NOVA NOTES

Halifax Centre

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1990 Halifax Centre Executive

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Notice of Meetings

Date: **Friday, November 16th: 8:00 P.M.** for the main speaker
Place: Nova Scotia Museum, Summer Street, Halifax. Access from the side entrance. Meeting to be held in the lower theatre.
Topic: The Society's newly elected president, **Damien LeMay** will be in town! His talk is entitled: *Astronomy as a Science and Hobby.*

Date: **Friday, December 14th: 8:00 P.M.** for the main speaker
Place: Nova Scotia Museum, Summer Street, Halifax. Access from the side entrance. Meeting to be held in the lower theatre.
Topic: **Dr. Gary Welsh** from the Astronomy Department at Saint Mary's University will be giving a talk on the subject of S0 galaxies.

Date: **Friday, January 18th: 8:00 P.M.** for the main speaker
Place: Nova Scotia Museum, Summer Street, Halifax. Access from the side entrance. Meeting to be held in the lower theatre.
Topic: **Greg Roberts**, a student at the Technical University of Nova Scotia will be talking about the work that he has been doing with computers and digitizing of NASA images. His work has received local and national television coverage.

Halifax Planetarium Public Shows

At the following shows will be on the topic of "The Night Sky".

Thursday, November 22nd : 7:00 P.M.
Thursday, December 6th: 7:00 P.M.
Thursday, December 20th: 7:00 P.M.

The Halifax Planetarium is located in the Dunn Science Building on the campus of Dalhousie University.

Note: The above list is tentative and subject to change.

About the cover:

The cover show the four stamps which were recently released by the British Post office. They commemorate the centennial of the British Astronomical Association and the bicentennial of the founding of the Armagh Observatory. The designs are quite intricate and feature a wide range of graphical representations of astronomically related objects.

Editor's Report

Patrick Kelly

Before beginning the usual ramblings that come off of the top of my head as I write this column, I must apologize for the delay in getting out this issue of NOVA NOTES. It seems that in the university world, every term in which you expect that your work load will drop, the opposite happens! Having said that, we now return you to our regularly scheduled ramblings, which are already in progress...

This summer has been an exceptionally good one as far as the Halifax Centre is concerned. A large number of members participated in the General Assembly in Ottawa which marked the occasion of the Society's centennial. **Joe Yurchesyn** was the Halifax Centre's national representative for this year's G.A. Joe presented a talk at one of the paper sessions on the link between aurora activity and the large scale power failures on Earth. You can read his report on the G.A. elsewhere in this issue.

The Perseid Meteor BBQ and Meteor Watch went well (at least the first part did!) My family arrived at noon and found that we were the only ones there. As a result, we were forced to endure swimming, hiking, exploring trails, discover new wildflowers and all sorts of other nasty "park-type" activities rather than sit around and debate the merits of using damaged nebular filters for replacement checker pieces, etc! However, we had quite a few members show up around suppertime and soon had all sorts of various culinary delights cooking away. Meanwhile, the beautifully warm, clear sunny day slowly changed into a beautifully warm overcast evening, with the result that no meteors were seen other than a 1964 four-door model that I noticed in the parking lot on my way home!

Next came NOVA EAST. All I can say is that each one gets better than the last. Probably the most interesting comment heard was made by **Darrin Parker**: "Children, please don't stand on my telescope!". As **Doug Pitcairn's** report will appear in the December issue of the National Newsletter, I have reprinted the anonymous (Dave Driscoll?) write up that appeared in *Night News*, the Saint John club's newsletter. Trying to decide the dates for next year's event was tricky, due to the timing of the New Moon early in August. However, it was decided that next year's event will take place over the Labour Day long weekend. Hopefully the extra day will allow people from further away to attend and will also give us a chance at more clear nights.

You may recall that as part of the Centennial we were asking members to donate money so that we could start up a scholarship fund. The response so far has been quite encouraging and we

would like to thank all of those members who have made donations. We hope to collect the names of all of the donors and list them in a future issue in recognition of their generosity. It is not too late to contribute! If you would like more information please contact our treasurer.

Speaking of treasurer's, last year's financial report is a bit early this year. You will probably find the financial statement, located in the centerfold, easiest to read if you remove them.

Nat's financial report notes that we must now supply our own paper for NOVA NOTES. The figure that he quoted is for all of the paper for the upcoming year. The Nova Scotia Museum is still providing the cover stock and the printing at no cost to us. In an effort to make NOVA NOTES more environmentally friendly, the paper that you are currently reading is recycled paper and contains a minimum 5% "post-consumer fibre", meaning paper that has been collected at offices, etc, to be recycled. I'll bet you never even noticed! Also early this year are the president's report, handbook report, etc. I did allow for one "fat" issue for the upcoming year, I just hadn't expected it to come so soon.

Also, over the summer, our centre got another voice on the National Council as your truly was appointed as the new editor of the National Newsletter/Bulletin. I went to Toronto in September on a combined trip to attend the September National Council meeting as well as to meet with Ian MacGregor (whose position I was assuming) as well as the people at the University of Toronto Press. I will be taking over full production with the February issue, and I think you will find some major format changes beginning with that issue. In addition, the National Council agreed to a recommendation from the publications committee that the Annual Report no longer be published in its current form. Instead, it will become part of the April issue of the NN/B. For the upcoming year, I plan to stay on as editor of NOVA NOTES as well, until I see how much time my new position will require. My only regret, is the same as the one I had when I took over as editor of NOVA NOTES... I don't get to be surprised by finding a new unread copy in the mail!

One of our "executive" members has returned to the Canadian West as a result of their spouse being transferred. **Phyllis Kennedy** left in late summer to return to the prairies. As "cookie chairman", she always made sure that we had lots of good munchies after meetings. Her sense of humour at Beaverbank always made for interesting observing sessions. We wish her the best and hope that she gets to finish her Messier list soon! Also on the move is Digby member **Bill Thurlow**. He is moving (along with "Big Red") to Summerside, P.E.I. It is probably safe to say that astronomy on the island will not be the same....

Another item worth mentioning is that members may recall

that **Nat Cohen** gave a talk on his trip to Israel at the June meeting. He gave this talk despite having felt "under the weather" all day, and some may recall that he had to get some water to drink halfway through his talk. Luckily, he went to the hospital right after the meeting and rumor has it then when someone there asked if he could help them, he replied "I believe I'm having a heart attack, could you have someone look at me." Well, after they looked, they didn't let him go until after he underwent a triple bypass operation! I visited him before he was released and he had some rather disparaging remarks about doctors in general and the ones that worked on him specifically! Now that he has all of his valves operating at peak efficiency and has lost quite a bit of weight, he has become considerably more animated and energetic (and can now talk for even greater lengths than before on the advantages of digital setting circles)!

Now for some news from some of the other local astronomy clubs. The Nova Central Astronomy Club, in Truro, has started their new year with a healthy increase in membership. Elections were held at the September meeting with **John Jarvo** being elected as president. In Sydney, the Cape Breton Astronomical Society has started a newsletter. They also put on the astronomy section of an educational summer camp at which our own **Joe Yurchesyn** had his 17.5" scope there for the students to look through. Joe also gave his talk on aurora and power blackouts at their September meeting. Meanwhile, across the Bay of Fundy, the Saint John Astronomical Society's October talk was on meteors and their November one will be about an ongoing astronomy project at Mount Allison University.

Membership renewals are coming in at a record rate, thanks in part to our new computerized billing system. At the time of writing, we had a paid membership of over 125, plus nine associate members! Members who had not renewed at the time of mailing will find a second renewal notice and a return envelope enclosed with this issue. Please renew as soon as possible.

I received a sample copy of a publication which some members may be interested in. It is a new bimonthly newsletter devoted entirely to comets. Each issue contains one 8.5 x 11 page devoted to each comet currently visible. The page includes the comet's name and designation, orbital elements (for those with computer programs such as *Voyager*), a table of positions , finder charts and notes on the comet. What makes this publication of interest is that it includes **all** comets currently in the sky, including the 18th and 19th magnitude ones. The subscription rate for Canada is $US 24 per year. Interested members can write to Edward A. Locke, c/o Tennessee Comet Trails, P.O. Box 1883, Columbia, Tennessee 38402-1883.

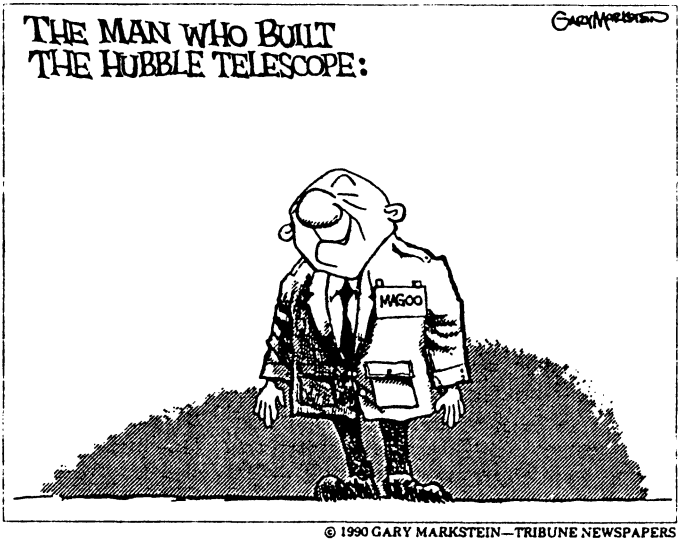
The following list was generated as a result of the

conversation at one of the tables at the Hamilton Centre's annual banquet. It gives some possible reasons for the sudden disappearance of Jupiter's South Equatorial Band:

- + Carl Sagan is using it for a headband.
- + Jupiter had to sell it to pay for the G.S.T.
- + It was mailed by Canada Post
- + It's on Mikhail Gorbachev's forehead.
- + Roseanne Barr ate it.
- + It's buried with Jimmy Hoffa.
- + Exxon finally cleaned it up.
- + Elvis is wearing it.
- + It's hiding in the Vatican Embassy.
- + Peter Pocklington traded it to L.A.

Just last week I finally got a chance to fulfil a promise that I had made during the summer to my oldest son. He had wanted to go out to Beaverbank for an observing session and most importantly, to see some meteors. According to *The Observer's Handbook* , it was the peak of the Orionid meteor shower. After a night of observing, however, I think that the handbook requires the following disclaimer:

Hourly rates listed here are solely for theoretical purposes. The listed rates assume that you do not wish to actually observe a meteor shower. If observing a meteor shower, divide the given rates by two if observing alone; by three if observing in a group; and by four if you have brought someone observing specifically to see meteors. Ω



President's Report
Mary Lou Whitehorne

First, let me say what a pleasure (and honour) it is for me to be able to serve as president of our centre. This is largely due to the fine group of people who make up the centre's executive and who do so much of the work. We all owe them a vote of thanks.

The past year has been a very successful one for the Halifax Centre, both financially and activity-wise. Several members continue to bring astronomy to the public through their planetarium shows. Some give talks and slide shows to school classes and community groups. A couple of us have even appeared on local cable TV to help promote public awareness of astronomy and the R.A.S.C. And, of course, Doug Pitcairn, with his newspaper column and continuing education courses, does the Society a great favour.

Along with the increasing number of members in our centre over the past few years, this time period has seen the growth of several "satellite" clubs: Hebron, Truro, Antigonish, Sydney, Summerside and Saint John. We try to foster the growth of these groups with some financial support, occasionally providing speakers for their meetings, with correspondence, and by getting together with their members at NOVA EAST each year. These clubs are an excellent way of extending our reach to out-of-town members and to the general public. One idea to further strengthen our ties with these clubs is to hold an "astronomy weekend" once a year where people can get together, exchange ideas and report on their activities. Such a gathering can be very beneficial to everyone involved.

The Halifax Centre is fortunate in having an excellent library for the use of its members. For those of you who cannot make it to meetings, our librarian will mail books to any member who request it. All we ask is that you return the books on time! We also have a couple of telescopes available for use by members who have been "checked out" on their use and care. Arrangements can be made through the Observing Chairman. The Centre has also set up a lending library of slide sets. These are made available to Nova Scotia science teachers and to Centre members who find themselves giving talks from time to time. Just this past year we have purchased a slide projector for use by members who give talks but do not have a projector of their own. So far, the projector and the slides have seen quite a bit of use.

A long term goal of the centre is to establish a science fair ward for senior high school students. We made some small progress in this direction with a few donations which the Centre has matched in amount. We hope to build up our fund to one

thousand dollars through donations to the Centennial Fund.

The weather has not been very favorable of late but there have been a few good observing sessions here and there... notably a couple of superb nights in Fundy Park at NOVA EAST. This year's event was the most well attended yet with very successful public observing programs. Many thanks are due to the people (you know who you are!) who worked so hard to pull it all together. Many of our members do their observing in a solitary mode and I want to remind them of our Messier Challenge, Mini-Messier Hunt and the Double Star Observing Project. Details can be obtained from the Observing Chairman.

The R.A.S.C. has adopted a new National Constitution which should serve the society well for many years. As a result of this, the centre has established a constitution committee which is working on drafting a new centre constitution to bring us in line with the national body.

The Nova Scotia Museum has also made a change which affects us directly in the bank book. We now have to provide our own paper for the printing of NOVA NOTES; a service formerly provided free of charge. It's a good thing we have such an able and conscientious treasurer for the past few years, enabling us to meet the increased cost with a minimum of pain!

Over the past year, the centre has been fortunate in being able to obtain a variety of excellent speakers for our meetings. The aim has been to try and cover as wide a range of topics and levels of interest in the subject of astronomy. I feel that we have been quite successful with a good mix of topics and "degrees of difficulty" in the talks given.

In the upcoming year we should see a speaker exchange take place between Halifax and Winnipeg. National Office provides some funding for these exchanges and our application was favorably received. As many of you know, I am involved in a joint observing project with Chris Brown of the Winnipeg Centre. Plans call for me to give a talk in Winnipeg next May with Chris coming to Halifax to give a talk in the fall of 1991.

We have a great group of people here in the Halifax Centre. There are lots of ways to indulge your interests in astronomy, not the least of these being active participation in your centre. If you have ideas or suggestions, please bring them to any member of the executive. Remember that our executive meetings take place immediately prior to the regular meetings and are always open to members. Maybe you have a great idea for a talk, or maybe you have a great talk you would like to give. Write a book review or an article for NOVA NOTES. Perhaps you would like to be involved in the planetarium. Why not? One of the things I like best about the R.A.S.C. is that the more you put into it, the more you get out of it! Quo ducit Urania! Ω

Report on the 1990 G.A.

Joe Yurchesyn

This year's General Assembly (G.A.) was held in Ottawa at Carlton University. Since I was the Halifax member whose transportation to the GA was funded by the Centre, it has fallen to me to submit a report to Nova Notes, even though I was not the official National Representative.

Halifax Centre was the third largest attending centre, with 9 delegates. We were outperformed by Ottawa:59, Toronto:19, and Unattached:12 (but they are not a centre).

Friday featured the National Council meeting. Later that day, the scheduled East-West baseball game was cancelled, due to wet field conditions. This was followed up by a member's slide show, both Murphy type and otherwise. Presentations were given by Halifax members Dan Falk and Dan MacLennan. Awards were given out, for the best and the worst. Dan MacLennan's photo observations of the sun during the summer of 1989 managed to win him a third place finish - good going Dan! At this gathering, I announced that since two Halifax members and no western members showed up to play ball prior to cancellation of the game, that the East claimed victory in the first annual East-West baseball game by default. This resulted in a re-scheduled time for the game!

Since it was also the 100th anniversary of the R.A.S.C., a symposium of five speakers entitled "You and the Universe" started off Saturday's proceedings. The distinguished speakers included:

Lydia Dotto: .....Planet Earth as a Life Support System
Terrance Dickenson:....Naturalists of the Night
Richard Jarrell:.....The Value of Astronomy for a Civilized Society
René Racine:.....Astronomical Research - Pain and Bliss

Dinner on this day was followed by the Helen Sawyer Hogg lecture. This year's the speaker was Joseph Veverka whose talk was entitled: Exploration of the Solar System - Voyager and Beyond. The Wine and Cheese concluded the day.

Sunday was primarily devoted to paper sessions (sixteen presentations in all). It was at this point, that I worked for my grant. Acceptance of the travel funding required I provide a presentation. My paper was entitled "Aurora and the Power System". The most memorable of all the presentations was one from Winnipeg about the observations they were making with the Santa Barbara Instrument Group's CCD camera. They showed

several images, including one of Pluto taken with a five minute exposure using a C90.

Other events held that Sunday included the group photo, the baseball game (which was won by the West, although the exact score escapes me) and a barbecue which had to be moved indoors due to weather - it was sunny. If you think the weather changes fast in the Maritimes - think again! The evening was free for viewing of the Canada Day activities. Randall and I ended this day with a visit to an Ottawa member's personal observatory.

Monday began with a half day tour of the Museum of Civilization in Hull. The afternoon was the Annual Meeting. It began with the our new National President, Damien LeMay, taking on his new position. The presentation of committee reports was uneventful, but considerable discussion surrounded the motion concerning the increase in fees. The Society now has a sizable annual deficit, and as a result membership fees would have to be affected. The increase proposed by the Finance Committee was from $25 to $32.

It was justified by comparing the increase in fees over the last 10 years to the consumer price index (CPI). Based on this, it was shown that the proposed $32 fee was still below the escalated 1980 fees. Considerable discussion ensued, with vocal members arguing the extremes (no increase, or an increase to $35); and several compromise motions were discussed and defeated. In the end, fee increases to $32, $20 and $640 resulted. I will keep my thoughts on this subject to myself, but any member wishing more information can consult with any member who attended G.A.

The Annual Meeting was followed by a short National Council meeting. This day ended with the Banquet, held at National Arts Centre. It's a pretty neat building! The presentation of awards was made, and Dan MacLennan won a prize for his exhibit, which consisted of his observations of the sun in 1989. Doug George was also given an award to honour him for his discovery of a comet. Congratulations Doug. The after dinner speaker was Lloyd Higgs, speaking on astronomy in Canada.

Tuesday was a half day tour of the Indian River Solar Observatory, operated by the N.R.C. Unfortunately, the technicians on duty were on their last day, since the federal government has cancelled funding for the facility.

Halifax Centre last hosted a G.A. in 1980. There is a feeling that Halifax should host in 1993 (Vancouver has 1991, and Calgary has 1992), but it now appears that Toronto wishes to offer for 1993. In order to challenge Toronto, a G.A. committee must be formed to do preliminary organization. If any members are interested in participating, please feel free to contact anyone on the executive. The G.A. Committee will be independent of the Centre executive. Remember many hands make light work! Ω

Small Amplitude Red Variable Stars

David Fleming

The study of variable stars is a fascinating topic within astronomy, and one in which there is still much to be learned. This past summer, prior to my third year in the physics/mathematics program at Mount Allison University, I received a NSERC grant for the study of small amplitude red variable stars at the University of Toronto. Working under Dr. John Percy in the Department of Astronomy, I selected a program of twenty-one suspected red variables for photoelectric examination. On cloudy nights (of which there were many) I ran previously compiled data from the AAVSO's Photoelectric Photometry division through a period searching program.

Small amplitude red variables are very common naked eye objects in our skies. The vast majority, however, have magnitude variations of less than 0.6 magnitudes, with some possessing amplitudes of under 0.1 mag. This means that strictly visual observations are ineffective. Instead, photoelectric photometry is often used for examination of these variables. At the University of Toronto, a photometer has been connected to the sixteen inch reflecting telescope at the top of Burton Tower, St. George Campus, for just this purpose.

A photometer, quite simply, consists of an adjustable diaphragm, a flip mirror, a filter wheel, a Fabry lens and a photomultiplier or photodiode. The diaphragm cuts down on stray light, which is particularly important if your star belongs to a binary system. The mirror allows for easy viewing of whatever light source (i.e. star) is being registered by the photometer. The lens brings the light to a focus, and the filter wheel can be rotated to allow observation in different components of the electromagnetic spectrum. In my work, a visible light filter was used, but blue, red and infrared are other common types. The photomultiplier converts light intensity to a small electric current, which in turn is registered proportionally as a digital, graphical or scaled readout.

An IBM PC was interfaced to record the digital displays resulting from our photometer. These readings, when averaged over five trials at ten second intervals, indicate the luminosity of the star being monitored. (Actually, they really indicated the sum luminosity of the star **and** background sky, so a "sky reading" was also obtained and subtracted from the "star+sky" value.)

The procedure of differential photometry I used, was based on the relation between brightness and digital readout. Two comparison stars, similar to the suspected variable in position,

magnitude and color were picked for each of the twenty-one stars in the program. Since these comparison stars were selected so as to be constant in brightness, they provided a known scale against which each suspected variable could be judged as it brightened and dimmed throughout the summer.

Physically, the red variables themselves are giant or supergiant stars of spectral type K to M. My study focussed exclusively on giant M-type stars. Red giant variables are stars that have exhausted their hydrogen supply and are located on the "red giant branch" of the Hertzsprung-Russell diagram. Their periods of variation range from a few weeks to months. The Mira variables, a close relative of small amplitude red variables, are further evolved. With most of their helium used, as well as their hydrogen, Miras fall on the "asymptotic giant branch" and generally sport larger amplitudes, longer periods, and more regular variations. The line that separates small amplitude and Mira variables is somewhat arbitrary, but is usually said to occur at an amplitude of 2.5 magnitudes, with the red variables having brightness variations below this amount.

Small amplitude reds have radii of about one hundred solar radii, luminosities of a few hundred times that of the Sun and temperatures in the cool range of 2500 - 3000K. An important question which arises is: What exactly causes these particular stars to vary? As in the case of the well-known Cepheid variables, the gaseous layers of these stars actually pulsate; absorbing energy upon contraction and releasing it with expansion. This "giant engine" explanation, however, cannot possibly account for all of the variation. A larger factor, in fact, is the presence of titanium oxide and other molecules in the atmospheres of these cool giants. Pulsations arising deep within the star propagate outward, creating shock waves which heat the TiO molecules, causing them to dissociate. This corresponds with a brightening phase in the star's appearance. When the TiO recombines, it forms an opaque cloud, dimming the star. The cycle then begins anew.

My program stars this summer were suspected small amplitude reds with generally unknown periods and amplitudes of variation. Despite several long breaks between observations due to cloudy spells, variations, in the form of sine curves can be seen in about a dozen of the stars. Although there are exceptions, most of them display periods in the area of thirty to one hundred days, with amplitudes from under 0.1 mag. to just over 0.6 mag. The summer also provided an excellent opportunity to get the feel of a fairly large and busy astronomy department. I was able to talk to many professors and graduate students, including Dr. Percy and Ian Shelton (of supernova fame). As well, the chance to live in Toronto was nothing to complain about! Thanks go to all who made it possible. Ω

Treasurer's Report

Nat Cohen

Compared to last year, we did not do so well. However, we did not go into "the red", and as long as we remain solvent there is not too much to worry about. Looking on the income side of our balance sheet, we were up very slightly overall, but two items which help our balance are rather disappointing. One is the sale of handbooks, and the other is under miscellaneous; things like mock auctions, sales, etc. Now, we are not meant to be a "money making" outfit, so whilst it is nice to see a large surplus of income over expenses and make everybody feel quite happy, our real purpose is the promotion of an interest in matters pertaining to astronomy for the benefit of all our members. If this uses up most of the yearly income that we collect, so be it. Of course, we do have to ensure that we do not consistently spend more than we collect over even a few years, as this would very rapidly deplete our coffers; but as far as I can see at the present, this is unlikely.

So, let's look at the expense side of the picture. Meetings and the newsletter is up considerably. Some of this can be accounted for by the "goodies" we nosh after the meeting, but the bulk of this is for postage costs for the newsletter. Additionally, we are now required to supply paper for the newsletter, whereas before we got this gratis. It cost us $136 for the first supply of this paper. We spent $502 upgrading our telescope, the philosophy behind this was that by doing so we might encourage members who otherwise could not afford to do it, an opportunity to try their hand at some astrophotography. In any case, the raison d'être for this telescope is that members should avail themselves of its use. We spent a bit more on educational stuff; slides, and a projector, so that when our members go to give a lecture, they do not have to rely on finding one by chance at the venue of their talk. Office administrations costs are up. This is also a "one shot deal" for this year, as is much of the expense listed under miscellaneous.

Therefore, I tend to take a positive view of our financial situation. This is reinforced by the fact that we are increasing our membership, and our meetings are generally well attended, which one has to attribute to their being interesting, not only to our own members, but to the general public, as I have noticed a fair number of them turning up at the last couple of meetings.

As most of you know, I have this tendency to being something of a raconteur. Therefore, in order to dispel any thoughts that some "shmoosing" is being gently applied, the books and accounts are going to be audited. Thus, you may all be assured that the "baksheesh" for Mary's camel ride in the Holy Land was not misappropriated from the Centre's funds! Ω

Royal Astronomical Society of Canada - Halifax Centre
COMPARATIVE INCOME STATEMENT - YEARS ENDING Sept. 30th, 1989 and 1990

	Year ending September 30th		Amount of increase or (decrease) during 1990	Breakdown of the $25 membership fee	Percentage of Membership Fees		Percentage of Total revenue	
	1990	1989			1990	1989	1990	1989
REVENUE:								
Membership Fees	$3,920.00	$3,175.00	$745.00	$25.00	100.00%	100.00%	55.27%	45.24%
Life Members Grant	280.00	280.00	0.00	1.79	7.14	8.82	3.95	3.99
Donations	130.00	151.60	(21.60)	0.83	3.32	4.77	1.83	2.16
Educational Activities	-	-	-	-	-	-	-	-
Interest & Dividends	559.44	402.47	156.97	3.57	14.27	12.68	7.89	5.73
Sales of Handbooks (net)	663.77	1,215.84	(552.07)	4.23	16.93	38.29	9.36	17.32
Advertising	245.00	30.00	215.00	1.56	6.25	0.94	3.45	0.43
General Assembly (inc. grant)	171.65	129.50	42.15	1.09	4.38	4.08	2.42	1.85
Other Grants	1,000.00	1,000.00	0.00	6.38	25.51	31.50	14.10	14.25
Miscellaneous	122.52	633.50	(510.98)	0.78	3.13	19.95	1.73	9.03
Total Revenue	$7,092.38	$7,017.91	$74.47	$45.23	180.93%	221.04%	100.00%	100.00%
EXPENDITURES:								
Fees to National Office	$2,565.00	$1,926.00	$639.00	$16.36	65.43%	60.66%	36.17%	27.44%
Library	120.92	90.42	30.50	0.77	3.08	2.85	1.70	1.29
Meetings & Newsletter	2,176.60	1,792.33	384.27	13.88	55.53	56.45	30.69	25.54
Annual Dinner (net)	(91.68)	102.65	(194.33)	(0.58)	-2.34	3.23	-1.29	1.46
General Assembly (excl. grant)	238.00	259.00	(21.00)	1.52	6.07	8.16	3.36	3.69
Equipment & Supplies	652.80	0.00	652.80	4.16	16.65	-	9.20	-
Office Administration	510.48	73.22	437.26	3.26	13.02	2.31	7.20	1.04
General Expenses & Audit	-	-	-	-	-	-	-	-
Educational Activities	257.35	127.85	129.50	1.64	6.57	4.03	3.63	-
Insurance	-	-	-	-	-	-	-	-
Awards & Donations	125.00	82.50	42.50	0.80	3.19	2.60	1.76	1.18
Operating Expenses - Observatory	-	-	-	-	-	-	-	-
Miscellaneous	313.73	9.88	303.85	2.00	8.00	0.31	4.42	0.14
Total Expenditures	$6,868.20	$4,463.85	$2,404.35	$43.80	175.21%	140.59%	96.84%	6
Surplus or (Deficit)	$224.18	$2,554.06	($2,329.88)	$1.43	5.72%	80.44%	3.16%	3

Royal Astronomical Society of Canada - Halifax Centre
COMPARITIVE BALANCE SHEET - YEARS ENDING Sept. 30th, 1989 and 1990

	Year ending September 30th		Amount of increase or (decrease) during 1990	Breakdown per member for 1990	Percentage of Cash		Percentage of Total Assets	
	1990	1989			1990	1989	1990	1989
ASSETS:								
Cash	$4,482.46	$4,258.28	$224.18	$30.70	100.00%	100.00%	49.97%	53.83%
Est'd Membership Receivable (net)	-	-	-	-	-	-	-	-
Accounts Receivable	-	-	-	-	-	-	-	-
Handbook Inventory	-	-	-	-	-	-	-	-
Merchandise Inventory	329.02	262.76	66.26	2.25	7.34	6.17	3.67	3.32
Prepaid Expenses	-	-	-	-	-	-	-	-
Investments	-	-	-	-	-	-	-	-
Est'd Library	1,998.16	1,882.24	115.92	13.69	44.58	44.20	22.28	23.79
Observatory Equipment	1,909.97	1,407.17	502.80	13.08	42.61	33.05	21.29	17.79
Estimated Miscellaneous	250.00	100.00	150.00	1.71	5.58	2.35	2.79	1.26
Total Assets	$8,969.61	$7,910.45	$1,059.16	$61.44	200.10%	185.77%	100.00%	100.00%
LIABILITIES:								
Estimated Handbook Payable	$284.55	$142.00	$142.55	$1.95	6.35%	3.33%	3.17%	1.80%
Estimated Operating Expenses	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-
Total Liabilities	$284.55	$142.00	$142.55	$1.95	6.35%	3.33%	3.17%	1.80%
CAPITAL:								
Equity	$8,685.06	$7,768.45	$916.61	$59.49	193.76%	182.43%	96.83%	98.20%
Retained Revenue	--	-	-	-	-	-	-	-
Total Capital	$8,685.06	$7,768.45	$916.61	$59.49	193.76%	182.43%	96.83%	98.20%
Total Liabilities and Capital	**$8,969.61**	**$7,910.45**	**$1,059.16**	**$61.44**	**200.10%**	**185.77%**	**100.00%**	**100.00%**

NOVA EAST '90 Report

reprinted from - **Night News** - Saint John Astronomical Society

The fourth annual NOVA EAST astronomy meet took place at Fundy National Park the weekend of August 17th-19th. Astronomers arrived throughout Friday and Saturday, with a couple of arrivals Thursday night. As usual, public observing sessions were held, but unlike in previous years, only a handful of telescopes were used to view a handful of objects. This eliminated the mass exodus of telescopes and astronomers to the public observing site and simplified the logistics of the weekend, making it a more relaxing stay for most of those present. I personally hope this is the start of a new trend.

The first public observing session was held at the administration parking lot on Friday night. There were four telescopes on hand and about two hundred skywatchers showed up for the 5¢ tour. The number of enthusiasts varied according to who was giving the estimate, but based on past years, two hundred seems a likely figure.

Meanwhile, back at the Micmac campsite, a father with his son and daughter stumbled upon those astronomers not at the public show (which was most of us). He got the SEE THE WONDERS OF THE UNIVERSE - TEN TELESCOPES, NO WAITING grand tour. From the comments made - "OOH! AAH! Didn't know my buddy saw stuff like this" - I think another soul may have gotten the astronomy bug. I hope his buddy (an astronomer living in Ontario and not present at NOVA EAST) likes company when he goes observing. Around midnight Friday, the clouds rolled in and the observing creaked to a halt.

Saturday was spent checking out all of the telescopes and mounts, hiking, swimming and goofing off, depending on one's inclination. Saturday was also spent eating. About one hundred people (astronomers, families and hangers-on) ate their way through the NOVA EAST Corn-Boil-And-Weiner-Roast-Chow-Down. On Saturday evening, the public talks were held at the Assembly Hall. The subjects ranged from 'Close to Home' to 'Where No Man Has Gone Before'. Subjects offered were:

The Collision Theory of the Moon's Formation by Larry Bogan
Larry gave an overview of past lunar formation theories and the collision theory. The argument was supported by computer simulations and examples of other possible collision victims in the solar system.,

The Cause and Effect of Aurora by Dave Driscoll & Tom Anderson
David explained the relationship between solar flares, the Earth's magnetic field and the Northern Lights, while Tom

showed concrete results of aurora (geomagnetic storms) such as lost satellites and Québec power blackouts.

The Summer Planets by Patrick Kelly

Pat showed close up views of the planets visible through the night (which was most of them) with N.A.S.A. views of the planets and their satellites

Life Out There by Doug Pitcairn

Through the use of a simple statistical formula, Doug explained why there probably are "little green men". He then explained why they can't come and visit. This talk received a very varied response, mostly from kids who wanted explanations for the "I Was Kidnapped By UFO Aliens" and "Elvis's face on Mars" headlines from the Enquirer.

Unfortunately, Saturday also had lots of clouds and rain, and not lots of clear skies and stars. All was not lost, however, because for the first time in its short history, NOVA EAST had electricity(!) at the campsite. Instead of sitting in the dark and grousing, we were treated to a slide show of Stellafane '90, various astronomical slides, and "THE DOUG'S" computer graphics of astronomical objects.

If you could only observe one day and/or night at NOVA EAST, Sunday was the day to do it. An arctic air mass had moved in overnight and Sunday was clear blue to the horizon, with no haze visible. The forecast was clear and cold, with the temperature dropping to 5° overnight. Sunday afternoon was spent much like Saturday afternoon, but minus the mass feeding. The more unfortunate – those with long drives and early morning work schedules – packed up and headed home. Mary Lou Whitehorne extended an open invitation to visit at the Caledonia Highlands Inn and have a peek at the Sun through her Celestron fitted with an H-alpha filter.

On Sunday night, an unscheduled observing session was offered to the public. Once again, attendance was high. After dark at the Micmac campsite was an observer's heaven – clear, dark skies, no haze, and a multitude of excellent telescopes. It was cold, but so what!!! The sky was magnificent. The only loss was part of the northern horizon due to a small aurora. Most stayed up until at least 4:00 A.M., with a few diehards still around to greet the Sun at 6:00. The observing highlights were:

Comet Levy:	Naked eye, easily found and up all night. Position change was visible to the naked eye after only a couple of hours. A tail had started to develop by Sunday night.
Neatest New Thing:	The Sun in H-alpha. Prominences, flares and filaments were all visible with

	noticeable structure changes over short periods of time. A great toy if you have the major bucks to buy the filter (4 digit price tag included).
Best Deep Sky:	M42 through Tom Anderson's 12" f/9 with 2" Ultra Wide Field 32 mm(?) eyepiece and a Lumicon UHC filter.
Most Difficult Object:	The California Nebula. Despite repeated attempts with different telescopes, the elusive object was never found.
Strangest Sight:	Numerous children stress-testing Darrin Parker's newly competed fork mount.

Based on the number of registration and opinion poll forms filled out, 51 astronomers and interested persons were at NOVA EAST, not counting spouses, children, etc. The results of the poll regarding when to hold NOVA EAST next year was... the Labour Day Weekend. It has a better chance of clear skies and gives most observers an extra night. You now have lots of notice for next year, so plan to BE THERE! Ω

Periodical Picks

Patrick Kelly

Discover - July 1990

- *Battle of the Bulge*, p. 18: A look at the evidence which points to our Milky Way galaxy being a barred spiral.
- *Maker of Worlds*, p.46: A look at Harvard physicist Sidney Coleman and his ideas on why the universe exists.

Discover - August 1990

- *Freewheeling on Mars*, p. 22: An update on N.A.S.A.'s plans for an "intelligent" Martian rover.
- *Mapping the Universe*, p.60: How two astronomers are using computer graphics to map the universe galaxy by galaxy.

National Geographic - August 1990

- *Neptune: Voyager's Last Picture Show*, p. 34: A summary of Voyager 2's encounter with Neptune. Lots of interesting graphics and photographs. BONUS SUPPLEMENT: A National Geographic map of the solar system.
- *Voyage of the Century*, p.49: A look back at the success of the two Voyager space probes.

National Geographic - October 1990

- *Under the Sun - Is Our World Warming?*, p. 66: Our atmosphere, what we are doing to it and what the results might be. An excellent summary of the current state of our understanding on the greenhouse effect. Ω

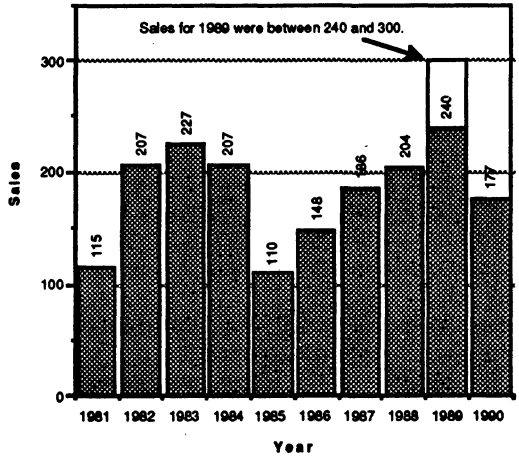
1990 Handbook Report

Joe Yurchesyn

Over the past year, handbook sales have continued to be an important source of income for the Centre. Each handbook sold can bring in a maximum of $3.85 in revenue. This enables us to maintain a healthy financial position while avoiding the membership fee surcharge imposed by some other centres.

The Halifax Centre has traditionally been in first place nation wide for the sale of handbooks. In 1989, the Halifax Centre sold more handbooks then all of the other R.A.S.C. centres combined! The sale of 1990 handbooks is down considerably from 1989. After a review of the 1989 financial records it appears that either 240 or 300 handbooks were sold last year, since there is some uncertainty in last year's handbook records. While 300 sales can be inferred, evidence for only 240 sales is documented .

Halifax Centre Handbook Sales - 1981-1990



The 1990 sales have the following breakdown:

SELLER	1990	1989	Margin
Atlantic News	12	10	$1.65
Gov't Book Store	21	32	"
Pair of Trindalls	10	?	"
Cole Harbour High	30	?	$3.85
Nova Scotia Museum	39	60	"
Parkview Education	22	?	"
Brooks, Randall	2	?	"

Cohen, Nat	4	?	"
Kelly, Pat/Pitcairn,Doug	6	?	"
Larkin, Len	9	?	"
Smith, Paul	2	?	"
Tindall, Dave	1	?	"
Zurawski, Richard	4	?	"
Miscellaneous	11	138	"
Free '90 for lost '89	2	?	-$7.10
Lost in the Mail	2	?	"
TOTAL	**177**	**240**	

SOURCE	**1990**	**1989**	**Margin**
Commission Sales	43	?	$1.65
Non-commission Sales	91	?	$3.85
Member Sales	39	?	"
Other	4	?	-$7.10

Sales Revenue	$1,894.35	?
Less cost of Handbooks	1,256.70	?
Less Commissions	94.60	?
Gross Handbook Income	$543.05	$1,238.75
Plus Mailing Revenue	$4.10	$17.75
Less Expenses	9.38	40.66
Net Handbook Income	**$537.77**	**$1,215.8***

* Unadjusted

Since I have just taken on the 1st Vice-President's position this past January, I apologize for any errors or omissions in the above list. Records are sketchy, and the 1989 stats are the best that I can determine. The 1990 Net Handbook Income as reported here is in variance with that deduced from the 1990 Financial Report, $537.77 as opposed to $521.22 - which is the adjusted value after this year's outstanding handbook credit of $284.55 is subtracted from, and last year's credit of $142 is added to the $663.77 reported. The handbook credit adjustment for 1989 is estimated at $42.00, so the net 1989 handbook income is $1,173.84.

If you have any ideas on how to increase handbook sales or awareness, please feel free to contact the executive. Ω

Ask GAZER

GAZER

Things have been a bit slow over the summer, but it is nice to get some mail, even like the one below, so keep those letters coming, eh!

Dear GAZER:

I would like to respond to your recommendation to "Anxious in Antigonish" (NN's Vol. 21, No.4) regarding his/her inheritance of a Questar. A couple of points deserve to be made. You comment on the frequency of Questars in the Ski & Tel ads; the reality of the situation is that Questars are about the only telescope worth buying second hand - the others are of questionable quality even when purchased new and the sellers are aware of the fact. Astronomers, being a most reliable and honest bunch, would never dream of trying to pass off a defective instrument to those who are so discriminating. can you imagine anyone, with say an "Audasay", trying to sell it to a fellow RASCal? Except for one oversized lout at our observing sessions, I don't know of anyone who has bough his opinion that views with his "Audasay" surpass those of the small superbly crafted and convenient Questar - even the Centre's 35 year old Questar! That guy must be some short sighted! And after seeing interferograms of Meldes (a flawed product of the Vulcan mind) and Crastrons made to almost the same exacting tolerances as the Hubble Space Telescope, it is not difficult to see why ads for them rarely in Ski and Tel. Would you buy a telescope based on the following ad - typical of those for Meldes, Crastrons or Audasays - without ever seeing and testing it?

LIQUIDATION SALE: Must sell. Space telescope used for only a few weeks; leaving town immediately. telescope in storage most of its life - only used on Sundays for friends of the Company. Selling as is, where is; needs minor adjustments. Sorry, can't provide any guarantee as to performance. Price: $2x10^{9} o.b.o. Buyer must arrange to pick up. Apply to Dud Elmer, Pasadini, Californe I A.

Sincerely
Diligent Dartmouthian

This is certainly an interesting perspective of reality. I'll bet I could guess who wrote this, as not too many people would admit the fact that they live in Dartmouth, let alone put it in writing! I guess that it then follows that all those people selling their little Questars must have been so impressed with them that they need the money to buy a 7" Questar.... Yeah, right.

Dear GAZER:

I have recently read two questions asked of the Ultramind, as well as his replies - recorded in the Hamilton newsletter ORBIT. They appeared to be stimulating, though provoking questions; so I am writing to obtain your thoughts.

Question #1: I'm still shaking after the close brush we on planet Earth had with that asteroid a little while ago. According to top scientists, we could all have been killed! If a giant meteor does hit our planet, what should I do?

Signed, A Concerned Citizen of the Cosmos

Question #2: Why is the universe so dull?

Signed, Unimpressed

Since a reputation of intellectual enlightenment is associated with your opinion, I eagerly anticipate your reply! Perhaps "Concerned Citizen of the Cosmos" and "unimpressed" will grow from your reply as well.

Seeking knowledge

When the editor of this distinguished(?) publication approached me with the idea of doing this column, he said that one of the other executive members (Mr. Yourcheesein?) had suggested the idea, based on a similar column in another newsletter. I take it "the Ultramind" is that column. Well, I must admit that "GAZER" is a bit less presumptuous than "Ultramind" unless the "Ultra" in "ultramind" is based on the astronomical use of the term "ultra" which means: the same old regular stuff but with a better marketing gimmick! I would be curious if you could forward a copy of his replies (if you still have them) to me. (To maintain my anonymity, send them care of the editor.)

In response to Question #1, it would help to know what is meant by "giant". I mean, let's face it, if it is big enough (or lands close enough), about the only thing you would have time for is the last step from the (modified) British instruction manual of what to do in the event of a nuclear attack. I believe it involved bending over, putting your head between your legs (as in an airline crash position) and kissing your posterior goodbye!

If the area of devastation does not affect you directly, life would probably take a few beneficial turns. For example, the television networks would have something more important to broadcast than football games and soap operas. The late night news would no longer be filled with items on the Senate, the failure of Meech Lake, the recession, etc. Scientists would have some experimental data to see if the nuclear winter theory is correct. Maybe we would be really lucky, and it would hit Iraq!

Of course, there would be the down side too. The doomsday/religious weirdos would be out if full force, claiming that this was just the beginning. And we would still have those amazing scientific headlines on the front pages of the scandal sheets proclaiming: "Aliens Aim Asteroid at Earth!" and "With Earlier Warning Roseanne Barr Claims She Could Have Eaten Meteor!" but you have to take the bad with the good. However, I think that there are more things down here on Earth that have a greater chance of causing you harm than being hit by a meteor, so I wouldn't spend the rest of my life staring up into the sky looking for the "big one"... you're liable to get run over by a car!

On to question #2. This is a rather interesting question as the it can be interpreted to mean either the universe in general is dull or the universe in the specific area around the person stating the question is dull. If they mean the former case, the best answer would be that it appears dull because the overall laws of physics don't care one way of the other about the dimensions and time scales common to humans. From an astronomical point of view, even a supernova is a boring event unless you're right on top of it.

The second case, that of dullness around a specific observer, can have one of two causes. The first cause is a result of spending long period of time living in Dartmouth (see the first letter). The best cure for this is to move to a real city (i.e. one with that has a downtown). However, if the original poser of the question lives in Hamilton, this seems to be an unlikely cause.

The only other possibility is that this person is a generator of dullness. Just in the same way that electric eels can generate electricity, certain types of humans generate large quantities of excess boredom. In this case, the only known cure is to get actively involved in your local astronomy club. The non-dull types who do this as a matter of course produce such large quantities of anti-dullness that they will compensate for the afflicted individuals own production. Usually after several years of exposure, the dull person is completely cured, and in numerous cases, they will actually start producing their own supply of anti-dullness. Luckily, astronomy enthusiasts are more than willing to help any individual who suffers from excessive dullness.

I hope that these answers will inspire another flood of questions from other troubled souls. Ω

Rebate System Introduced for Affiliated Clubs

Halifax Centre

The area of Canada that falls within the "boundary" of the Halifax Centre is quite large, encompassing the three Maritime Provinces as well as a sizeable portion of New England. Over the last ten years, the percentage of members of the Halifax Centre who live outside of the immediate metro area has been growing considerably. A lot of this interest has come about as a result of people in other areas joining local clubs and learning of the R.A.S.C. through them. In addition, we are beginning to get new members as a result of NOVA EAST .

Since the aims of the R.A.S.C. include advancing public interest in astronomy, it is to our benefit that local clubs flourish. Such clubs now exist in Nova Scotia in Antigonish, Hebron, Sydney and Truro; in Prince Edward Island in both Summerside and Charlottetown; and in Saint John, New Brunswick. The last issue of NOVA NOTES mentioned that the Halifax Centre had started a policy of rebates to give some financial assistance to these clubs. The actual policies governing these rebates has been finalized by the executive and are summarized below for your information.

To encourage the advancement of astronomy in the Maritime Provinces, the Halifax Centre provides partial membership rebates to affiliated clubs on the following basis:

1) Rebates shall only be paid to groups approved by the Halifax Centre Council and which have a minimum of five (5) members in the Halifax Centre.

2) Rebates shall only be paid to those members of the affiliated club who are in good standing of the Halifax Centre on the 1st of January of each year.

3) The amount of the rebate per member (life, regular, senior and youth) shall be determined by the Halifax Centre Council at its January meeting each year and the amount of the rebate shall not exceed the amount retained per member from their membership fee of life membership allotment.

4) The rebate shall be paid only upon written request by the associated club.

5) The associated club must have a bank account in the club's name.

It should be noted that starting with the 1991 membership year, membership applications forms as well as membership renewal forms will contain a space to indicate if a member also belong to an affiliated club. Ω

A Witch Satellite

Mike Burkhead

reprinted from - **The Electronic Journal of the Astronomical Society of the Atlantic**

On Halloween nights, witches are often imagined by little children to fly in the night sky between Earth and Full Moon. One such evening, very briefly, I thought they really did. On Halloween, October 31st, 1987, I arrived home after work and saw a clear Georgia twilight sky with the Moon waxing gibbous. I though this would be a good time to get out the telescope for lunar observing. I could even leave it set up for the children making their rounds trick or treating.

As I focussed my 60 mm refractor on the Moon, the ocular filled with light. I adjusted the scope so that the southern region of the Moon was in one side of the eyepiece, and twilight in the other. Suddenly the unexpected happened. I saw something black appear at the edge of the Moon's image! As it began to move across the lunar face, I wondered aloud what the heck was going on. Suspecting a bug crawling on the objective lens, I checked the front of the scope. The lens was clean with no insect to be found.

I though I was seeing things. Back in the ocular, the black spot was still there, moving across the Moon. My mind made associations: Halloween, Moon, Witch! It's a witch! I moved away from the scope and looked at the Moon with the naked eye. Nothing was in motion; the Moon was by itself.

With the witch theory discarded, I decided to study the dark object more closely. By now I had to adjust the scope so the northern area of the Moon was in the field of view. The object was still traversing the Moon at a very steady rate, but it appeared to be twirling or tumbling. Eventually, it moved off the edge of the illuminated Moon and vanished. I looked up at the sky and saw no further traces of it. Was it a man-made satellite? It had to be; but unlike other satellites that I have watched crossing the heavens, the sky was too bright to see the satellite itself, or else it was in the Earth's shadow and had no light of its own. I take back all the times that I have said I have no luck – I've never won anything, but the odds of being in the right place and looking in the right direction to see the silhouette of an artificial satellite as it transited the Moon must be "astronomical". Although my explanation seems long, the event only took ten to fifteen seconds to transpire. I suppose the satellite was of Soviet origin, since it travelled south to north in polar orbit, as many Soviet satellites do. All in all, it was truly a splendid sight to see and probably a once in a lifetime event. The only thing I remain a little curious about is "witch" satellite it actually was. Ω

Could He Have Seen It?

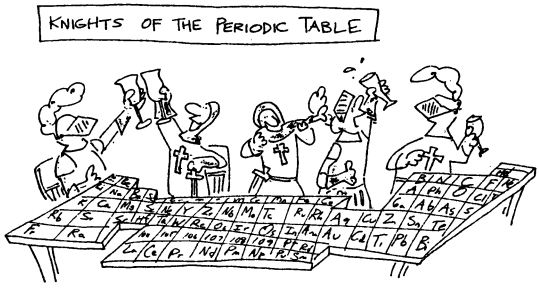
Doug Pitcairn

This claim to have seen an artificial satellite should be examined a wee bit more closely. Could Mr. Burkhead have actually seen a satellite? A little math might cast some light on the problem. First of all, let's get the facts straight. In a twilight sky in October, a waxing gibbous Moon should be quite low in the sky. I will use twenty degrees as a round figure. I have difficulty with the statement about twilight being in the other half of the field of view, since the gibbous Moon would be in the darkest quadrant of the sky, the south-east. But perhaps it means that twilight had just begun.

If we assume that the object was a satellite, how big would it appear to Mr Burkhead? Let's take a best case. At twenty degrees altitude, a satellite in a 300 kilometre high circular orbit would be 900 km downrange. If the satellite was a large one, say 5 metres in diameter, than it would subtend an angle of 0.12 arc-minutes, or about seven arc-seconds. That's quite visible at medium power in a high contrast case such as a silhouette against the Moon.

But a more typical case would be a 2 metre satellite about 3000 km downrange. This would only appear to be .7 arc-seconds, and would certainly be beyond the reach of a low power view in a 60 mm refractor.

In summary, Mr. Burkhead could have seen a satellite **if it happened to be a large satellite in a very low orbit.** Under normal conditions, I would suggest he may have observed a high altitude airplane. The tumbling could well have been a result of low viewing angle turbulence. One further point, I think I have seen telescopic satellites cross my field at least six times during my last four observing sessions. I suggest that anybody who observes the Moon regularly will likely pick up a satellite or two eventually. With all the junk that the "space agencies" have dumped out up there, it's a wonder we can see the Moon at all!! Comets should be that easy to locate. Clear skies! Ω



NOVA NOTES INDEX

September-October 1990 Volume 21, Number 5

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HALIFAX CENTRE - R. A. S. C.
1990 CALENDAR OF EVENTS

October

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

November

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

December

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	**13**	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

January 1991

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Key to calendar:

Regular and
Observer Group Meetings: **bold and shadowed**
Special days: **bold**
Possible observing sessions: underlined

Special Days:

November 17 - Leonid meteor shower
December 13 - Geminind meteor shower
December 23 - Two shadows on Jupiter (7:50 P.M. AST)

Note: Some events listed may occur in the early morning of the following date.

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Royal Astronomical Society of Canada
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Canada
B3H 3A6

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136 Dupont St.
Toronto, Ontario
Canada
M5R 1V2