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BULLETIN

La Société Royale d'Astronomie du Canada

Supplement to the Journal of the Royal Astronomical Society of Canada

An Amateur at the IAU General Assembly

Mary Lou Whitehorne
Halifax Centre

"The International Astronomical Union (IAU) was founded in 1919 to provide a forum where astronomers from all over the world can develop astronomy in all its aspects through international cooperation. Since that time the Union has devoted itself to this purpose and its reputation is such that most of the international cooperation in astronomy is conducted through the IAU. The Union has Adhering Member Organizations in 56 countries and about 7 300 individual members. The Union is very diverse in character and its scientific activity is reflected in the work of its 40 commissions, which refers to all phenomena in outer space. General Assemblies are held every three years and almost 330 major scientific meetings have been sponsored by the IAU. Many other meetings are co-sponsored with other international, scientific Unions and Committees within the structure of the International Council of Scientific Unions (ICSU)."

- IAU Information Bulletin #71, October 1993.

Having read the above quote, you now know that the IAU does more than just determine specific boundaries for the constellations, broadcast IAU Circulars, and designate names for features on the surface of the planet Venus! The IAU is the governing international organization for astronomy and it holds its triennial General Assemblies somewhere in the world every three years. This year the meeting took place from August 15 to 27 in The Hague, The Netherlands.

You may recall an article published in the **BULLETIN** (June 1993) entitled "Where are the Women?" It generated some interesting feedback for the author (myself), including a letter from Dr. Elizabeth Griffin (Cambridge University, England) asking whether I would consider attending and participating in the upcoming IAU GA where there would be a session dealing with the topic of women in astronomy.

Amateurs are not normally included in IAU GA's and since we generally do not have the qualifications for membership (i.e. a PhD and gobs of really great post doctoral research), we have to jump through a few other hoops in order to get past the guard at the gate. So, I started jumping just to see how far I could get. Jeremy Tatum wrote a nomination for me for "Invited Participant" status. This was followed by a letter of endorsement from Dr. Griffin. These letters went before the Canadian IAU committee which approved the nomination and issued a formal invitation for me to attend. While this was going on I spent many hours wearing out my dialing finger in an effort to find a source of funding so that I could afford the trip. I had to turn a lot of stones but eventually found a sympathetic ear at Industry Canada. The arrangement is such that I provide a dozen astronomy awareness programs for young people and they will kick in $900 retroactively towards my travel costs. To my great delight, the Halifax Centre offered (I didn't even ask!) an additional grant of $500. Taken together, this meant a 50% subsidy of my total expenses and suddenly the IAU GA was a reality for me. This simple procedure took a mere seven months from October to May. I just barely made the registration deadline.

I arrived in The Hague on the morning of August 15th after one of those delightful all-nighters on the plane. I was very glad that I had done my homework about currency and local transportation, etc., so that I had at least a vague

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BULLETIN

is a publication of the Royal Astronomical Society of Canada and is distributed together with the society's *Journal*. It contains articles on current activities of the RASC and its centres across Canada, as well as articles from members and non-members which are of general interest to members of the society. Inquiries about the society should be directed to its national office at 136 Dupont Street, Toronto, Ontario, Canada M5R 1V2 (416) 924-7973.

Cover Picture: Middle Cove, one of the many beautiful inlets that can be found north of St. John's.

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Letters to the Editor

Die Energie der Welt ist constant

The recent letter from M. B. Stewart on Newton and entropy covered some points that I had intended to write about. It is perhaps a small point, but this type or erroneous citation can be a bit like urban legends, which develop a life of their own because people repeat them as fact, without knowing that they are incorrect.

The quotation "The total energy of the universe is constant and the total entropy is continually increasing." is familiar, in German, to those physical chemists, who, like myself, studied Lewis and Randall's text *Thermodynamics*. It would also be familiar to an earlier generation who studied the works of J. Willard Gibbs, where references to the original sources are given.

As Stewart has pointed out, Newton could not have made this statement since the concepts of entropy and the conservation of energy in the broad sense had not been developed in his time. It was a century and a half later that these laws were finally formulated as a result of experimental and theoretical studies in the first half of the nineteenth century. The quotation should be credited to Rudolf Clausius, German physicist, 1822-1888, who was concerned with the theoretical formulation of thermodynamics and who introduced the concept of entropy as an important term in the thermodynamic equations. He stated this idea in two parts:

1) Die Energie der Welt ist constant.
2) Die Entropie der Welt strebt einem Maximum zu.

These were first published in *Annalen der Physik und Chemie herausgegeben von Poggendorff* 125, 400, 1865. He also repeated it in the second part of some collected writings: *Abhandlungen über die mechanische Wärmetheorie*, Abl. IX, p44, 1867.

I cannot claim any expertise in German, but it is interesting that he used the word "Welt", which recent dictionaries translate as "world". However, in his discussion he refers to "das ganze Weltall" which would be "the entire universe", so that a simple translation, differing slightly from the above, would be:

1) The energy of the universe is a constant.
2) The entropy of the universe tends towards a maximum.

Clausius referred to the results of his extrapolation from the lab to the universe as laws, but he also specifically noted their tentative nature. Lacking any universal experimental verification they might, perhaps, be best described as conjectures. Most books on cosmology ignore Clausius and his work. There is, however, some current theoretical work on entropy production in the universe, some of which seems to involve a search for definitions of entropy that are consistent with the requirements of general relativity and the various models of the universe currently under consideration. Some authors even question the validity of applying the concept of entropy to the entire universe. While these conjectures of Clausius were bold, and perhaps inspiring, it appears that their status is still not clear.

Allan Reddoch
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1995 RASC Observer's Calendar

Rajiv Gupta
Vancouver Centre

The 1995 edition of the *RASC Observer's Calendar* is now available. Several changes have been made to the 1995 version of the *RASC Calendar*. All photos have been coated with a clear varnish to prevent fingerprint marks and to eliminate ink rub-off. The calendar can now be written in without having an impression appear on the next page. Also, a finer resolution line screen was used for the photo halftones, resulting in better reproduction, and times of Jupiter satellite double shadow transits visible in Canada have been included.

Attached members may purchase copies from their centre, and unattached members may order copies for $8 for the first copy and $7 for subsequent copies. Cheques should be made payable to 'RASC Vancouver Centre' and sent, along with your mailing address to:

RASC Vancouver Centre
Attn: National Calendar
1100 Chestnut Street
Vancouver, B.C., V6J 3J9

Please allow four weeks for delivery.

All Canadian astrophotographers are encouraged to submit photos for consideration in future editions of the calendar. Photos should be sent to the address above. ✪

Items of Interest

The First Canadian Comet

This year marks the 20th anniversary of the first Canadian comet: Comet van den Bergh 1974 XII (1974g), discovered on November 11th of that year by Sidney van den Bergh using the 48-inch Schmidt telescope on Palomar Mountain. A brief account of the discovery appeared in *JRASC* Vol. 69, No. 1.

E-mail Listing in Preparation

Randall Brooks is preparing a listing of all society members who have electronic mail addresses. Any member who wishes to have their e-mail address placed in the listing or who wishes to request a copy of the completed list should contact Randall (by electronic mail, of course!) at brooks@husky1.stmarys.ca ✪

Observing the Palomar Clusters

Randy Pakan
Edmonton Centre

Albert Wilson, Edwin Hubble, Walter Baade, Robert Harrington, George Abell, Halton Arp, Sidney van den Bergh and Fritz Zwicky—a very impressive list of names. Do you know what they all have in common? Together, in 1955, they co-discovered the fifteen Palomar globular clusters using plates from the Palomar sky survey.

Some of these clusters are among the largest and most distant in our galaxy. They are heavily obscured by galactic dust, which makes them difficult to detect visually. All of them, except Palomar 9, appear only as faint wisps of light—you would never know that they are globular clusters by their appearance. To find these smudges you need a very transparent night, patience and perseverance. On April 29th I found Palomars 14 and 15, ending a gruelling three-year observing quest to find and sketch all fifteen of them—they were my last two.

Palomar 9, alias NGC 6717, is the only one of the bunch that is an easy object. I can see it in my 80 mm finderscope with no difficulty. I suspect that it may even be visible in 10x50 binoculars. The most intriguing of the group is Palomar 5. With a diameter of 6.9 arc-minutes and a visual magnitude of 11.8, it appeared as a large, soft glow filling one-third of the field at 227x. Within the glow, several fifteenth magnitude stars flashed in and out of sight, but they may have been foreground stars. For Palomars 1, 2, 3, 4 and 13, I used powers of 250x and up. Conversely, Palomars 6 and 7 were best seen at under 100x. For the remaining clusters 150x to 180x worked well.

Good transparency is needed in order to see these objects, but even on poor to average nights I would go through the star hops of some of them. The reason for this is that some of them are rather tricky to find and it helps if you have the fields memorized in anticipation of a night of good transparency. This paid off big when we had a good night at Buck Mountain, our remote dark site. That night I found and sketched seven that I had not previously been able to see. The fact that there are only fifteen makes it fairly easy to memorize the star hops.

"Had I not spoken to him I would probably still be looking for it!"

Alister Ling asked me if I was sure that I had found Palomar 13, the toughest of them all. Frustratingly, the answer is "no". I have sketched a suspicious candidate that is in the right place, but I have not been able to confirm it with a photograph. The *Deep Space CCD Atlas* is an excellent reference to confirm sketches of obscure objects, but unfortunately, it has only nine of the fifteen Palomars. (Maybe I can persuade John Vickers to photograph the other six!) Whenever someone mentions NGC 7479 (a lovely barred spiral in the vicinity of Palomar 13) I chuckle and say "Oh yeah, that galaxy is easy to find—just go to Palomar 13 and then swing half a degree to the south-east!".

Two years ago I had a nice chat with Lucien Kemble in regards to finding the Palomars. He has found all of the them with his C11. He warned me that some of the sources list Palomar 11 at a declination of +8° 02′. Actually is at -8° 02′ ! Had I not spoken to him I would probably still be looking for it!

Although Lucien used a C11, most observers would need a much larger scope to see these faint objects. I used a 16" f/5 on a Poncet platform. If you decide to tackle this project, here is a tip. Palomars 6, 7, 8, 9, 11 and 12 are the easiest of the bunch—13 and 15 are extremely hard. As a whole it is a very tough project.

To end on a confusing note: in the second printing of Volume II of the *Uranometria* there is an addenda and errata to the first and second printings of Volume I. It states "Chart 106 change Pal 4 symbol to a galaxy."; "Chart 234 change Pal 3 to U5438 and the symbol to a galaxy."; "Chart 244 change Pal 5 to U9792 and the symbol to a galaxy." However, in the *Deep Sky Field Guide* they have an addenda to *Uranometria* and in it they state that the original information was correct after all!

So, if you are game for a real challenge, then give the famous Palomar globular clusters a try. They are spread out all over the sky and there is usually one or more of them up every night. The accompanying table gives, for each object, its name, coordinates for epoch 2000.0, visual magnitude, surface brightness, constellation and size (in arc-minutes) ✪

Designation	R.A.	Dec.	Mag.	S.B.	Con.	Size
Palomar 1	3h33.2m	+70° 35'	13.6	12.4	Cep	1.8'
Palomar 2	4h46.1m	+31° 23'	13.0	10.5	Aur	1.9'
Palomar 3	10h05.5m	+0° 04'	13.9	14.2	Sex	2.8'
Palomar 4	11h29.3m	+28° 58'	14.2	14.4	UMa	2.1'
Palomar 5	15h16.1m	-0° 07'	11.8	15.7	Ser	6.9'
Palomar 14	16h11.1m	+14° 57'	14.7	15.7	Her	2.1'
Palomar 15	16h59.9m	-0° 32'	14.2	16.0	Oph	4.2'
Palomar 6	17h43.7m	-26° 13'	11.6	12.8	Oph	7.2'
Palomar 7	18h10.7m	-7° 12'	10.3	12.8	Ser	7.1'
Palomar 8	18h41.0m	-19° 49'	11.2	10.9	Sgr	4.7'
Palomar 9	18h55.1m	-22° 42'	9.2	7.3	Sgr	3.9'
Palomar 10	19h18.2m	+18° 34'	13.2	13.1	Sge	3.5'
Palomar 11	19h45.3m	-8° 02'	9.8	11.9	Aql	3.2'
Palomar 12	21h46.5m	-21° 14'	11.7	12.9	Cap	2.9'
Palomar 13	23h06.7m	+12° 46'	13.8	13.5	Peg	1.8'

The first Man I saw was of meagre Aspect, with sooty Hands and Face, and Hair and Beard long, ragged and singed in several Places. His Clothes, Shirt and Skin were all of the same Color. He had been Eight Years upon a Project for extracting Sun-Beams out of Cucumbers, which were to be put into Vials heremetically sealed, and let out to warm the Air in raw inclement Summers. He told me, he did not doubt in Eight Years more, that he should be able to supply the Governor's Gardens with Sunshine at a reasonable rate.

Jonathan Swift
Irish satirist/clergyman (1667-1745)

Astrophotography—Field Rotation

Rajiv Gupta
Vancouver Centre
reprinted from *NOVA*

Obtaining photos in which the stars are pinpoints over the entire negative is something that every astrophotographer aspires to accomplish. Many aberrations, both optical and mechanical, conspire to get in the way. In the February issue, I discussed field curvature and how bending film can eliminate this particular aberration. Field rotation is another commonly encountered problem, and one that anyone who does deep-sky photography should understand.

What is Field Rotation?

Careful guiding during a long exposure will ensure that the guide star remains perfectly stationary on the film, so it will have a good image in the resulting astrophoto. Nevertheless, the other stars will trace small arcs centred on the guide star. This phenomenon is known as field rotation.

Altitude-azimuth mounts are especially prone to field rotation. Professional observatories use sophisticated methods to correct for this, but these methods are not generally available to amateurs. An equatorial mount, if properly aligned, will eliminate field rotation. However, since perfect polar alignment is impossible to achieve, there may still be some field rotation.

Recognizing the Problem

Field rotation will cause elongation of only those stars far away from the guide star. If you astrophoto has elongated images near the guide star, your main problem is not field rotation, but guiding error.

Other optical aberrations, such as coma and field curvature can lead to stars being acceptable in the centre of the frame but elongated at the edges and these may be confused with field rotation. One way of distinguishing these optical aberrations from field rotation is to note whether short exposures also exhibit the elongated stars. Since field rotation only manifests itself in long exposures, any aberrations apparent in short exposures are likely optical.

Another way to recognize field rotation is to note whether the elongated stars do indeed trace arcs centred on the guide star. The amount of elongation in a stellar image should increase as the distance from that star to the guide star increases. Since optical aberrations increase as the distance from the centre of the frame increases, and the guide star is likely to be in the centre of the frame, this method is not as reliable as the previous for recognizing field rotation.

Another possible cause of elongations is differential refraction. This will be a problem only if you photograph within 20° of the horizon.

Quantifying Field Rotation

In order to really understand field rotation, it is necessary to know the parameters on which it depends. The amount of rotation that a photographic field undergoes depends on the following factors.

1) The amount of polar misalignment. Call this quantity, measured in degrees, P.

2) The declination of the guide star. Call this, also measured in degrees, D. The closer D comes to 90° (i.e. the closer the field is to a celestial pole) the greater the field rotation is.

3) The length of the exposure, in hours. Call this T.

Two exposure with the same values of P, D and T can have different amounts of field rotation, depending on the direction of the polar misalignment. I will consider only the maximum amount of rotation.

Let R be the maximum amount that the photographic field will rotate about the guide star over the course of an exposure, measured in degrees. A rough formula for R is:

$$R = P \frac{T}{4} \cos D$$

An exact formula is considerably more complicated and requires some heavy spherical trigonometry. For most purposes, the above approximation is sufficient. If we know the maximum amount of field rotation that we are willing to tolerate, we can solve the equation for T to get the maximum exposure time. Doing so yields:

$$T = \frac{4\,R\,\cos D}{P}$$

Using the Formula

In order to use our formula, we need to determine how much field rotation is acceptable. This depends on the size of the negative and the maximum size of the stellar images that we are willing to tolerate. For example, for a 35 mm negative and 25 micron star images (this is a reasonable target) we should keep R to less than 0.075°. (This assumes that the guide star is near the centre of the field (and hence the object being photographed); if not R will have to be smaller. Also, R will have to be smaller if we set a finer tolerance for stellar image size or use a bigger negative. Using the formula we conclude that for the given example, the maximum length of time, in hours, we can expose is:

$$T = \frac{0.3\,\cos D}{P}$$

This equals about two hours if D is 45° and P is 0.1°.

You can use the formula yourself to determine, for your own photography, how accurate your own polar alignment needs to be to avoid field rotation. You will find that unless you are photographing near the pole, polar alignment accuracy of a few arc-minutes is sufficient, and it is not difficult to achieve this accuracy. You will need a super-accurate polar alignment (less than one arc-minute) only if your D is close to 90°, for then cos D will be small. One last warning: I derived the above formula myself and have not seen it in print anywhere, so use it at your own risk! ✪

National Awards

The RASC may, from time to time, confer awards on members in recognition of meritorious service or achievement. Recommendations for such awards should, in most cases, be made through the council of the local centre. Unattached members may submit recommendations, if they so wish, to the national council for consideration. Centre councils will, of course, submit recommendations as they see fit to the national council for final approval. All nominations (including citations) should reach the national office by December 31st.

CHANT MEDAL

The Chant Medal was established in 1940 in appreciation of the great work of the late professor C. A. Chant in furthering the interests of astronomy in Canada. This medal is awarded, not more often than once a year, to any amateur astronomer resident in Canada on the basis of the value of the work for which he or she has carried out in astronomy and closely allied fields of investigation.

SERVICE AWARD MEDAL

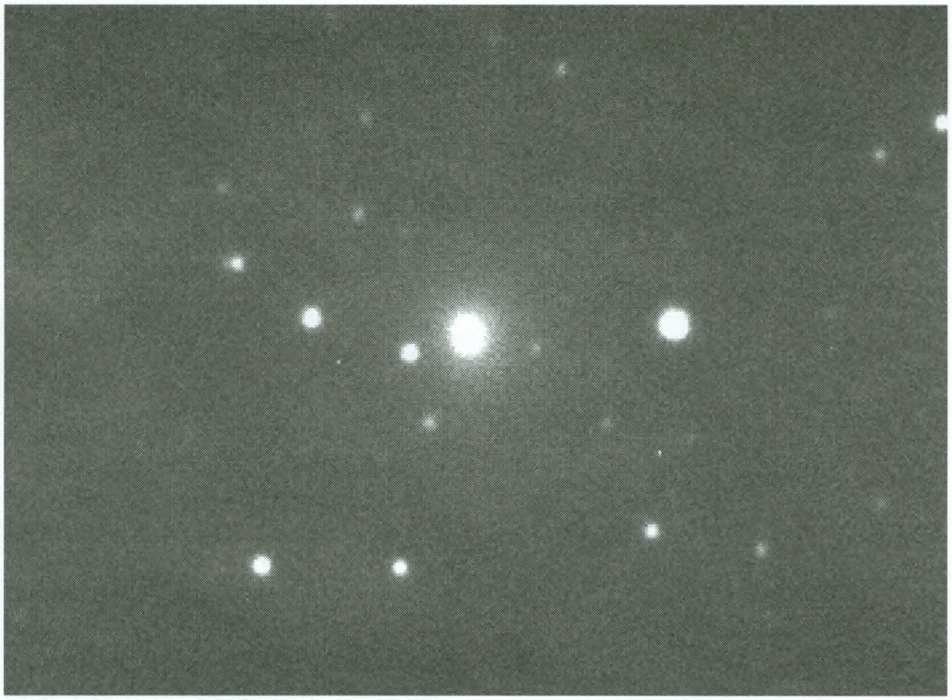
The Service Award was established in 1959. This bronze medal is presented to members who have performed outstanding service to a centre or to the national society.

KEN CHILTON PRIZE

The Ken Chilton Prize was established in 1977 by the national council in remembrance of the late K. E. Chilton, an active member of the Hamilton Centre. The prize is awarded annually to an amateur astronomer resident in Canada, in recognition of a significant piece of astronomical work carried out or published during the year. ✪

The One That Got Away

Jeremy Tatum
Victoria Centre



Kesao Takamizawa discovered his fifth comet from Japan, 1994i, on a photograph on May 6.69 UT, and it turned up again the following night. Brian Marsden of the Central Bureau for Astronomical Telegrams moved fast to get independent confirmation from other observers, logically contacting observers in Europe and eastern North America, since observers in western North America have to wait a little later for nightfall. However, the first independent observation to reach Brian was from David Rabinowitz with the Spacewatch Telescope in Arizona, with an observation on May 8.47.

At this time, we on the west coast had still not heard of the new discovery, partly because of local disruptions in our electrical supply. By the time of Rabinowitz's observation, Chris Spratt of the Victoria Centre had independently discovered the comet, on May 8.34. It was a genuine independent discovery, and, but for a delay in communications, it may have shared his name.

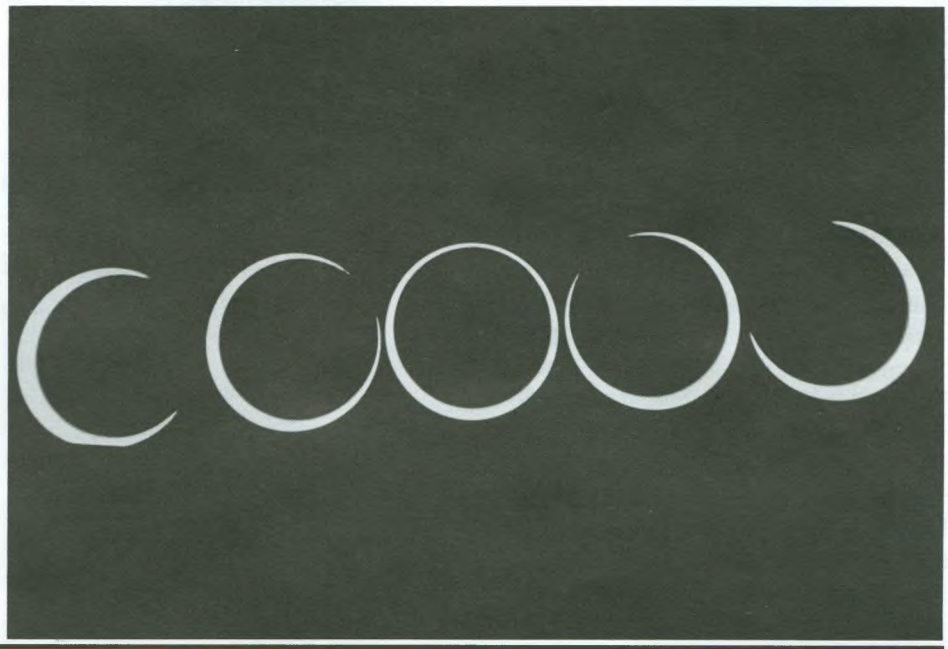
Chris was trying out a brand new toy, a ten centimetre (four-inch) Genesis-SDF refractor, with a four-degree field. (For those who dislike acronyms as much as I do, I believe SDF stands for Special Dispersion lenses plus Fluorite.) He had tried the telescope out briefly on two previous nights, but this was his first night of semi-serious observing, though his primary intent was still just to become "used to" the telescope. He had successfully found three comets that evening—McNaught-Russell, Tempel 1 and Takamizawa- Levy, and he was sweeping below the globular cluster M10 in Ophiuchus, close to the meridian, when he spotted a faint comet-like patch. Now, comet-hunters have a dread of prematurely announcing a comet that turns out not to be real, and at this point Chris made his fatal mistake. He thought to himself: "Well, I can't disturb Dr. Tatum by telephoning him in the middle of the night, so I'll wait until the morning."

Now I definitely do not want all and sundry to be constantly pestering me with nonexistent discoveries, but I know Chris to be a very experienced observer indeed. In fact this was the hundredth individual comet he had observed! Chris is one of the few observers who is welcome to telephone me at any time of day or night if he thinks he has something. This time he did indeed have something—after just three hours' observing with a new telescope—but by dawn the Spacewatch confirming observation was already in, and the comet had been named.

Anyway, congratulations, Chris! It was a close thing, and since this one took you just three hours, maybe it will not be long before you get your next one. In the meantime, here is a CCD image of the comet, obtained by Dave Balam of the University of Victoria with the 20-inch reflector of the university's Climenhaga Observatory, on May 11. It shows no tail, though it should be remembered that present-day CCDs are relatively insensitive to blue light, so that any plasma tail would be inconspicuous. ✪

Composite Eclipse Photo

Ian Grant
London Centre



This photo was taken during the May annular eclipse. The camera had a 225 mm lens set at f/11 and was used with a 3x teleconverter giving an effective focal length of 675 mm at f/33. A neutral density 4.0 filter was used and the film was 35 mm Kodachrome 64. The shutter was locked open through the sequence and a makeshift external shutter was used to make the five 0.03 second exposures. These were taken 180 seconds apart, with the fourth image timed to be exactly at third contact, as calculated for my home using the equations and data in Meeus' *Canon of Solar Eclipses*. The second exposure

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Endangered Asteroids

Jeremy Tatum
Victoria Centre

By my last count, there are thirty-seven asteroid names with a Canadian connection. These are:

855	Newcombia
2104	Toronto
2154	Underhill
2904	Millman
2905	Plaskett
2917	Sawyer Hogg
2980	Cameron
3023	Heard
3034	Climenhaga
3166	Klondike
3269	Vibert-Douglas
3304	Pearce
3307	Athabasca
3314	Beals
3315	Chant
3316	Herzberg
3497	Innanen
3658	Feldman
3670	Northcott
3673	Levy
3748	Tatum
3749	Balam
3931	Batten
3944	Halliday
4021	Dancey
4058	Cecilgreen
4091	Lowe
4113	Rascana
4230	van den Bergh
4276	Clifford
4340	Dence
4451	Grieve
4719	Burnaby
4789	Sprattia
5272	Dickinson
5424	Covington
5553	Chodas

Nearly all of these have been observed reasonably adequately, and their orbits are fairly secure. However, according to Minor Planet Electronic Circular 1994-S04, issued by the International Astronomical Union's Minor Planet Center, two of them, 3023 Heard and 4340 Dence, have made it on to the endangered list, and an effort should be made to observe them. 4340 Dence is described as "poorly observed", which is the least critical of the six categories of "endangerment". This December it should be not too difficult to spot, at magnitude 17 low down in Cetus. 3023 Heard is more critical, having been observed only once in the last ten years. It is magnitude 18 and deep in the densest parts of the Milky Way very low down in Sagittarius. It will not be observable until the summer, and then only with difficulty. If anyone spots either of these asteroids, be sure to let the Minor Planet Center know. ✪

Observing in Twilight

Alister Ling
Edmonton Centre

Many astronomers take note of the end of astronomical twilight as if it were some kind of starting gate: "Now we can observe." While the complete absence of skyglow may be necessary for long exposure photography, visual observers have no such limitation. Before the Sun reaches a solar depression (angle below the horizon) of 18°, the sky is readily dark enough to see detail in the dust lanes of the Milky Way. By that time, one can see all sorts of deep-sky objects, including star clusters, planetary nebulae, and bright emission nebulae. Naturally any challenge objects should be left for the middle of the night when one is dark adapted and the object is placed high in the south. Experience shows that solar depressions of about 14° produce an adequate darkness.

Observing in astronomical twilight is important in two respects. Firstly, for those of us north of 50° latitude, there is no astronomical darkness for a month or more centred on the summer solstice, and quite simply we do not want to give up! Even in August and May, it would be nice to dilate the observing window a bit. Secondly, if you plan to be set up and ready to observe by the end of astronomical twilight, then you still need another twenty minutes to dark adapt.

On a past night in mid-May two of us recorded the times when we agreed that the sky was very appealing, although still glowing slightly in the north. I realised that even at this point the aurora-free and non-pitch black sky was still significantly better than the darkest nights I had years ago at my site which was a 90 minute drive west of Montreal. Later calculations gave the solar depression as only 14°.

To maximize the amount of observing time, one should be ready to observe about twenty minutes beforehand. This ensures that the eyes will be dark-adapting as the night deepens. In the meantime take the opportunity to appreciate the darkening sky, perhaps by scanning with binoculars or searching for naked eye novae.

A couple of hours later in our session we could see features on the ground a bit too easily, and concluded that the sky had begun to lose its appeal. To my initial surprise, the solar depression turned out to be 16°, significantly greater than the 14° we found acceptable at the start. The discrepancy makes sense when it is realised that by morning twilight, the eyes have become truly dark adapted (apart from disruptions by red flashlights). Evidently a full day's bleaching of the visual purple requires a recovery of more than twenty minutes in the dark, but it is a good start.

By beginning your observing session at a solar depression of 14° and ending it at 16°, you can effectively lengthen your night by almost an hour, depending on latitude and season. Except for the month or two around the summer solstice, a half hour before the end of astronomical darkness is a rough and ready value for timing the start of the night.

Although relatively simple formulae exist for calculating the solar depression given the time and date, the easiest (laziest) method is to use a planetarium type computer program and make a few clicks of the mouse.

If you are in the same situation as me, then you do not want to waste observing time. Think about it: we cherish two hours of observing in early May or August. If we start observing only at the end of astronomical twilight then we're wasting almost 25% of those precious minutes dark adapting. Start when the Sun is 14° below the horizon and enjoy more of the sky. ✪

In the city of Tours on 31 January in the eighth year of the reign of King Childebert [583 A.D.] this day being Sunday, the bell had just rung for matins. The people had got up and were on their way to church. The sky was overcast and it was raining. Suddenly a great ball of fire fell from the sky and moved some considerable distance through the air, shining so brightly that visibility was as clear as at high noon. Then it disappeared once more behind a cloud and darkness fell again. The rivers rose much higher than usual.

Gregory of Tours
Frankish ecclesiastic/historian (538-594)

We have something more than the mere magnitude of the planets to allege, in favour of the idea that they are inhabited... though this mighty earth, with all its myriads of people, were to sink into annihilation, there are some worlds where an event so awful to us would be unnoticed and unknown, and others where it would be nothing more than the disappearance of a little star which had ceased from its twinkling.

Thomas Chalmers
Scottish theologian/author (1780-1847)

An Amateur at the IAU General Assembly

(continued from page 1)

idea of where I was going in the city. Once registered and checked in to my hotel, I was free to get acquainted with the city and the conference centre where the GA was to take place.

Held in the Nederlands Congresgebouw, a very large conference centre, the IAU GA had a lot to offer. The GA was officially opened with a ceremony attended by Queen Beatrix. The programme booklet was a scant 101 pages in length, with tables and lists of all the concurrently running symposia, joint discussions, working group meetings, committee meetings, etc. I could pick and choose what I wished to attend. There were several hundred poster papers too—their abstracts were published in a 300 page book, along with a map, so that you could find the section of poster papers that interested you! There is no way any one person can take in so much information, even if they stayed for the entire two week duration of the conference.

I attended the symposia on stellar populations and compact stars in binaries; the joint discussions on women in astronomy and education in astronomy, and sat in on some of the sessions on active galactic nuclei. There were sessions on everything in the universe; there was no shortage of things to do. Admittedly, I nodded off a few times during some of the first sessions I attended, but I soon realized that this was from jet lag and that I was in good company—there were plenty of "nodders" for the first couple of days as everyone tried to reset their internal clocks.

About 1 600 people registered early enough to be included in the list of attendees; in all about 2 000 astronomers were at the IAU GA. Coffee breaks were held in the large central foyer and, as you can well imagine, it was wall-to-wall with bodies and the hum of scientific conversation was raised to a loud roar.

I was invited to speak at the "Women in Astronomy" workshop, where my presentation was well received. It was quite an eye-opener to hear from women astronomers from all over the world, and learn of the varying degrees of difficulty that they work under in order to pursue their vocation. The playing field is most assuredly not an even one!

I also had an opportunity to speak at the joint discussion on education in astronomy. This was chaired by our own Dr. John Percy, and again my comments were well received. It was during this session that I made contact with Dr. Lucienne Guguenheim of Meudon Observatory, who made sure that I received a copy of the astronomy materials she has developed for use in French elementary schools. They look to be first rate and I plan to make use of them at the first available opportunity.

I also had the chance to meet and chat with a positively delightful Indian astronomer who develops planetarium programs and insists that at least one astronomical concept be fully explained in every planetarium show—a real departure from today's trends. She has promised to send me a copy of her "recipe for a star" that we caught a quick look at and that explained star formation in very comical "cookbook" terms that kids and adults can easily grasp.

Another dynamic lady astronomer that I met is Dr. Julietta Fiero from Mexico, who is the astronomy consultant for a science museum there. We had a wonderful conversation—she is a real ball of fire—and she promised to send me (so I can forward it to Roy Bishop) one of her pinhole mirror projection kits that they have used very successfully in Mexico. She got the idea from the handbook and I know that Roy (and all of the RASC) will be tickled to know that his idea has had wide and successful application in Mexico.

I then met a Belgian astronomer named Andre Heck from the Strasbourg Observatory who is compiling a huge international astronomy database and who would not let go of me until I sat through a long demonstration of Mosaic on the computer. Thus, I missed most of the session on active galactic nuclei...

I stole some time and visited the Omniversum, met the director, and had the royal tour, including a free show. They have a Digistar planetarium projector and they actually use the Omnimax as a special effect in their planetarium shows. It was most impressive. These people have a very clear vision of their mission, and they appear to be very successful in meeting their objective; that is, the popularization of science. The yearly attendance figures for their facility range from 350 000 - 500 000 visitors. It helps to have fifteen million people within a two hour drive of your planetarium!

S' Gravenhage (the correct Dutch name for The Hague) is a beautiful city and I partook of an organized tour to see some of it; including all the embassies, the Houses of Parliament, the Queen's residence, the Royal Stables, the Ritterzaal, museums, canals, etc. I stayed in a very nice hotel, located a three minute walk from one of Europe's finest beaches. For four nights of my stay there was an international fireworks festival/competition held on the beach that I could see from my hotel window.

The Netherlands has an excellent public transportation system and I thoroughly enjoyed the trains and trams for getting around. The IAU had organized tours running every day and since I was paying most of the bills out of my own pocket, I did not hesitate to take advantage of them. This enabled me to visit a few very unique places like Kinderdijk, the Netherlands longest line of working windmills. You can see some of them behind me in the photograph on page one. I also went to the Delta Works, the large system of barriers built against the North Sea in the province of Zeeland (near the border with Belgium). Another excursion visited the nearby town of Delft, famous for its pottery, and we visited one of the shops where the Delftware is made and painted entirely by hand.

One of the highlights of my trip was a technical visit to ESTEC, the European Space Agency's (ESA) research and technical facility in Noordwijk. Here is where ESA assembles and tests space vehicles before they are launched on an Arianne rocket from their South America launch site. While there we toured the facility, saw most of the testing set-ups, heard all about how they do what they do, and watched as they filled ISO—the Infrared Space Observatory — with liquid coolant in preparation for launch in early September. We also saw ERS 2 (European Remote Sensing), an Earth monitoring satellite, undergoing final testing before being sent to South America for a September launch.

The second part of this tour was a visit to Space Expo, ESA's public space museum. On display here are models and mock-ups of nearly everything that has ever gone into Earth orbit. There is even a large scale model of the business end of an Arianne rocket that you can walk underneath, look up and contemplate the fireworks that would result from its launching. Sputnik, Voyager, the lunar lander, Giotto, the space shuttle, Mir, Apollo, Soyuz, Hermes; they are all there. One really impressive display was called "Living in Space" and it did a very credible job of mimicking what living quarters look like in zero gravity. Naturally, there was a full size, cutaway version of the infamous space shuttle toilet and it generated plenty of interest from our group.

So now I am back from the big trip to the IAU. It was fun, exciting and exhausting. I cannot even remember half of what I saw and did, much less repeat it all here. On my last night in the Netherlands, I went to the boulevard on the beach, and sampled one of the local specialities: pancakes. Actually, it was only one pancake, but what a pancake. It was like the Milky Way—round and flat, with a central bulge of whipped cream, and seemed to be a hundred thousand light years across. It nearly killed me but I managed to subdue the monster. ✪

Special Conference Travel Grant

At the St. John's G.A., the national council authorized an expenditure of up to $500 in support of the conference *Astronomy Education: Recent Developments, Future Coordination* which is being held June 24th-25th, 1995 at the University of Maryland. The support will be in the form of a travel grant to a conference delegate. Preference will be given to RASC members in good standing who are currently active astronomy educators. Letters of application will be reviewed by the executive committee, and must be received by the national secretary, Dr. Randall Brooks on, or before, February 3rd, 1995. The grant recipient(s) will be expected to share the benefits of the conference by writing a report for publication in the *Journal* or the **BULLETIN**. Details of the conference are available from:

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Composite Eclipse Photo

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was thirteen seconds before second contact—making it exactly at that time would have made the images uncomfortably close.

The external shutter was a long board that slid on a table and which was pulled by a string passing over the edge of the table with a weight attached to it. The camera stood on a tripod in the shadow of the end of the board that projected over the table. The projecting end had an 8 cm wide slot in it. By pulling the board back the correct distance and releasing it, the leading edge of the slot, accelerating with the falling weight, would move exactly 16 cm before exposing the camera to the Sun. This resulted in a repeatable 0.03 second exposure, much shorter than could be achieved with the usual "hat" trick.

The exposure time was probably too long, but at third contact Bailey's beads show well. I was particularly impressed by the fact that after taking the exposure at third contact, I walked over to a projected solar image and was able to watch for Bailey's beads for what must have been several minutes as the horns of the solar crescent drew well back. ✪

T'was the Night Before Christmas

Mark Chartrand

This piece was composed by assorted grad students (myself included) at the Warner & Swasey Observatory, Case Western Reserve University, way back in 1967.

T'was the night before Christmas and up in the dome
A grad was observing and wished he was home;
The Faculty was nestled all snug in their beds
While visions of research grants danced in their heads.

Alone in the dome with no one around
I'd started a spectrum and just settled down
When out on the catwalk there came such a clatter
I sprang from the 'scope, and tripped on the ladder.

Away to the doorway I started to fly
Stepped out on the catwalk and looked at the sky.
And what to my wondering eyes should appear
But a Nova Vulpecula (at this time of year?).

Faster than corpuscles the photons they came
And I whispered and shouted and called them by name:
H-alpha, H-beta, forbidden OII
(And all of the spectrum was shifted to blue).

From the lines in the blue to the lines infrared
I kept all the wavelengths arranged in my head.
As quick as I could I turned 'round the slit,
And in came the photons, lickety-split.

As I opened the shutter and looked at my watch,
"This exposure" I said, "I'll try not to botch."
I said no more words but went straight to my task;
In the light of my nova I knew I'd soon bask.

And laying some neon aside of my star
I said in a whisper "I'm alright, so far."
I raced to the darkroom clutching my treasure,
And developed it twice, just for good measure.

I fixed it and washed it and dried it with glee,
For now I could publish in *PASP*.
And they heard me exclaim as I passed out of sight
"Happy Christmas to All, and Observe a Good Night." ✪

A lesson to be learned from this puzzle is that it is not necessarily the pieces which seem to fit satisfactorily that decide whether or not the picture is correct, it is the pieces which don't fit that really decide the issue.

Peter Warlow
British physicist/author (1982)

Found Poem

Jannen Werner-King

I think that this poem will be of interest to members of the society who attended the 1994 General Assembly and took part in the boat tour commemorating Edmund Halley's landing at Tors Cove, Newfoundland. My husband and I took part in this tour and I was inspired by the friendliness of the people at Tors Cove to write this poem.

It was
clear as water
in Tors Cove
on the anniversary
landing of Edmund Halley.
The rock
constellations on the sea-
bed gleaning universal secrets
as sun spilled off
faces of the town
meeting us on the pier.

The welcoming wave,
the tangle of voices,
a net pulling us
closer to the ancestral
warmth of these people in this new-found
land of wind rounding the point
melting one voice into
another and the sea
carrying us and history
on a collision course
like Edmund's expedition
and the rocks,
like Jupiter and the comet.
But we did not dramatically change
our planet's face
just marked a moment
a coming together
with words. ✪

The next object which I have observed is the essence or substance of the Milky Way. By the aid of the telescope anyone may behold this in a manner which so distinctly appeals to the senses that all the disputes which have tormented philosophers through so many ages are exploded at once by the irrefargable evidence of our eyes, and we are freed from wordy disputes upon this subject, for the Galaxy is nothing else but a mass of innumerable stars planted together in clusters.

Galileo Galilei
Italian astronomer/physicist (1564-1642)