NOVA NOTES

Volume 23 Number 3 May 1992

THE NEWSLETTER OF THE HALIFAX CENTRE OF THE RASC
c/o 1747 Summer Street, Halifax, N.S.,Canada B3H 3A6

NOVA NOTES, the newsletter of the *Halifax Centre of the Royal Astronomical Society of Canada*, is published bi-monthly in January, March, May, July, September, and November. The opinions expressed herein are not necessarily those of the *Halifax Centre*. Material for the next issue should reach the editor by **June 30, 1992**. Articles on any aspect of astronomy will be considered for publication. "Letters to the Editor" or to our resident expert: "GAZER" are also most welcome. The editor can be reached at:

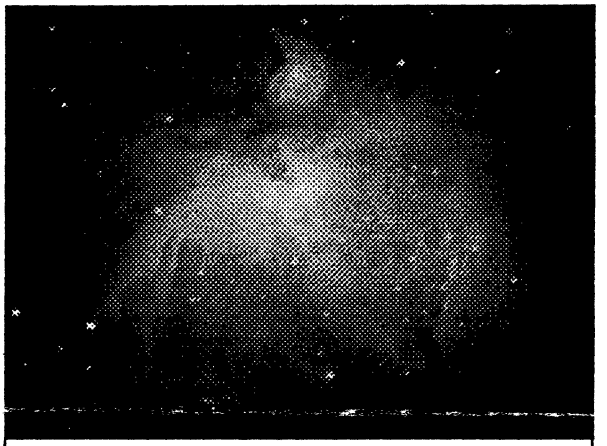
David Lane
4-26 Randall Avenue
Halifax, Nova Scotia
B3M 1E2
E-mail: 71601.247@compuserve.com
Compuserve: 71601,247
Phone: (902) 443-5989

Inside This Issue...

Editor's Report: by David Lane

This issue is, again, a bit late! Sorry about that, but my employer sent me to sea for two and a half weeks on the Grand Banks of Newfoundland right in the middle of the time in which *NOVA NOTES* was to be prepared for publication. I was on the Bedford Institute research ship *CSS Hudson* testing a scientific instrument which I had designed. And I missed the annual banquet to boot! Do you think I could get a refund from Nat?

You are going to find this issue a bit thin. This is because you, the membership, haven't sent me much material to publish! You will also find some format changes, namely the shaded boxes and a couple of font changes. I hope these meet with your approval. Ω



"Astrophoto of the Month"
The Orion Nebula (M42)
David Lane took this photograph using a Meade 2120 SCT (10") at f/7. The film used was Konica 3200 with an exposure of 30 minutes. The photo was guided using an SBIG ST-4 CCD Camera.

Despite the fact that the day of Terry Dickinson's talk was also the day of the previously mentioned migration to Falmouth, I actually managed to make it in for his talk. (I would like to thank Mary Lou for filling in for me on such short notice. I only realized that the two events were on the same date on the previous weekend!) His talk was fantastic and he had some absolutely amazing slides of the Milky Way and the northern lights.

We also had an excellent talk for our banquet. John Hault gave us an presentation on the planetarium industry, including some of his feelings as to what has been the result of their financial troubles of late. David Fleming, this year's Burke-Gaffney Award winner, was able to make it to the banquet to pick up his prize, an autographed copy of *The Backyard Astronomer's Guide*. We were provided with an excellent meal

President's Report: by Patrick Kelly

Where does the time go? It seems as though I was writing a president's report only a few days ago. The "Great Migration" has occurred and I am more or less getting back to normal in my new abode in Falmouth. The sky from there is quite good. I haven't had a chance to quantitatively test it yet, but I would guess that it is comparable to that from the Beaverbank site (but without the forty-five minute drive!)

and Nat Cohen deserves a lot of credit for having made all of the arrangements.

The Nova Scotia Planetarium Advisory Committee has chosen the successful bidder to conduct the feasibility study from the proposals submitted. An application for funding for the study has been sent to the Atlantic Canada Opportunities Agency (ACOA). ACOA will only fund 50% of the cost of a feasibility study, so we much raise the balance. We should know whether funding has been approved in time for the June meeting. I would like to thank those members who have contributed towards this project. I will be sure to keep you updated as things progress.

By now, you should have received your April issue of the **BULLETIN** and *Journal* along with the *Annual Report* and agenda for the upcoming annual meeting. You have probably noticed that there is a proposal to increase the regular membership fees from $32 to $40 for the upcoming year. One of the items on the agenda for the June executive meeting will be to determine the centre's position on this matter. If you have any feelings on this matter (one way or the other) those of us on the executive would like to hear from you so that we can best represent the feelings of the centre membership. Unfortunately, it is not likely that you will see this newsletter before the decision will be made.

On the same topic, I have heard unofficially that at least two other centres are collecting proxy votes to take to the annual meeting. (For those of you who are not familiar with this procedure, the society's constitution allows members to submit a letter giving their centre's national council representative the right to vote on their behalf at the annual meeting. This way, members who cannot be present at the meeting can still make their presence felt.) Unfortunately, due to the short period of time before the annual meeting (July 1-5), anyone who wishes to exercise this right, and wants to know what the centre's position is, will have to contact someone on the executive as soon as possible. Keep in mind that authority for a proxy vote must be in writing. Dave Lane will be attending the General Assembly as your National Representative, so proxy votes should be delivered directly to him.

Last, but not least, I would like to remind those of you to send in your membership survey as soon as possible. We need your opinions in order to shape the future of the society and the sooner you send them in, the more data we will have to mull over at the General Assembly! Ω

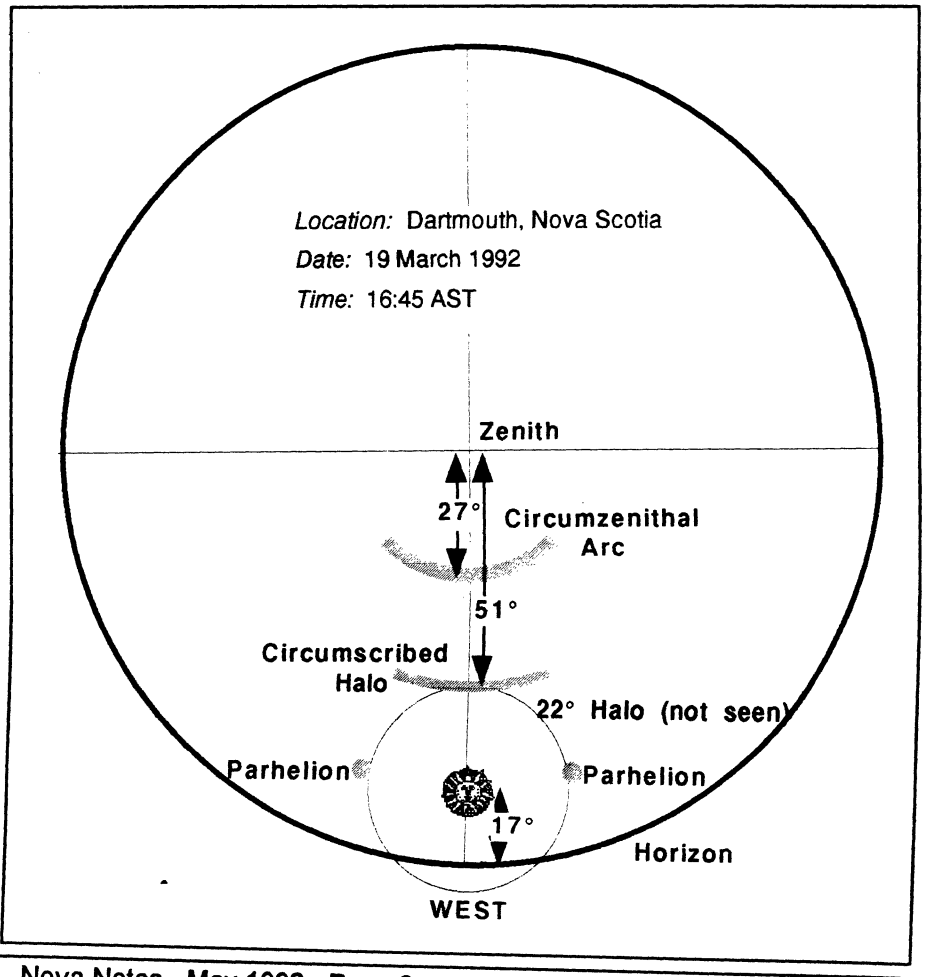
The Day of the "Upside-Down Rainbow":

by David M. F. Chapman

On the last day of winter this year, I witnessed a rare and beautiful atmospheric phenomenon: a solar halo complex consisting of two parahelia (or "sun dogs"), a circumzenithal arc, and part a circumscribed halo. In this article, I shall describe what I saw and attempt to explain it.

The Observations

It was 16:45 AST on March 19, 1992. The sun was still well up in the western sky. The air was cold and the sun was shining through some thin high cloud; the weatherman had forecast snow for that night. I was on my way home from work, but had dropped by the daycare to pick up my five-year-old daughter, who was outdoors in the playground with her schoolmates and teachers. One of the kids suddenly pointed high up in the sky - almost overhead - and cried "Hey! Look at the upside-down rainbow!" Of course, we all turned to look, and we saw not one but two "upside-down rainbows," whose arcs curved upwards away from the horizon instead of towards it. Also remarkable was the fact that we had to face the sun to see these arcs, rather than having to put the sun at our backs (as for "normal" rainbows). The higher arc seemed nearly overhead (at least we



had to strain our necks to see it) and displayed vivid spectral colours. I could see right away that it was centred on the zenith, even though it was incomplete, being only about an open hand's breadth long. The lower arc was about halfway between the sun and the first arc, and was less distinct.

Looking around for other features, I saw that there were two multi-coloured parahelia or "sun dogs," one on either side of the sun. These I have seen quite often, usually on a winter's morning just after sunrise. I did not observe the classic 22-degree halo around the sun often seen with the sun dogs, but there was a white-light pillar above and below the sun.

The phenomenon did not last long: we could not see it ten minutes later, when we arrived home.

The Theory

That evening, I did what research I could in my home library. The most useful book was Minnaert's *The Nature of Light&Colour in the Open Air*[1], which has since been complemented by Greenler's excellent *Rainbows, Halos, and Glories*[2]. There is also an interesting chapter in Schaff's *The Starry Room*[3] and some nice photos in Ronan's *The Sky-watcher's Handbook*[4].

To work out the position of the sun at the time of observation, I used *Voyager 1.2*, the "desktop planetarium" for the Apple Macintosh[5]. At 16:45 AST in Halifax on 19 Mar 92, the Sun was at azimuth 252° (WSW) and altitude 17°. It was due to set at 18:25, one hour, 20 minutes later.

The phenomena I observed can be explained by the presence of two kinds of hexagonal ice crystals in the atmosphere: the *plate* crystals and the *columnar* or *pencil* crystals. Both are prisms (in the geometric sense) with hexagonal cross-sections, but the plate crystals have a small length-to-width ratio, while the pencil crystals have a large length-to width ratio.

Both crystal types are prisms in the optical sense, as well. A ray travelling perpendicular to a crystal axis striking one of the sides is directed not to the neighbouring side but the *following* side, and then back into the air again. In effect, this hexagonal prism behaves as a 60° triangular prism. Using an index of refraction of 1.31 for ice, Minnaert shows that the angle of minimum deviation of the transmitted ray from its previous direction is 22°. Rays striking a face and exiting one of the ends behave as though they were transiting a 90° prism, with a corresponding angle of minimum deviation of 46°.

Armed with this knowledge, the theory states that if there were a cloud of randomly-oriented crystals of either type between us and the sun, we would have seen two halos around the sun: one of radius 22° and one of radius 46° - yet we saw neither!

If, however, the crystals were oriented with their axes aligned vertically, then we would have seen patches of light at the same altitude as the sun, but a little over 22° away on either side. (A little over, because the rays are not travelling the *minimum* deviation route.) Aha! The sun dogs! It turns out that it is more likely that the flat plate crystals would descend gently with their axes vertically-aligned, whereas the pencil crystals prefer to lay on their sides. Therefore - the theory claims - vertically-aligned plate crystals cause the sun dogs.

If plate crystals high overhead were to refract the sun's rays through their 90° corners, then the situation would get rather more complicated. If the crystal axis were perfectly vertical but randomly oriented in azimuth, then the refracted rays all form the same angle with the vertical, but may be deviated from side to side. The result: an arc centred at the zenith, called the *circumzenithal arc*.

Minnaert shows that the relation between the elevation angle H of this arc and the Sun's elevation h is

$$\sin^2 H = n^2 - \cos^2 h,$$

where n is the index of refraction for ice. (Trigonometry students will deduce from this that the Sun's elevation must be less than 32.2° for the arc to be seen, and that the elevation of the arc itself must be greater than 57.8°.) In our case, the elevation of the arc would have been about 64°.

This leaves the lower arc to be explained. It is the pencil crystals lying on their sides with random orientations that are thought to form this arc. Unfortunately, this one is not so easy to visualize, and Greenler resorts to computer modelling to simulate the *horizontal tangent arc to the small* (i.e. 22°) *halo*, or the *circumscribed halo*. However, this tangent arc must touch the small halo at a point directly above the sun, so the

Astro-Ads

4" Bausch & Lomb Criterion 4000 Telescope

4 years old, hardly used, like new. Complete 11 piece kit including two eyepieces,table top tripod, equatorial drive base, and carrying case
Very portable. Asking $400
Call Al Ingarfield - 443-1864

Meade 2045D 4" Telescope

1 year old, like new. Schmidt-Cassegrain optics. Equatorial fork mount with table-top tripod, carrying case, Celestron hand controller/drive corrector, JMI declination motor, tele-extender, and other photo accessories. Asking $950
Call Norman DeGreef - 857-3544 (Black Point)

(Astro-Ads is a free service to Centre members. Non-members are asked to make a small donation to the Centre)

elevation of this arc must be $h + 22°$, or about 39° in our case. This coincides with our observation that the lower arc was halfway between the sun and the upper arc (The exact halfway elevation would have been 40.5°).

Although Greenler claims that these phenomena are not rare, I have never seen them before and would consider myself lucky ever to see them again. The world of physics may seem grey and dull to many, but the day of the "upside-down rainbows" was one instance when Nature provided a beautiful spectacle that taught me a little science at the same time. Ω

[1] M. Minneart, *The Nature of Light & Colour in the Open Air* (Dover Pub. Inc, New York, 1954).
[2] Robert Greenler, *Rainbows, Halos, and Glories* (Cambridge University Press, New York, 1989).
[3] Fred Schaff, *The Starry Room* (John Wiley & Sons, New York, 1988).
[4] Colin A. Ronan, *The Skywatcher's Handbook* (Marshall Editions Ltd., London, 1985).
[5] Carina Software, San Leandro, California, 1989.

Oh, What a Night!

by Mary Lou Whitehorne

Date: Monday, March 30, 1992
Location: Beaverbank Site
Observers: Doug Pitcairn, Jason Adams, Dave Lane, Shawn Mitchell, Blair MacDonald, Mary Lou Whitehorne
Equipment: C8, 8" Schmidt Newtonian, 10" Odyssey, 13" Super Bucket, 7X50 binocs

There were six of us but there should have been more. We called some of you but got either no response or a feeble excuse of some kind. Well, you missed THE night of the year! You know, that one night of the year when the big refractor is worth the extra dollars! (Are you listening, Joe?)

The sky transparency was not the best; MVM was only about 5.2 but to make up for it, the seeing was rock steady. When was the last time you looked at Jupiter at 300X and saw an image that looked like a Voyager shot? For six of us it was last night. There sat Jove; King of the Planets, large, brilliant and overflowing with detail. We were awestruck as we gazed upon all the detail in the Jovian clouds. The Great Red Spot was truly great - it showed prominently as a salmon colored oval surrounded by its brilliant near-white depression, set into the South Equatorial Belt. All of the belts and bands were sharply delineated with remarkable contrast and detail right into the polar regions of the planet. We gaped and uttered inadequate adjectives to try and describe the beauty of what we were being treated to. Then we spent considerable time imagining how we would kick a certain 6" Astro-Physics refractor owner all over Halifax for not coming out on that one night a year when the refractor really pays off!

Galaxies galore! This is the time of year for Virgo and Leo and The Realm of the Galaxies. The hunt was on and what a fruitful hunt it was to be. Light buckets excel at sweeping up those faint fuzzy patches from far away and long ago. We swept up so many of them that we lost track of how many we spotted. There were many fields that held two, three, or even four of these stellar cities at a time. All different and all lovely. Some with clearly visible dust lanes, some showing spiral arms, some spindle shaped, some with bright stellar nuclei and some very wispy and tenuous; on the limit of visibility. Can anyone possibly remain unaffected by the sheer beauty that makes up this Universe?

We turned to M82 with the 13" bucket at 300X. It was like looking at another of those photographs out of a book. Never before have we seen such incredible detail in this tortured galaxy. It filled the eyepiece with it's ghostly light; it was riddled with dust lanes. We were almost struck speechless, but not quite! We were reduced to babbling like idiots about what a phenomenal night this turned out to be; what a feast for the eyes and soul. What a loss for everybody else who didn't come and share in the profound beauty of the night.

I missed the bright green -5 magnitude fireball that streaked through Perseus but the excited howls of delight from the rest of the group were enough to send shivers up my spine. I regret missing it but I was pleasantly occupied in catching the photons from four distant galaxies at the time. A worthwhile compensation, wouldn't you say? Ω

Breaking in Dollar Lake:
by Mary Lou Whitehorne

Nice night. Clear, mild, light breeze and no Moon in the way till much, much later. A good night to give our new observing site at *Dollar Lake Provincial Park* a good tryout to see just how good a site it really is. Dave Lane and I made a few calls to a few observing nuts and agreed to meet there at 9:30pm. The plan was to do a little astro-photography.

We arrived on time, the sky was still light but that's good - it makes setting up and doing polar alignment a bit easier. The site looked great! So we set up and got polar aligned. During this process another observer arrived in the person of Paul Gray. While I waited for the sky to get really dark I took the opportunity to fiddle with my *Sure-Sharp* focusing aid. By the time the fiddling was complete, the sky was dark enough to get down to the real business of photographing a planetary nebula for this silly astrophoto contest that Dave and I got roped into - but that's another story altogether - it involves Blueberry Grunt at the restaurant in Alma, New Brunswick - and you don't really want to know the rest!

Now poor Dave was having some trouble with his scope. There seemed to be an inordinate amount of drifting going on. Realizing that he hadn't charged his battery in a very long time he began the ritual of *Cursing On The Dead Battery*. Neither did he have his adapter to plug into his car battery! The solution was simple; I loaned him my adapter. Problem fixed, right?

Meanwhile back at my scope I had centered my object in the field and acquired a guide-star twice only to bump the scope and have to start all over again. **Grrr!!!** Then we heard a despondent howl coming from the direction of Paul Gray. Seems he had forgotten those critical bolts that attach scope to tripod. Needless to say, he was not happy.

All set to begin my first photo of the night, I advanced the film in my camera. Or should I say: I TRIED to advance the film. No go. I was at the end of the film with no spare roll of the stuff with me! Now both Paul and I were heavily involved in *Cursing Our Own Stupidity*.

During all this Dave was quietly trying to get started but his scope was still drifting badly. Obviously it couldn't be the battery that was the cause of the problem. He stepped back in puzzlement and then noticed to his utter horror and disgust that he had polar aligned on Kappa Cephei - a good 12 degrees away from the pole! **AARRGGHHH!!!!!!** So we were all *Cursing Our Own Stupidity* in unison; except for Larry Parker, who had arrived late, set up his scope and happily busied himself with observing a Jovian satellite shadow crossing the disk of Jupiter. I think he was secretly amused at our ineptitude...

Dave gave up in total disgust and handed his scope over to Paul who gladly snatched the opportunity to get in a bit of observing when he thought all was lost. Since I had no film, Dave handed me his roll - "Here, you might as well use it!" Actually it was film sent to him for hypering by Len Larkin so now I owe Len a roll of Ektar 1000. Thanks, Len! (I think!)

I should say that I did manage to polar align on the right star. The alignment was good, too, because the only drifting that my guide-star did was what I made it do. It was not an auspicious beginning for the Dollar Lake site but now that the site has been properly "broken in," the rest of you should not hesitate to go observing there! You should feel very much at home there knowing that you can make just as many, and just as good, mistakes there as you can make at Beaverbank. Ω *(Editor's Note: For a map to either observing site, see the March 1992 issue of Nova Notes.)*

Nova Notes Editor, Halifax Centre
Royal Astronomical Society of Canada
c/o 4-26 Randall Avenue
Halifax, Nova Scotia
B3M 1E2

National Office R.A.S.C.
136 Dupont St.
Toronto, Ontario
Canada
M5R 1V2

Notice of Meetings

Date: **Regular Meeting - Friday, June 19th: 8:00pm** 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: This month is **Member's Night**. Present a short talk to the membership on the astronomical topic of your choice. Please call the President to ensure a space is reserved. Also, the annual trivia contest is being substituted this year in favour of an **"Amateur's vs. Pro's Reach for the Top Game"**.

Public Observing Sessions

Public observing sessions will be held over the summer at **Dollar Lake Provincial Park** on Friday, July 24th (rain date July 25th) and on Friday, August 21st (rain date August 22nd) at dusk.

Nova East 1992 Star Party

Nova East '92 will be held on **August 28 to 31 at Fundy National Park** in New Brunswick. Full details will be published in the next issue. Plan to attend! Contact the **Observing Chairman** for advance information.

Halifax Planetarium Shows

Regularly scheduled planetarium shows will not be held during the July and August summer months. Regular shows will return in the fall. The fall show times and topics will be published in a future issue.

1992 Halifax Centre Executive

Honorary President	Dr. Murray Cunningham	
President	Patrick Kelly	798-3329
1st Vice-President	John Connelly	679-1333
2nd Vice-President	Mary Lou Whitehorne	865-0235
Secretary	Wesley Howie	457-3052
Treasurer	Joe Yurchesyn	422-8030
Nova Notes Editor	David Lane	443-5989
National Representative	Brian Segal	783-2722
Librarian	Walter Zukauskas	423-2400
Observing Chairman	Doug Pitcairn	463-7196
Councillors	Dr. David Turner	435-2733
	Jason Adams	864-9783
	Paul Gray	864-2145