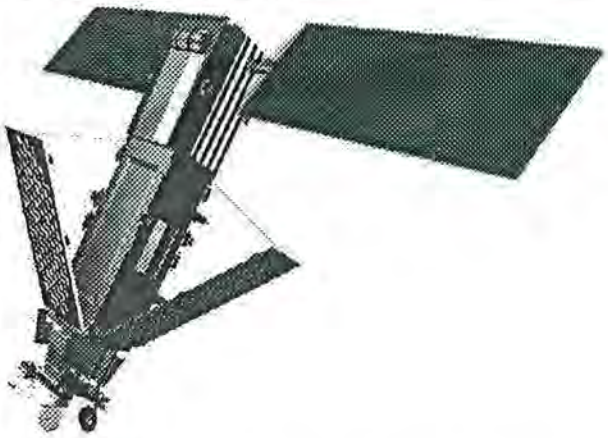
The brightness of these flares can easily exceed magnitude -8, some 40 times brighter than Venus and several hundred times brighter than Sirius, making them the brightest object in the sky after the Moon. The image at right, taken by a Belgian astrophotographer, shows a magnitude -8 flare from Iridium 12 near the border of Cygnus, Lacerta and Pegasus. As a measure of the brightness of this flare, note the internal lens reflection at right of frame

Image by Chris Dorreman on Sept 20, 1997 at 19:10:23 UT.

Bright flares are also observable in daylight, while others have even been seen through fairly thick cloud (though this requires the observer to be in a dark country location). The duration of individual flares is dependent on their brightness and would typically be in the range of 10 to 20 seconds, though one -8.2 magnitude flare I have observed in near daylight conditions seemed to last almost a minute.

So what is it that can transform a barely observable, or even invisible, point of light into a dazzling searchlight? The answer

to this lies in the design of the satellite and its orientation to the Sun. The satellite has a triangular cross-section and is approximately the size of two telephone booths stacked on top of each other (4 m tall x 1 m wide). Maintained in a vertical orientation, it has two solar panels located at the top and three Main Mission Antennae, or MMA, angled at 40° from the base. In the illustration at right, the third MMA is hidden behind the satellite body.



Iridium satellite

Each MMA is about the size of an average household door (188cm x 86cm x 4cm) and is manufactured from polished aluminium with a silver-coated Teflon covering. This forms a near-perfect mirror which can provide a direct (or specular) reflection of the Sun's disk onto the ground below. The area covered by this reflection on the Earth's surface is only a few tens of kilometres wide, requiring an observer to be within this small area to see a very bright reflection. Given the orientation of the spacecraft, the angle of the Sun and the observer's position, it is a fairly simple matter to predict when and how bright a flare will be.

There are now several computer (DOS) programs commonly available which can be used to predict *Iridium* flares. Sample output for the Observatory from one such program (IRIDFLAR by Rob Matson) is shown below. In this instance, the predicted flare will be around magnitude -6.1 (Mag) fairly high in the south east, but note the last column. Read in conjunction with the value in the Peak Mag column, it tells us that if we travel 5.5km East, the flare will be magnitude -8.3!

			Iridium		Coordinates		Range	Sat		Solar			Flare		Peak	Std	Maximum Flare		Bearing
Ir	Date	Local Time	Azm	El	RA	Decl	(km)	N	Ill	Azm	Elev	M	Angle	Mag	Mag	Mag	Latitude	Longitude	(km)
59	98- 5-11	18:27:09.0	142	60	11h30	-51.6	901.1	D	Lit	284	-11.7	R	2.72	0.7	-8.4	0.8	-30.6014	116.2091	
59	98- 5-11	18:27:16.6	146	57	11h37	-54.8	922.4	D	Lit	284	-11.7	R	0.33	-6.1	-8.3	-6.0	-31.0191	116.1914	5.5 E
59	98- 5-11	18:27:25.0	149	54	11h45	-58.0	948.8	D	Lit	284	-11.8	R	2.86	1.0	-8.2	1.0	-31.4987	116.1712	

IRIDFLAR (~90k) and other prediction programs can be obtained from the Visual Satellite Observers Home Page on the Internet at <http://www.satellite.eu.org/sat/vsohp/iridium.html>. Note that you also need recent orbital element (TLE) files as well. These should be updated at least monthly, but preferably each week. Links are provided on the VSOHP page to appropriate sites. If you do not have Internet access, I can provide copies of IRIDFLAR with the latest elsets if you supply me with a blank disk.

While the *Iridium* MMAs provide a visual spectacular for satellite observers and amateur astronomers, they are major source of interference for radio astronomers. One of the frequency bands (1621.35 to 1626.5-MHz) used by *Iridium* is perilously close to the narrow spectral band set aside for astronomical studies of the 1612-MHz line, which is emitted by hydroxyl (OH) radicals star-forming clouds and cool stellar envelopes. This narrow band is sure to receive severe interference from a leakage of transmissions from the Iridium satellites into the hydroxyl band. While an agreement was reached last March between the Iridium Corporation and the Arecibo observatory to limit off-peak transmission in the observatory's vicinity, no other observatory has negotiated a similar arrangement which will severely curtail their research efforts in this important area.

If you have something to contribute to the newsletter, you can submit it to me via fax on (08) 9250 8240 or e-mail to <bmh@bigpond.com>. Alternatively, submissions may be pinned to the volunteer notice board for collection. Thanks, Bevan