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Reflections: The Other Side of the Night

Randy Pakan
Edmonton Centre

Our observing session on January 22nd is one that I will remember for a long time. Not so much because of the observing but because of the chain of events that happened that night. Some background first, though.

My house is on the southern outskirts of Edmonton and one of the reasons I bought it is because of its backyard southern exposure—it is a pretty good observing site for being in the city. For example, one night when searching for a comet near M81/82 I found a likely suspect. Upon checking *Uranometria*, to my surprise, it was UGC 5028, a magnitude 13.8 galaxy!

At the back of my property is a six-foot fence, behind that is a greenbelt, then a walkway, and behind that, a complex of townhouses. About a year ago, an elderly lady bought the end unit of the complex and decided that she needed an automatic 500 watt halogen "security light". The light lights up the walkway, the greenbelt, my backyard, and I can now do shadow puppets on the inside wall of our bedroom.

On the first night when the light went on I totally freaked (just picture Macauley Caulkin in the *Home Alone* ad). However, I thought I had better wait awhile before I confronted her because I am sure she had to pay the electrician a couple of hundred bucks for the wiring he did. In some ways she did me a favour, because now

I automatically just head out to the dark site rather than settling for lazy backyard observing.

So getting back to January 22nd. We had a short but extremely transparent evening. My favourite Sharpless nebulae were easier to see than usual and for the first time several of us were able to see the Horsehead Nebula without a filter! Alas, the clouds rolled in and we left around midnight.

I took my time driving home and eventually went to bed around three. However, just as I laid back I heard a blood curdling "Help rape... rape... help... please help us!". The two girls' screams shot through me like a jolt of electricity. I told my wife to call 911 and I pulled on my pants and bolted out the door. On my way out I grabbed a large walking stick that I carved last year at Cub Camp—never did I imagine that I would ever pick it up as a weapon!

The screams were coming from the complex parking lot. As I rounded the corner, wired on adrenaline, I confronted a man whom, I assumed, was a rapist. His face was bleeding and he was obviously very shaken. We were having a harsh stand-off just as two police cruisers screamed into the lot. The cops yelled at me to "drop my weapon" as they blasted me with a searchlight (and I thought the old lady's light ruined my night vision!).

To make a long story somewhat shorter, they ended up arresting two drunk teenage girls who did not even live in the area. They had tried to stiff this poor taxi driver for a \$30 fare. When the cabbie grabbed one by the arm and demanded his money the girls started yelling rape and commenced beating on his face with their purses.

After I found out what really happened I sincerely apologized to the cabbie and assured

him that I would have been there just as fast had it been him calling for help. A couple of hours passed and the officers convinced the girls to apologize to the cabbie and pay him his fare. Being a practical and forgiving man he accepted the cash and dropped the charges. The officers were officially required to tell me what I did was very stupid, but off the record admitted they would have done exactly the same thing. I am sure that the fact that I have a teenage daughter had a lot to do with the way I reacted.

The next day the manager of the complex (who just happens to be the floodlight lady) introduced herself and thanked me a half dozen times for reacting the way I did. She was thoroughly disgusted that out of the 200+ people that live in the complex, help had to come from someone that lives one street over. (You can now see where this story is going.) I seized the opportunity to tell her how her "security light" was doing nothing but destroying my backyard observing. I told her that if we could put a switch on the light then I could resume my observing and that I would be more than happy to keep an eye out for trouble. She was thrilled at the idea of having a "nightwatchman" nearby.

She is going to have a switch installed and I am to let her know the nights when I would like it turned off. I told her to pass the word that if anyone is interested in looking through my telescope that they are welcome to come over and explore "the other side of the night". ☪

The observer listens to nature; the experimenter questions and forces her to reveal herself.

Georges Cuvier
French zoologist/anatomist (1769-1832)

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: A view of the Ambassador Bridge, which links Windsor with Detroit.

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Letters to the Editor

Looking for Phenomena

I am presently working on a project which started in January 1994. One important area of the research is astronomy. I require literature and observed examples of unusual meteors, bolides and transient lunar phenomena.

David J. Robinson
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Great Britain CA2 7PN

Let's Keep Urania

I am writing in response to Patrick Kelly's *A New Society Logo* which appeared in the August issue. Along with many other members of the Calgary Centre I was shocked that Mr. Kelly suggested changing the society's logo. A youth member myself, I like the logo and have found that all the other youth members that I have talked to feel the same way. I therefore object to the fact that Mr. Kelly so assuredly stated that it discourages youth members. I do not know about those in Halifax, but the feelings of the youths here are not in compliance!

In my opinion the logo brings an air of distinction and dignity to the society. Urania, to me, is indicative of the desire to learn and gather knowledge that so encompasses the society. Rather than discouraging me, I found that it almost encouraged me to join. "The woman sitting in the middle" reminds us all of the beginnings of our science and should not be so swiftly brushed aside. In today's society it seems to me that we are often too hasty in wanting to throw out or change our symbolic links with the past. These links can provide continuity and reminders of our past and are the foundation for our present and future.

The work of the Greek civilization has laid the foundation for our study of the heavens and well deserves the recognition. I might also add that a woman is depicted in the logo and provides a

much needed encouragement for women to enter the scientific field.

As for the "dead language" to be found on the logo, I believe that it also brings an air of distinction and of learning to the society's name. It is also beautiful and perhaps Mr. Kelly might be interested in its meaning: where Urania leads. It elegantly outlines the purpose of the society.

Mr. Kelly also suggests that the logo, when small, is impossible to discern. This may be true, but I would be interested in knowing how often the symbol is used in such a context. When depicted at appropriate sizes, the elegance and visual appeal of the logo greatly outweighs the problems encountered at reduced sizes.

In short, I feel it utterly unnecessary to change our society's logo. If it has served us well for so long already, I fail to see why it must suddenly be abandoned in such haste. I encourage Mr. Kelly to consider that "as we head into the third millennium" our history must not be forgotten in the process. Urania, along with her Latin aphorism, beautifully summarizes the endeavours of the members of our society to learn more about astronomy. Mr. Kelly does not do our logo justice. It is an attractive symbol to represent our society, of which we should all be proud.

Camilla Robinson
40 Sunmount Crescent S.E., Calgary,
Alberta T2X 1W1 ☺

Nominations for Treasurer

Peter Broughton
Nominating Committee Chairman

At the annual meeting of 1995, the term of treasurer expires and the membership will have the opportunity to elect someone to this office for a three-year term. Terry Hicks was elected treasurer in 1992, but had to resign because of health problems in 1994. In accordance with RASC by-laws, the national council made an appointment to complete Mr. Hicks's term. The person appointed was Dr. Rajiv Gupta of Vancouver and the nominating committee is pleased

to learn that Dr. Gupta is willing to let his name stand for election in 1995.

Any member of the society may be nominated for the office of treasurer. Such nomination (in writing, signed by at least five voting members of the society, and confirmed by a written statement of acceptance from the candidate) must be delivered to the secretary of the society, Dr. Randall Brooks, by May 1st, i.e. at least sixty days before the annual meeting.

The formal duties of the treasurer are outlined in the society's by-laws, but it should be pointed out that the routine book-keeping is handled by the executive secretary, Ms. Rosemary Freeman, and regular financial statements are prepared by the society's auditors. ☺

Items of Interest

Halifax Members Make History

David Lane and Paul Gray, using a CCD camera at Saint Mary's University's Burke-Gaffney Observatory, discovered Supernova 1995F. This is the first supernova to be discovered from Canada by either an amateur or professional astronomer. It was discovered on an image taken on the night of February 10th and is located about 2" east and 1" south of the centre of NGC 2726 (RA = 9h 05 min, Dec. = +60°). When discovered, the supernova was at magnitude 14.7 and was two to three weeks past its maximum. The discovery was announced in IAU circular number 6138.

While the discovery was made on the 10th, the supernova was not officially confirmed until almost two weeks later. By then the supernova had already faded and Roy Bishop was unable to locate it with his 17-inch telescope. The media have shown a lot of interest in this story. Paul Gray has been interviewed for CBC national radio, CTV's Canada A.M., and CBC's Middy to name a few. Reliable sources confirm that a more detailed article describing their project will be in a future issue... ☺

An Invitation to Everyone!

The Windsor Centre thinks it is time for you to start thinking about those vacations plans and with the GA just around the corner, Windsor will be the place to be. This GA will be a special one, as it is also the Windsor Centre's 50th anniversary. Starting as a small group, the centre has steadily grown, both in size and reputation.

This year's GA will be held at the University of Windsor, commencing on June 29th and running until July 2nd. Things will start off with a bang at the International Freedom Festival Fireworks on the Detroit River. Tours are scheduled for the Fort Malden National Historical Museum, The Pelee Island Winery (where the wine that will be served at the GA will be made) and Point Pelee National Park, the most southerly part of mainland Canada. A lot of free time has been allotted for you to visit the Freedom Festival, downtown Windsor's carnival for the Canada Day holidays and Windsor's newest attraction, the Windsor Casino.

The Ruth Northcott Lecture will be delivered by Mrs. Carolyn Shoemaker, who has thirty-three comet discoveries to her credit, including Shoemaker-Levy 9 which crashed into Jupiter last summer.

The organizing committee has worked hard to ensure that you enjoy yourself, so plan to come and join the party!

For registration information contact your centre secretary or the Windsor Centre directly. The centre can be reached by electronic mail at sheple6@server.uwindsor.ca, telephone at (519) 723-2389 or by mail at:

FRANK J SHEPLEY
GA '95 CHAIRMAN
RR#2 344 SOUTH MIDDLE ROAD
MAIDSTONE ON NOR 1K0 ☎

Across the RASC

Toronto

Centre members Fred Giles, Vera Jelinek and Ralph Chou joined up with a group of 200 eclipse chasers to view the total solar eclipse of November 3rd, 1994 from Iguazu Falls, Brazil. The group included expeditions from Chicago's Adler Planetarium and the Los Angeles Museum of Natural History.

At Iguazu Falls, Edmonton Centre member Alister Ling and Toronto Centre member Ralph Chou were part of a six person site selection

team which was charged with finding the most advantageous eclipse observing site in the surrounding countryside. Much to everyone's delight the eclipse was successfully viewed under clear skies from a soccer field fifteen kilometres from the falls. To quote Ralph: "Venus, Jupiter, Mercury and Spica appeared like brilliant diamonds on a deep navy velvet, flanking a spectacular coronal display extending five solar diameters to the east and west. Fine coronal filaments could be seen. It became so dark that I could not see the shutter speed settings on the camera body... A hedgerow prominence appeared over 90° along the lunar limb, heralding the return of the chromosphere. Five brilliant Baily's beads appeared and three minutes and thirty-eight seconds of totality ended without a cloud in the sky. As the cheers began, we could hear shotgun blasts from the surrounding farmers as the locals chased off eclipse demons."

One of the experiments Ralph conducted during the eclipse was to record contact times using his watch, which had been set to UT. His recorded times are as follows:

First contact	11:00:36
Second contact	12:45:20
Third contact	12:48:58
Fourth contact	14:08:28

Some of the sightseeing taken during our ten day trek included tours of the various attractions in the Rio de Janeiro area. In addition, visits were made to the National Museum, the National Observatory, the Astronomical Museum, as well as many places of interest in Iguazu Falls and Buenos Aires. Needless to say, considerations are already being made towards witnessing the upcoming solar eclipses in South America and in Southeast Asia. ☎

Astronomy Week 1995

Sandra Ferguson

This year International Astronomy Week is May 1st-7th, with International Astronomy Day being celebrated on Saturday, May 6th. This is the nineteenth year in which Astronomy Day will be held in Canada. It provides an opportunity for all centres of the RASC to promote both astronomy and our society, as well as to educate and inform the public. This year centres are encouraged to organize public events and activities with the theme "Light Pollution—A Very Serious Problem", emphasizing the importance of informing the public about how light pollution affects our night sky and suggesting alternatives on how to control the amount of artificial lighting in our urban areas that will result in safe streets as well as successful observing.

For an information package to assist your centre in organizing Astronomy Day events in your community, including how your centre can apply for the Astronomy Day Award sponsored by *Sky and Telescope* magazine, contact:

SANDY FERGUSON
238 MAIN STREET APARTMENT 11
SASKATOON SK S7N 0B5
(306) 931-3184
(306) 244-4423 (FAX)
E-Mail: huziak@sedsystems.ca ☎

Nova East Date Change!

An invitation is extended to all astronomy enthusiasts to attend Nova East '95 if you happen to be "down east". This year, Nova East will be held on the weekend of **July 28th to 30th**. (NOTE: This date has changed from the one indicated in the RASC calendar, so that many of the organizers could attend this year's Starfest, which will be held on the weekend that Nova East was originally scheduled for.)

The site, Fundy National Park in New Brunswick, is a well established park, with many conveniences and facilities which make a beautiful compliment to the excellent dark skies. Talks are held both for the public, and for the astronomers, and we welcome any who would like to present a talk.

For the first time this year, registration is mandatory. Advance registration is \$10 per person, \$15 per family, on-site registration is an additional \$5. Registration fees are waived for speakers, camping is always free. T-shirts, which are always a hot item, should be pre-ordered to guarantee that you will actually get one.

Further registration information can be obtained by contacting Doug Pitcairn at:

13 FERGUSON ROAD
DARTMOUTH NS B3A 4J8
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(902) 463-7196 (home)
Internet: pitcairn@tuns.ca ☎

At Lammas [August 1st] of this year, King Henry went oversea; and on the following day, while he lay asleep on board, the light of day was eclipsed over all lands, and the sun looked like a moon three nights old, and there were stars around it at midday.

Then men were greatly astonished and terrified, and said that some important event should follow upon this; and so it did, for in that very year the King died in Normandy the day after St. Andrew's Day [November 30th].

Anonymous
The Anglo-Saxon Chronicle (1135)

Spaced Out in Nova Scotia!

Mary Lou Whitehorne

President

The Atlantic Space Sciences Foundation, Inc.

The Atlantic Space Sciences Foundation, Inc. (formerly NSPAC—the Nova Scotia Planetarium Advisory Committee) continues to work on the Nova Scotia planetarium project. This past autumn we sponsored a Challenger Learning Centre teacher workshop, "Touching the Future: Linking the Classroom with Space," as part of a province-wide science teachers' conference. This workshop gave the twenty-four participating teachers the training and materials to bring hands-on space science into their classrooms. "Touching the Future" was very enthusiastically received by those teachers; they enjoyed the training session very much and rated it as the best workshop they had ever attended. As a result, there should be a lot of students getting enthused about space science, and science in general, in our schools this year!

Although the workshop was presented at no charge, it certainly did not come for free. The Atlantic Space Sciences Foundation (TASSF) sponsored the event and had to find funding to the tune of \$5,000 in order that teachers and their students could benefit from the workshop. This means that the actual cost of the workshop was just over \$200 per teacher for the one day training session. This first Challenger workshop was funded by the Canadian Space Agency as a pilot project, with the understanding that future Challenger workshops would pay their own way. This means that next time we will not be able to give it away; TASSF will have to charge teachers the actual cost of the workshop.

It is also appropriate to note that in addition to the workshop TASSF gave away about another \$5,000 worth of slide sets, booklets, videos and other handouts of a space science and/or astronomy related theme to some two hundred twenty-five teachers who attended the conference. This was our first major province-wide outreach program and should stand as solid evidence of our commitment to the improvement of science education here in Nova Scotia.

TASSF is also working on another project for Nova Scotia schools called Starlab. These amazing silver igloos are portable, inflatable planetariums that faithfully reproduce the night sky. Starlab is fun, exciting, easy to use, appropriate for all grade levels and is a dynamic and powerful teaching tool, providing a unique and totally immersive learning environment, not just for

astronomy but also for social studies, math, physics and science in general.

TASSF has already secured partial funding for the first Starlab, and is actively seeking the balance of the \$17,000 required to obtain the unit. We are confident that within a year we will have a shiny new planetarium that will be available to the schools for the benefit of all Nova Scotia students.

Starlab is to be available, through advance bookings to any school in the province that has a qualified teacher. How do teachers qualify? That is easy! TASSF will be offering a number of one day training sessions to interested teachers as soon as we have accepted delivery of the Starlab. These units come complete with operating instructions and curriculum materials ready to go. Quality curriculum materials are essential to the effective implementation of any educational program. Starlab's curriculum manual is a 350 page compendium of the very best programs and activities. This curriculum has been designed and classroom tested by K-12 Starlab users world-wide.

TASSF is assuming responsibility for the initial cost of the unit and half of the operating costs of the program; which include phone, fax, printing, postage, shipping, routine maintenance and small parts replacement, teacher training sessions, and a salary for a part-time Starlab program coordinator. The other 50% will have to be recovered from the user schools. Present budget estimates indicate that the Starlab can be in a school for a one week period at a cost of no more than \$200 per week. If that sounds like a lot, think of it this way: it is a lot less expensive than two bus trips to the local museum for four school classes and the Starlab can be in the school for an entire week, allowing all classes access to it. Now, it looks like the bargain that it really is!

In addition to these activities, TASSF and RASC members continue to offer regular public programs in the existing small Halifax planetarium. In this way we are building a successful track record that cannot be overlooked when we eventually finish the final two phases of our feasibility study for the new planetarium. It has been a very slow process, but we have found two private sponsors who have agreed to finance the final phases of the study. In the end we should have a document, which, along with our positive track record, will show that our dream of a new planetarium is a project worthy of support. ☆

Knowledge is a matter of science, and no dishonesty or conceit whatsoever is permissible.

Mao Tse Tung

Chinese political leader (1893-1976)

Belittling Keck

Germain Dionne

Ottawa Centre

reprinted from *AstroNotes*

Open any introductory astronomy textbook and look up what the author has to say about light-gathering power. You will probably reach the end of the paragraph, feeling sorry for that clearly inferior instrument, the human eye. Perhaps a different perspective will make you feel a little bit better about it.

First, let us look at that giant marvel of observational technology, the Keck Telescope in Hawaii. It has thirty-six hexagonal mirrors whose total reflective area equals one ten-metre mirror. Its light gathering power is directly related to the total area of its mirrors, 78.5 m². Impressive indeed, but you have not seen anything yet!

Now, let us look at that humble instrument, the human eye. Using the same line of reasoning as above, let us do a little bit of math (nothing painful though!). A few assumptions to start:

- The current world population is approximately six billion inhabitants.
- Half of the people on Earth are on the night side of the planet at any one time.
- Half of these people have clear skies at night.
- The percentage of visually-impaired inhabitants is negligible.
- The pupil area of the fully dark-adapted human eye is about 20 mm².

Now comes the number crunching. The total human optical array consists of three billion lenses which can be used in stereoscopic pairs so that they can be pointed towards separate targets, or to observe the same object simultaneously. Used together, the combined light-gathering power equals that of a single 276 metre telescope, whose total area is a staggering 60 000 m²! Now if that does not shift the balance of light gathering power, what could? In fact, if we could get everyone on Earth under a clear night sky, the numbers are even more impressive as the total light gathering area would then be 240 000 m²—equivalent to a single mirror with an approximate diameter of 550 metres!

To conclude, the next time you feel tempted to be awed by optical behemoths of the ten-metre variety, just stop and think about this: we need the equivalent of 3 000 Keck telescopes to match human light-gathering power! ☆

I grow daily to honor facts more and more, theory less and less.

Thomas Carlyle

Scottish historian/philosopher (1795-1881)

National Council Update

Cathy Hall
Kingston Centre

The February national council meeting was held in Toronto at the Royal Ontario Museum. There were observers at the meeting from a number of centres. Observers are always welcome at these meetings, and encouraged to participate. Observers do not have a vote, but they can speak up on any issues they are concerned with!

Dr. Doug Hube, National President, mentioned various news items. He congratulated Terence Dickinson on being awarded the Order of Canada for his contributions to astronomy and education in Canada. Dr. Alan Batten's request for a telescope to send to Vietnam has come to fruition, and the equipment is on its way.

The secretary's report, by Randall Brooks, was extensive. The Ontario Science Centre has announced a special educational program for grades six to eight centred around studies of Mars. The Royal Society of Canada has advertised for nominations for the MacNeil Medal, awarded for contributions to science. The Herzberg Institute of Astrophysics is planning to publish the results of a radio astronomy workshop. The University of Maryland will be holding a conference on astronomy education, and invites participants. Amateur astronomers in Algeria have requested a handbook and newsletter exchange with the RASC. Approval was given to exchange publications for one year.

Closer to home, the Quebec Centre has requested an examination of its by-laws by the constitution committee. For those wishing our by-laws in French, a translation has been done by Raymond Auclair. Revised pages for the RASC manual are now available.

On an observational note, Finest NGC Certificates were awarded to Randy Pakan (Edmonton), and Walter MacDonald (Kingston) and a Messier Certificate was awarded to Cathy Hall (Kingston).

Peter Broughton, talked about an article by Peter Jedicke in the *London Free Press*. He encouraged all members to continue to submit clippings, photographs, and memorabilia to the RASC archives.

Rajiv Gupta, presented the finance committee report. A motion was passed to invest the society's funds in fixed income term deposits and GIC's with a maximum fixed term of three years. A revised travel policy was passed, which allows for various percentages of travel and

accommodation reimbursement for elected, appointed, and other voting members of the national council. This is to encourage wider participation and attendance at council meetings. A budget for 1995 was approved.

Items in the financial notes included an increase in the executive secretary's salary and RRSP contribution, and funds approved for the production of new RASC pins. There was a transfer of \$7,000 from the general account to the Centennial Fund. At the end of 1995, the Centennial Fund will be closed out, with any balance transferred to the Endowment Fund. This fund has, in the past, been used for such items as special centre projects. These projects will now be accommodated by other funds. The long range planning committee was asked to review the historical use of our various funds.

The librarian, Walter MacDonald, mentioned that the computerized inventory of the national library is being updated to include periodicals and should be available in time for the GA.

The *Journal* editor, David Turner, sent a report in his absence. He feels that greater flexibility is needed in the society, and encourages greater involvement by the members in the society's publications.

The *BULLETIN* editor, Pat Kelly, asked, in his absence, for reports from centres which had not already sent in material for the society's annual report. Pat also appreciates photographs!

The handbook editor, Roy Bishop, sent a report detailing estimated costs and press run figures for the coming year, compared to previous years. The 1995 press run has been decreased in order to avoid as many surplus copies as last year. It is estimated that paper costs will be going up in 1996.

Leo Enright, the Beginners Observing Guide editor, reported that sales of the guide were going well. Flyers are being done up for planetariums, and a bulk order is being arranged with Scouts Canada. Centres are encouraged to have the books available for sale at their Astronomy Day exhibits.

A pamphlet to promote the society's various publications has been prepared by the publications committee, and will be distributed with the Observer's Handbook.

The awards committee were pleased to announce the following awards: Chant Medal: Paul Boltwood (Ottawa); Simon Newcomb Award: Michael Watson (unattached) Service Award Medal: Ron Gasbarini (Niagara) and Patrick Kelly (Halifax).

A number of motions were presented by the constitution committee. Among those passed was the creation of a temporary membership category, which allows centres greater flexibility

in the case of members joining part of the way through their very first year.

The historical committee has been having discussions with some of the professional astronomers in Canada, and will be making some motions at the GA with regard to a joint RASC/CASCA committee for historical work.

Ruth Lewis (Calgary) has resigned as chair of the light pollution committee, due to time constraints. A replacement will be forthcoming. Her work has been much appreciated.

The long range planning committee presented a rather dynamic report written by Peter Ceravolo. It commented on the nature of the society, its evolution, and the important role of a unifying publication in the society's long term goals. Although somewhat controversial, it is hoped that the report will serve as a useful means of encouraging discussion.

The publication revitalization committee presented a detailed report on the society's proposed new publication, *Astronomy Canada*. This publication would replace both the *BULLETIN* and the *Journal*, and better serve the needs of our membership. A budget of \$7,000, for the production and distribution of the prototype issue, was approved. The prototype issue will be distributed to the membership as a regular mailing, in lieu of a future issue of the *BULLETIN*. Approval was given to the committee to negotiate a contract with a publications professional to act as the first editor of *Astronomy Canada*, not to exceed \$20,000 per year, with commencement of the contract subject to approval to proceed with the new publication.

The Windsor Centre, represented by John Hurley, handed out registration packages for the coming General Assembly.

The Kingston Centre, via spokesman Leo Enright, distributed information packages for the 1997 General Assembly bid. Enclosed were invitational letters from the premier of Ontario and the mayor of Kingston, and information on the tentative schedule of events.

The 1996 RASC Observing Calendar was discussed, and funds of \$9,000 approved for production and distribution. The Vancouver Centre continues to produce an excellent product, with the 1996 version to be produced partially in colour.

See you at the next national council meeting—at the General Assembly in Windsor! ☺

You give a little push and bound through the air and come down and push off again. It's a very pleasant feeling to go loping across the surface. [Describing weightlessness during a moon walk.]

Commander Edgar G. Mitchell, Jr.
American astronaut (1971)

A Planetary Periodic Table

Dr. C. Musès

The Bode-Titius Law*, so remarkably accurate through Jupiter, and then increasingly wide of the mark, was shown by the author to consist of three separate but related paradigms, with Earth and Saturn at the overlap points. These facts were published in English, under the auspices of the National Research Council of Italy, in 1965 in *La Ricerca Scientifica*, Vol. 5, Series 2, Part 1, pp 193-204. On pages 200-201, the three Bode Law constituents were given and the deeper relation of the planetary distances with the zeros of the zeroth and first order Bessel functions explained. What follows is an update of that material.

The Bode-Titius Law is usually stated as $4+3 \times 2^n$, but even if we allow $n=0$, yielding $4+3 \times 1=7$ we arrive at the distance for Venus, and not at Mercury. The distance to Mercury is usually stated to be $4+3 \times 0$ without realizing that zero is no longer any finite power of two. Hence, already the ordinary Bode's Law (BL) does not apply to Mercury.

Actually, to include Mercury we need the law $a \approx 4+3n$ where $n=0,1,2,\dots$. However, since the only requirement is that $4+3n$ remain a positive distance from the Sun, we see that there is room for just one lesser and viable value, namely $n=-1$, giving $a=4+3 \times (-1)=1$. So, there is room for just one infra-Mercurial planet, which we will call Vulcan, because Leverrier was sure he had observed it and so named it.

We now have BL I: $a \approx 3n+4$; $-1 \leq n \leq 2$ for the planets Mercury, through Earth, predicting one infra-Mercurial body. Then BL II is $a \approx 3(2^n)+4$; $0 \leq n \leq 4$ for the planets Earth through Jupiter, also including the orbit of Ceres as the major body between Mars and Jupiter. Similarly, BL III is $a \approx 3n(2^s)+4K$; $K=m(1+\cos \pi m)-s^2$; $m=2^s$; $s=0.5(n-1)$ or $0.5(n-2)$ as n is odd or even, with $1 \leq n \leq 5$ from Saturn on, showing one transplutonian body.

Though there is an intrinsic lower limit for n in BL I, there is no such upper limit in BL III, so we must look beyond the Bode-Titius Law. The answer lies in the pair of often physically applicable orthogonal functions which can, like cosine and sine, be used for Fourier-like representations, namely the Bessel functions of zeroth and first order, usually designated J_0 and J_1 . Here we shall be concerned with zeros of each of these, the n th zeros being respectively $J_{0,n}$ and $J_{1,n}$. The results are most easily exhibited in the following tables, the unit being 0.1 AU. Brief commentaries follow each table.

Table 1

The Three Forms of the Bode Titius Law

BTL I:	$3n + 4$	$-1 \leq n \leq 2$
BTL II:	$3(2^n) + 4$	$0 \leq n \leq 4$
BTL III:	$3n(2^s) + 4K$	$0 \leq n \leq 4$

$$K = m(1 + \cos \pi m) - s^2$$

$$m = 2^s; s = 0.5(n-1) \text{ or } 0.5(n-2)$$

as n is odd or even.

n	s	m	K
1	0	1	0
2	0	1	0
3	1	2	3
4	1	2	3
5	2	4	4

Commentary on Table 1

The upper limit of $n=5$ for BTL III is gained through the closed series of the zeros for J_0 and J_1 , the zeroth and first order Bessel functions as shown in Table 3. We first have three zeros each for J_0 and J_1 (i.e. solutions of $J_0(x)=0$ and $J_1(x)=0$ where x is the mean distance from the Sun, given in units of 0.1 AU; then two zeros each, then one zero each. That is, the number of values is $(3+3)+(2+2)+(1+1)$, whereupon the series closes since $0+0$ adds no more terms, thus resulting in twelve values in all for the stable planetary orbits of our solar system. It is these same Bessel functions that play the primary role in determining the pattern of bright and dark bands in the diffraction of light.

Table 2

The Updated Form of the Bode-Titius Law of Mean Planetary Distance (a) from the Sun

Planets	BTL I		BTL II		BTL III	
	n	a_i	n	a_i	n	a_i
1. Vulcan	-1	1	-	-	-	-
2. Mercury	0	4	-	-	-	-
3. Venus	1	7	0	7	-	-
4. Earth	2	10	1	10	-	-
5. Mars	-	-	2	16	-	-
6. Ceres	-	-	3	28	-	-
7. Jupiter	-	-	4	52	-	-
8. Saturn	-	-	-	-	1	96
9. Uranus	-	-	-	-	2	192
10. Neptune	-	-	-	-	3	300
11. Pluto	-	-	-	-	4	396
12. Pan*	-	-	-	-	5	496

Table 3

The Planetary Periodic Table

Planet	k	r in $J_{k,r}$	a_r	a_p	a_i
1. Vulcan	0	1	2.40483	-	1
2. Mercury	1	1	3.83171	3.87099	4
3. Venus	1	2	7.01559	7.23332	7
4. Earth	1	3	10.17347	10.00000	10
5. Mars	0	5	14.93092	15.23688	16
6. Ceres	0	9	27.49348	27.68	28
7. Jupiter	0	17	52.62405	52.02833	52
8. Saturn	1	30	95.02923	95.38762	96
9. Uranus	1	61	192.42060	191.91391	192
10. Neptune	0	96	300.80791	300.61069	300
11. Pluto	0	126	395.05559	395.29402	396
12. Pan*	1	157	494.01469	-	496

a_r = value of r th zero

a_p = observationally derived value of average distance from Sun

a_i = value from improved Bode-Titius Law

* tentatively named because its orbit would encompass all the others

Commentary on Table 2

For BTL III, the range is $1 \leq n \leq 5$, there being a cutoff after $n=5$ because our sun's gravitational field cannot support a stable orbit for a body whose aphelion distance exceeds about 58 AU. As mentioned before and shown in the table, the mathematical basis of all three forms of the Bode-Titius Law is to be found in the zeros of the first and zeroth order Bessel function, also known as the cylindrical wave functions. That means physically that stable orbits or "gravitational grooves" are like wave interference rings, the waves in question being standing gravitational waves. Travelling gravitational waves were first postulated by Paul Gerber, who in 1898 proved that gravitational waves travel at the speed of light. He also deduced the equation for Mercury's perihelion shift seventeen years before Einstein announced the same equation. Gerber's work appeared in the *Zeitschrift für Physik* in 1898, with an amplified version in 1902.

Commentary on Table 3

The k , r , and a values are determined by the fact that for them $|a_p - a_r|$ is a minimum for the given a_p values. In the case of Vulcan, the k , r , and hence a_r values stem from the fact that only a single zero for J_k exists which is less than $J_{1,1}$; namely $J_{0,1} = 2.40483$. We now have a self-closing ring of k -values from Mercury to Pan and around to Vulcan: (1,1,1), (0,0,0), (1,1), (0,0), (1), (0), together with the related and substantiating fact that the sum of all the r values for $k=0$ equal the sum of all the r values for $k=1$, the total, in each case, being 254,

i.e. $1+5+9+17+96+126 = 1+2+3+30+61+157 = 254$.

Now all the r values for $k=0$ are fixed by the nature of the Bessel function and by observation. Also, all of the r values for $k=1$ except the last are likewise fixed. Hence, the summation condition determines that $r=157$ for the stable transplutonian orbit.

Table 3 shows twelve major stable orbits in our solar system. It is interesting that successive r -differences for all orbits from Saturn outward are almost equal: 31, 30 and 31 respectively. This is a consequence of BTL III, and all forms of the Bode-Titius Law predict the r -values for the governing cylindrical wave functions of stable planetary orbits.

In conclusion, from the "planetary periodic table" two major predictions are forthcoming:

- 1) an infra-Mercurial body at a mean distance of about 0.24 AU from the Sun, with a period of about 43 days;
- 2) a transplutonian body at a mean distance of about 49.5 AU with a period of about 348 years. ☼

Musical Stars

Bruce McCurdy
Edmonton Centre
reprinted from *Stardust*

Astronomers have a natural appreciation of beauty, and it follows that many of us are also music lovers. My personal tastes tend towards some contemporary popular music. Through this medium many modern poets interpret life, the universe and everything else (as Douglas Adams would say). Having paid increasing attention to the lyrics in recent years, my ear has caught numerous astronomical references.

Of course, myriad songs bear at least one allusion to the Sun, Moon or stars. A few tunes carry a space motif, such as David Bowie's *Space Oddity* and the Rolling Stones' *2000 Light-Years From Home* or The Police's *Walking on the Moon*. An occasional song bears a central astronomical theme.

The Moody Blues, English pioneers of the classic rock movement, opened their seminal 1967 LP *Days of Future Passed* with this spoken verse by songwriter Justin Hayward in *The Day Begins*:

*Cold hearted orb that rules the night
removes the colours from our sight
Red is grey and yellow white
But we decide which is right
and which is an illusion?
Pinprick holes in a colourless sky
let inspired figures of light pass by
The mighty light of ten thousand suns
challenges infinity and is soon gone
Nighttime, to some a brief interlude
to others the fear of solitude
Brave Helios, wake up your steeds
bring the warmth the countryside needs.*

Any discussion of musical astronomy must give a nod to the graybeards of acoustic psychedelia, England's Pink Floyd. Floyd's interest in things astronomical was evident in the first track of their first album, *The Piper at the Gates of Dawn* (1967). *Astronomy Dominé* (*Astronomy Rules!*), with which they still open every concert, includes the following lines written by original group leader Syd Barrett:

*Jupiter and Saturn, Oberon, Miranda, and Titania
Neptune, Titan, stars all brighten*

In 1973, a maturing Floyd went supernova with *Dark Side of the Moon*. Roger Waters closed the final song, *Eclipse*, with this indelible image that neatly sums up modern chaos theory:

*Everything under the Sun is in tune
but the Sun is eclipsed by the Moon*

Astronomical analogies carried over to Pink Floyd's next album, *Wish You Were Here* (1975). The centrepiece, nine-part *Shine On, You Crazy Diamond*, was dedicated to Barrett (who had visited the recording studio on a day pass from the asylum!):

*Remember when you were young,
you shone like the sun
Shine on, you crazy diamond
Now there's a look in your eyes
like black holes in the skies
Shine on, you crazy diamond.*

*You reached for the secret too soon,
you tried for the moon
Shine on, you crazy diamond
Threatened by shadows at night,
and exposed in the light
Shine on, you crazy diamond.*

The Moon has long been at one focus of artists both visual and aural. Irish "new age" luminary Enya was obviously doing some lunar observing while researching 1991's *Shepherd Moons*, proving in the process that Latin is alive and well and living on the Moon. In *Afer Ventus*, she sings:

*Mare Nubium. Umbriel.
Mare Imbrium. Ariel.
Et itur ad astra.
Mare Undarum. Io. Vela.*

Canada's Cowboy Junkies opened their 1993 blues album, *Pale Sun, Crescent Moon*, with Michael Timmin's mournful *Crescent Moon*:

*Reach a hand to the crescent moon
grab hold of the hollow.
If she sits in the palm of the left
that moon will be fuller tomorrow.
If she sits in the palm of the right
that moon is on the wane
and the love of the one who shares your bed
will be doing just the same.*

*Raise your eyes to a moonless sky
and try to wish upon a rising star.
Search all you want for her blessing
but you won't find her sparkling there.
Now cast your eyes to a part of the sky
where nothing but darkness unfolds
and watch as all around you
she reveals the brilliance of secrets untold.*

*Do I reach for you when I know you're on the wane?
Do I sense you when I know you're not around?
Do I search for you when I know you can't be found?
Do I dare speak your name?*

When composing *Moon Cradle* for her 1989 album *Parallel Dreams*, Canadian singer, songwriter and Celtic harpist Loreena McKennitt was clearly contemplating lunar libration!

*The moon-cradle's rocking and rolling
where a cloud and a cloud go by
The moon-cradle's rocking and rolling
the moon-cradle out in the sky.*

The night sky has long been used as a metaphor by the romantically inclined. In her 1993 album, *The Red Shoes*, England's inventive, theatrical Kate Bush performed the song *Constellation of the Heart*:

*We take all the telescopes
and we turn them inside out
and we point them away from the big sky.
Put your eye right up to the glass, now
and here we'll find the constellation of the heart.*

Enya, the ethereal empress of elevator music, sings from *Exile* in 1988's *Watermark*:

*My light shall be the moon and my path, the ocean
my guide, the morning star as I sail home to you.*

The Indigo Girls, paid homage to Galileo in their 1992 recording *Rites of Passage*:

*Galileo's head was on the block
the crime was looking up the truth.
As the bombshells of my daily fears explode
I try to trace them to my youth.*

*How long till my soul gets it right?
Can any human being ever reach that kind of light?
I call on the resting soul of Galileo
king of night vision, king of insight.*

On the darker side, the progressive English group Genesis opened their landmark 1972 album *Foxtrot* with *Watcher of the Skies*. Lyrist/singer Peter Gabriel cast a despairing look at a withering planet:

*Watcher of the skies, watcher of all
His is a world alone, no world is his own
He whom life can no longer surprise
raises his eyes, beholds a planet unknown.*

*Creatures shaped this planet's soil
Now their reign has come to end
Has life again destroyed life?
Do they play elsewhere?
Do they know more than their childhood games?
Maybe now the lizard's shedded his tail
This is the end of man's long union with earth.*

*Sadly now your thoughts turn to the stars
Where we have gone you know you can never go
Watcher of the skies, watcher of all
This is your fate alone, this fate is your own.*

Laurie Anderson, the avant-garde multimedia performer from New York City, has numerous astronomical references in her music. In *Kokoku*, from her 1984 album *Mister Heartbreak*, Anderson surveyed Earth from an even greater distance:

*And on a very distant star.
slimy creatures scan the stars
They've got plates for hands
and telescopes for eyes
and they say: "Look Down there!
A haunted planet spinning 'round".
They say: "Watch it move. Watch it shake.
Watch it turn. And shake."
And we say: "Watch us move. Watch us shake.
We're so pretty."*

Looking out from the inside, rising American star Paula Cole would rather be anywhere but Earth as the disaffected *Saturn Girl* on *Harbinger* (1994):

*Far away to an infinite world I escape
I'm clear and calm, I'm unafraid
Sunless days, in my sheltered Milky Way
In Saturn's rings I feel no pain.*

*I can't explain why
I don't belong to the same world
I don't fit in, and I will not stay
I want to fly, oh I long for my violet skies
my astral nights, my piece of mind.*

*Lost in another world, oh Saturn, Saturn girl
I'd rather be lost in my empyrean world
than be down on earth.*

*In my heart, in my head,
the Saturn girl has always bled
oh you're not from this world, Saturn girl.*

Sounds like she would rather be observing. I know exactly how she feels. Oh and as a service to my fellow astro-linguists who may be as perplexed as I was:

Empyrean - 1. The highest heaven; in ancient cosmology, the first sphere of the pure element of fire [root word pyre?]; 2. a. The visible heavens or firmament; b. The whole extent of cosmic space.

Who says music is not educational?

There are many songs which seem to hold references to observing. Canada's "Queen of Quirk", Jane Siberry, perhaps unintentionally captured the essence of astrophotography in *The Beginning of Time* from her 1993 album *When I Was a Boy*:

*We were waiting waiting waiting
waiting in the darkness.*

Laurie Anderson described a superb observing session in *My Eyes* from *Strange Angles* (1989):

*And then kerjillions of stars start to shine
and icy comets go whizzing by
and everything's shaking with a strange delight
and this is it: the enormous night
And ooo my eyes, they're looking all around
and ooo, my feet, they've left the ground.*

The last word has to go to Pink Floyd, whose third leader, David Gilmour, may also have been describing an unforgettable observing session when penning *Learning to Fly* from 1987's *A Momentary Lapse of Reason*:

*There's no sensation to compare to this
Suspended animation, state of bliss
Can't keep my eyes from the circling skies
Tongue-tied and twisted,
just an earthbound misfit, I.*

I am sure some of you readers who hung in to the bitter end have your own favourites which were not cited here. Let us talk—on the understanding that I retain distribution rights to the cassette! ☺

Eclipse Damage: A Burning Issue

Alister Ling
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reprinted from *Stardust*

Like a bad dream, the question always returns: Why is it dangerous to look at an eclipse when the Sun is 98% covered? After all, it is hardly bright outside.

Most of you reading this already know the answer; it is the difference between intensity and illumination. Until recently I have always had a hard time explaining this in simple terms, even to adults. Then, one day, I was faced with conveying the concept on a children's science TV show, in less than two minutes of show time... in French! Think. Think. Think.

Imagine a stove element on high. You can feel the heat on your face at a distance and you know it is too dangerous to touch. Covering half of it does not change the situation. However, cover most of it and what happens? You cannot feel the heat any more, yet there is a crescent-shaped sliver of red showing. How odd, the mind thinks. I have got to look at this more closely. Why can I not feel the heat? Let me touch it and see. BURN! With eclipses, however, there is no pain, just permanently damaged eyesight.

The advantage of the stove-top analogy is manyfold. Not only does it demonstrate to a five year old, it contains the real impact of burning. One can, and should, emphasize that while normal burns heal, eclipse burns cannot be repaired. Furthermore, the analogy aptly explains how the danger (and damage) of looking at the Sun on a normal day is greater—there are no magical ray-beams that come from eclipses. The difference is that normally you cannot look at the Sun, but an eclipse tricks you into lowering your defences. Curiosity kills the cat. ☺