Orbit

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This photograph taken by Steven E. Prewitt was sent in to accompany Michael Spicer's in-depth article on the Leonids that begins on page 6(?). Shot using a Canon 'Bell and Howell' camera with a 50mm lens on Fuji Superia X-tra 800 color print film, it was exposed for approximately 25 seconds.

Club banquet on May 25th - See Page 8 for Details.

Analysis of the First Wave of the 2001 Leonids

by: Michael J. Spicer
B.A., B.Ed, M.Div, D.Ed., LL.B.

Various astronomical models made diverse predictions for the 2001 Leonid meteor shower. All pointed to 17-18 November as a possible repeat of the 1999 meteor storm. Two peaks or waves were predicted. The first wave would be observable in Europe and the East coast of North and South America; the second possibly greater wave, visible in the Orient.

Weather predictions for southern Ontario were pessimistic in the days preceding the 17th. It seemed reasonable to assume that local bad weather conditions would continue through the Leonid event. I accepted an invitation to take part in an observation of the shower by a group of American astronomers at the dark-sky site near Landrum, South Carolina maintained by the Foothills Equestrian and Nature Centre (FENCE). The weather there on 17-18 November was cool but very

*See **Leonids** on Page 4.*

Activity on Jupiter

In the January 15th bulletin published by Sky and Telescope, John McAnally, assistant coordinator of ALPO, issued an alert to encourage amateurs to observe the activity taking place near Jupiter's Great Red Spot. The last of the three large ovals, designated BA, appears to be on a collision course with the GRS. Says McAnally, "Astronomers are asked to make special efforts to observe this GRS/BA interaction so that a complete sequence of events can be constructed to characterize the behavior of the winds, jet stream, and other atmospheric conditions surrounding this interaction -- data that would be of great value."

What's' in Orbit

by: Ev Rilett

January has seen a very mild month until this past week or so. Clouds, clouds and more clouds. Hopefully February will bring better skies.

There is still time to observe Saturn for those who wish to be involved in the Saturn Observation Program directed by Michael Spicer. His intention is to use the observation material, about this beautiful planet, to write a subsequent article to one from 30 years previous in the RASC Astronomical Journal. Your observations must be completed by the end of February and returned to myself or Michael Spicer at the March General Meeting.

Another planet to keep your eyes on is Jupiter. Both Saturn and Jupiter are excellent targets. They are quite high in the sky and at very reasonable times. Jupiter's moons are also a treat to observe. They are easily visible in binoculars and dance around the planet. They are different every time you look, just like Jupiter itself.

We'll also continue with our "Explore the Universe" program, specifically geared to beginners. It is offered by the RASC Observing Committee, referenced with the "The Beginner's Observing Guide" (not a pre-requisite). It introduces you to a good assortment of the things our world has to offer. It could also be a great refresher for those who've been away from observing for a while. I also know that all the experienced observers will help and share their knowledge and expertise.

A brief description: There is a wide range of 110 Observing objects with a requirement of 55 objects to be hunted down. The categories are organized by seasons, and span the Moon, Deep Sky, Constellations and Bright Stars, Solar System and Double Stars. I will supply the "Explore the Universe Observing Certificate" details by email for anyone interested and you can pick and choose which ones you'd like to chase.

Please come out to the observatory and enjoy the benefits and companionship of the members. All can share and learn from each other. Looking forward to seeing you all there.

Ev Rilett, Observing Director
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From the Eyepiece

by: Mark Kaye

January and February are without a doubt the hardest two months of the year to observe in. Clear skies are at a premium and the occasional clear nights are met with the coldest of temperatures. I am sorry to report that my observing has been very limited due to the lack of clear skies. I did manage a few pictures of some open clusters, but that is about it. I figure that I am being paid back for having clear skies during the peak of the Leonids.

This year, the General Assembly of the Royal Astronomical Society of Canada will be held over the May long weekend in the city of Montreal. Since it will be earlier than usual, it forced national council to hold their meeting in January instead of the end of February, beginning of March as is usually the case. Most of the meeting was taken up with one item. In 1999, Hamilton centre proposed a series of six changes to the way National office handles money, the most important of which was provisions for dealing with any national surplus and the least important was a suggestion that National decouple the fees to make booking keeping easier and to make it possible for National to increase the fees by exactly the necessary amount without having to add a surcharge for each centre, thus inflating any proposed fee increase. The five more important ideas were quickly dismissed, but the fee surcharge issue remained. After much discussion by centres who obviously did not come to the meeting prepared, the special motion barely passed and will now be voted on by the membership at the upcoming General Assembly. Look for more heated discussion, on the perils of making things easier at National Office, in the coming months.

Other items of note include an updated RASC manual. This can be found on-line in the members only section of the RASC. This is a password protected area, the user name is <member> and the password is <chant99>. (Type in only the letters and numbers.) While you are at it, check out the rest of the web page. Kevin Kell of Kingston centre has taken over the job of webmaster from Colin Haig and he has revamped the web page.

Calgary centre successfully lobbied council for a grant of 6000 dollars to do some serious modifications and repairs to their dark sky observing site. The Eccles Ranch site is the home of the Alberta Star Party, a joint Calgary and Edmonton Centre operation, so in effect, this grant was to two centres. All RASC members are welcome to the site, if you are in the area and want to use it, get in touch with the Calgary centre. Perhaps Hamilton centre should consider the merits of applying for such a grant.

The RASC calendar is looking for photographic submissions. Rajiv Gupta is concerned about the low level of input of quality photographs for this publication. He would like to make the calendar be RASC members only, but if he does not get the pictures, he may be forced to use non-member submissions. So, if you have any good shots, get them scanned and send a small jpeg of the shot to Rajiv <gupta@interchange.ubc.ca> and if he likes the picture, he will contact you about receiving a high resolution jpeg or a hard copy. The deadline for the 2003 calendar is March 31st.

A motion was carried to instruct the constitutional committee to work up an amendment to the by laws to allow for electronic participation at general meetings. Given the state of electronic video conferencing, this amendment is being made to allow for the possibility of future meetings being held with members from far flung centres being allowed to attend virtually. It is not meant as a replacement for personal attendance, but as a way to reduce the costs of bringing in people from all parts of the country while allowing them to have a say in what goes on at council meetings.

A motion was also made to submit for a bylaw change nominating procedures for president, vice president or second vice. Right now, a person can only serve one term at each position. The amendment to the by laws will make it possible for a person to hold the same office again in the future, but not for consecutive terms. The usual procedure high officers is the acclimation of each position. If a person should become 2nd vp, vp and then for personal reasons not go onto be presi-

*See **Eyepiece** on page 7.*

***Leonids** cont'd.*

clear with good seeing and relatively dark skies almost to the horizon.

Purpose of this Study

This article offers an analysis of the record of observations by 24 astronomers gathered at F.E.N.C.E. for the 2001 Leonid shower, including Steven E. Prewitt of the Foothills Astronomical Society, Mark Hornbeck, Victor Frady, Bob Ormand, Jim Cooper, Tim Linder, Mr. and Mrs. Mitchell Stedman, Steven Abelman, Richard Boozer, Lee Pettijohn, Sue Gray, Carolyn Schultz, Jesse Willard and the author. The results of this study were compared with predictions made for the Leonid first wave.

Observing Method Used

Dressed warmly against the dampness that plagues South Carolina in the autumn, observers sat or reclined in a circle. Each observed a section of the night sky. The entire sky was watched, each section of sky by at least one and often by as many as eight observers.

A number of cameras took photographs of meteor trails and the remarkably enduring trails left by brighter meteors in the early morning hours. The photographs in this article were taken by Steven E. Prewitt of Boiling Springs, SC with an Olympus OM-1 and a 50mm f-1.8 lens. Photo A (this page) shows 4 bright and one faint Leonid meteor trails on a guided photo of the eastern sky; Photo B (front cover) shows the wind-blown "L" shape of a meteor trail that was visible for over 7 minutes.

We all have read entertaining articles describing meteor showers in general terms, with "oohs" and "aahs" and excited comments such as

"Wow! Did you see that bright one!". Our audio tape recorded times of just such excitement.

Several meteors were extremely bright and one Leonid, bursting upon the far western sky just after 06:15 UT, was near magnitude -10. Still, it seemed more worthwhile to collect hard data from the event, assigning numbers to the sitings starting at zero each hour, with one person marking time at intervals; recording the sitings and later, playing the tape, analyzing the shower in 15 minute periods.

Each siting was a burst of exclamation (usually the next sequential number) from one or a number of observers simultaneously. Our co:ordinator Richard Boozer arbitrated the numbers and noted aloud the time at 15 minute intervals beginning at 07:00 UT and ending just before dawn at 10:00 UT. This writer made an audio recording of the sitings and time markers. At the same time, sitings by this writer were recorded as a click by tapping the microphone. In this way the observations of one observer could be compared to those of a group of 24.

The raw data for the observations collected is listed in Table 1 (opposite page).

The Predictions

Analysis of data resulted in a graphic representation of the

Photo A: This photo by Steve Prewitt of Boiling Springs, SC shows 4 bright and one faint Leonid. It was shot on Fuji Superior X-tra 800 colour print film using an Olympus OM-1n 35mm with a f1.8 50mm lens. The camera was mounted atop a Celestron Ultima 8 PEC to track the apparent movement of the stars.

Zenithal Hourly Rate (ZHR) for the group, and in the period 07:00 - 09:45, a comparison of ZHR for a single observer as well. This data is compared with three varied predictions published in the November 2001 issue of Sky & Telescope magazine at p. 111f:

- David Asher of Armagh Observatory and Robert McNaught of Australian National Observatory (the Asher Model);

- Esko Lyytinen and Markku Nissinen of Finland, with Tom Van Flandern of Washington, DC using a model (the Lyytinen model) based on a calculation of dispersal of meteoroids from close cometary orbit into related solar orbits;

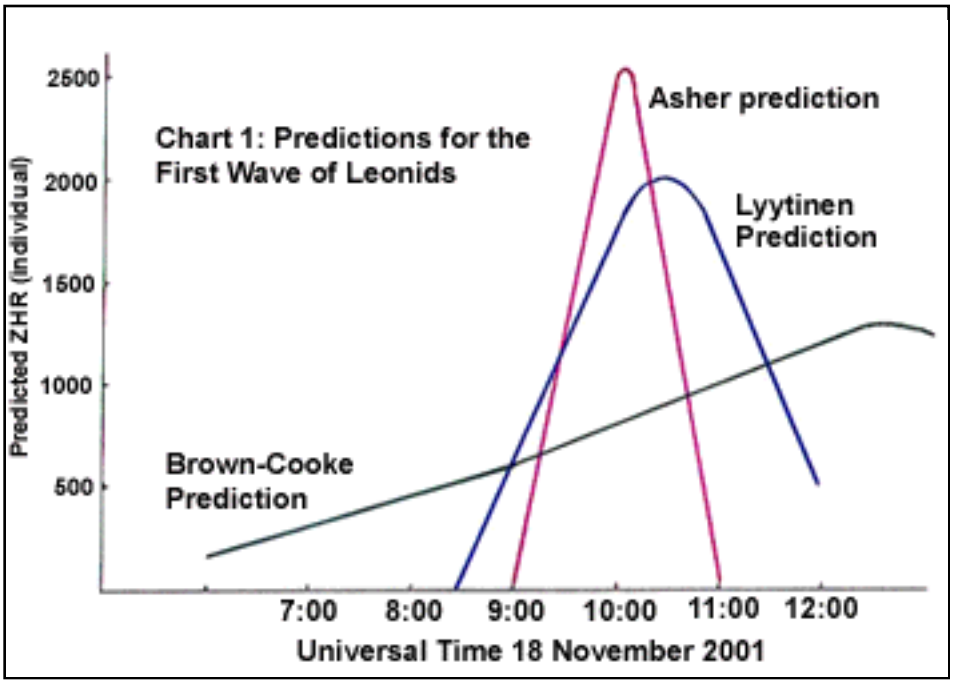
- Peter Brown of UWO, London, Canada and William Cooke of NASA (the Brown-Cooke Model).

Chart 1 displays the three predictions of the first wave of Leonids from the data published in Sky & Telescope. Both Asher and Lyytinen models predicted ZHR <20 until at least 08:30 UT with an explosive rise to >2,000 by 10:00 UT, thereafter plummetting to almost zero. In contrast, the Brown-Cooke prediction was for a ZHR >100 from 05:00 UT - over three hours before other models - increasing steadily to 750 by 10:00 UT. Moreover, Brown-Cook predicted a first wave climax of ZHR = 1,250 at 13:00 UT, three hours later than other models.

*See **Leonids** on Page 6.*

Table 1: Raw Data from the Observational Siting Record at FENCE

Time Interval (UT)	Group of 24		Individual	
	Sitings	ZHR (Group)	Sitings	ZHR (Indiv.)
03:00 - 04:00			18	18
04:00 - 05:00	Group observations		22	22
05:00 - 06:00	started at 07:00 UT		28	28
06:00 - 07:00			54	54
07:00 - 07:15	55	220	26	103
07:15 - 07:30	77	308	36	144
07:30 - 07:45	99	396	46	185
07:45 - 08:00	111	444	52	206
08:00 - 08:15	168	672	74	295
08:15 - 08:30	198	792	87	348
08:30 - 08:45	241	964	106	423
08:45 - 09:00	283	1,132	124	497
09:00 - 09:15	304	1,216	150	597
09:15 - 09:30	401	1,604	198	788
09:30 - 09:45	545	2,180	269	1,070
09:45 - 10:00	rate still increasing, sitings too numerous to count			



Analysis of the Observational Data

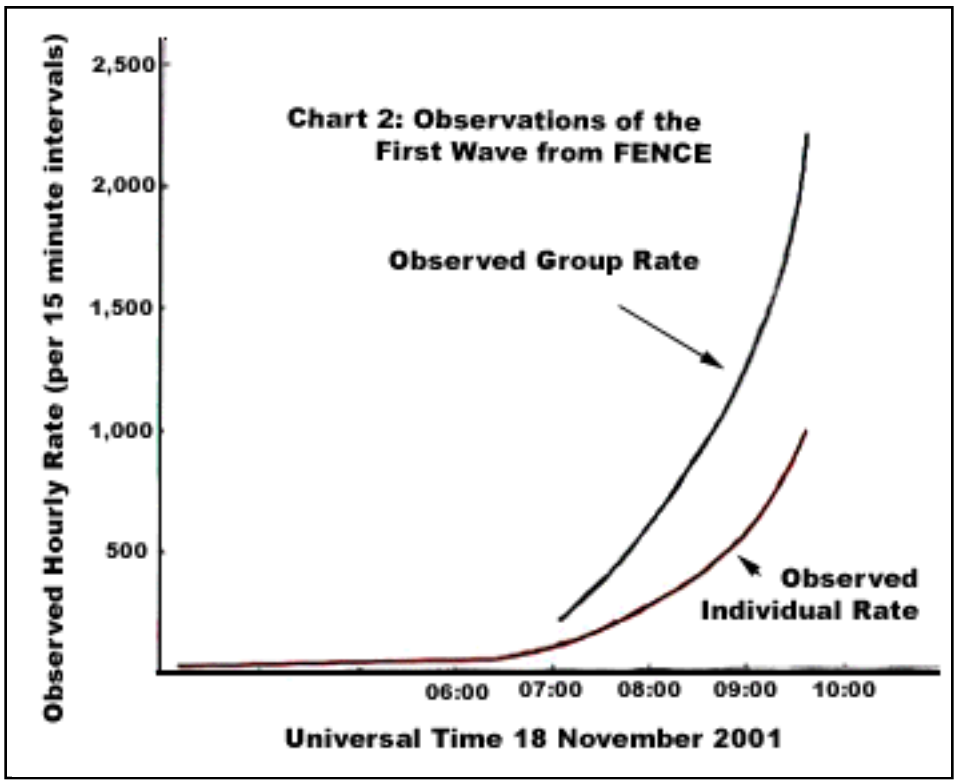
Chart 2 plots the individual and group ZHR as they increased over each 15 minute interval during the First Wave. Note the pre-climax gradual rate increase.

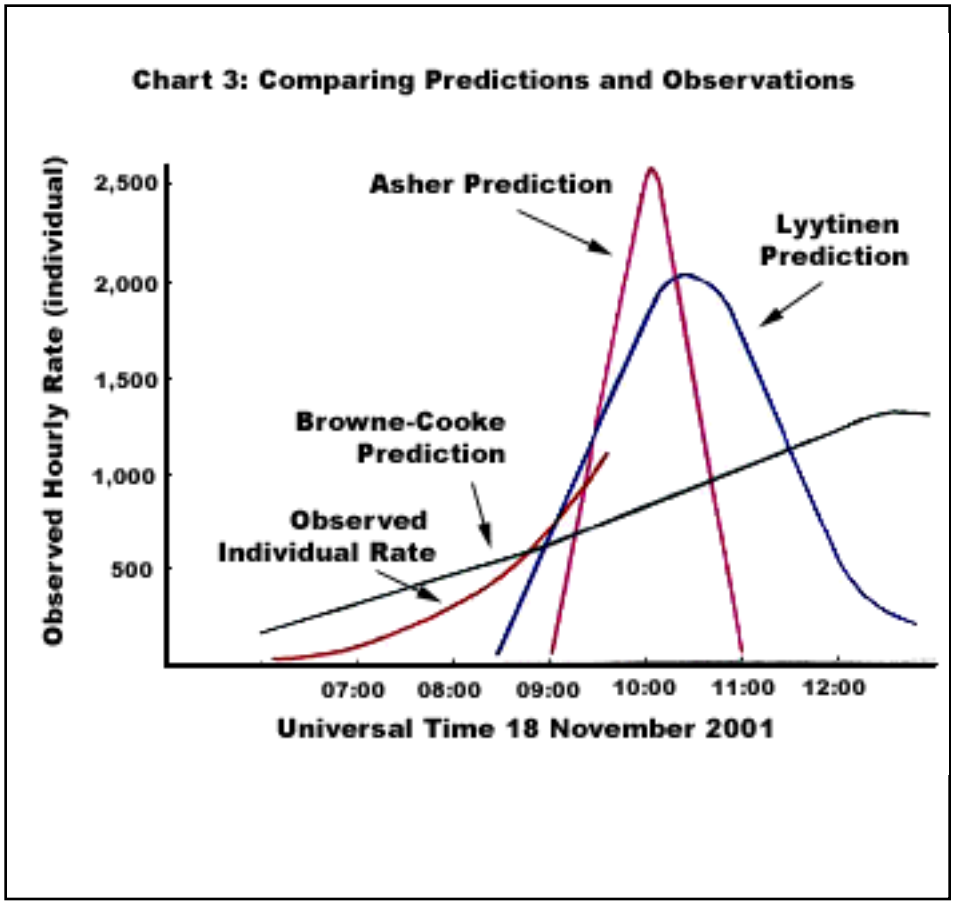
Chart 3 combines the Sky and Telescope predictions from Chart 1 with the individual and group ZHR from Chart 2 (now in red).

Chart 3 indicates that the First Wave individual ZHR rate was 1,070 and still increasing as dawn approached. In the period 09:45 - 10:00 UT meteors fell so often that the group was no longer able to keep up with the shower. Just before sunrise meteors fell from Leo, now at zenith, like the flames from a giant sparkler on the fourth of July, and the storm showed no sign whatever of letting up.

Observers on the west coast of North America may be able to confirm a continued increase in ZHR from 10:00 – 12:30 UT as Brown-Clarke predicted. The rate of acceleration of ZHR at 9:45 was 500 sitings/hr every 15 minutes. Had that rate of increase continued, extrapolation yields an individual ZHR of 1,460 in the 15 minutes ending 10:00 UT and 1,960 in the 15 minutes ending 10:15 UT. Alternatively, western observer data may show that the rate declined sharply after 10:00 UT as was predicted by the Asher and Lyytinen models.

The maximum ZHR for an individual observer was not more than 1,200 at 9:45, and the group ZHR did not exceed





2,500 at any time during the observing period. The many thousands of meteors per hour predicted by Asher and Lyytinen for the first wave, were not observed; neither was the extreme rate of increase predicted by these two models observed.

Conclusion of this Study

This study confirms the gradual increase to approximately 1,000 ZHR predicted by the Brown model.

The data was incomplete due to sunrise. It would be interesting to add to our study, observations from locations on the Pacific coast of North America covering the period from 9:45 – 12:45 UT to determine whether the ZHR continued to increase after 10:00 UT as predicted by Brown-Clarke, or abruptly decreased after 10:00 UT as predicted by Asher and Lyytinen.

This article, completed a month after the event, sought input from west coast observers for the period following 09:45 UT 18 November 2001. The February 2002 edition of Sky and Telescope at page 115 has west coast data - that the First Wave of the 2001 Leonids continued to increase to a rate between 20/min and 30/min (ZHR 1,200 to 1,800) at 10:45 UT 18 November; alas providing no further details.

This additional information extends our Chart 3 data one additional hour, indicating more emphatically that the Brown Model (if ZHR1,200) or the Lyytinen Model (if ZHR 1,800) was accurate, but disproving the Asher Model in both rate of increase and maximum ZHR for the First Wave. The 1766 dust trail of Comet Temple-Tuttle apparently left less particulate debris than the Asher Model had calculated.

The author would like to thank the Foothills Equestrian and Nature Centre for its continued support of astronomical studies, and especially for maintaining the dark-sky site near Landrum, SC.

by: Michael J. Spicer
B.A., B.Ed, M.Div, D.Ed., LL.B.

Editor's note: Michael Spicer was a member of the Hamilton Centre in the 60's and early 70's "when the Great Spot was Red, when you could see 5th magnitude stars from the Mountain Brow, when Ken Chilton wowed us on channel 11 with Holst and astronomy, in the heady days when men drove cars and golf balls on the Moon!"

During the past 20 years while away from the Hamilton Center he spent a great deal of time at university, both studying and teaching -physics and astronomy among other things - and currently practices law in Hamilton. He observes with an 11" Celestron Nextstar GPS with laptop control.

This is Michael's second Orbit article since his return to the Hamilton area. Welcome back, Michael.

SB

Eyepiece *cont'd.*

dent, they cannot enter that stream again. Since finding people to fill these jobs is hard enough, it does not make any sense to put extra restrictions on holding these positions.

The meeting was abruptly ended due to running out of time. Several important items dealt with at the end of the meeting were rushed through, including light pollution abatement. I strongly recommend that anyone in the Hamilton Centre who wants to become involved with the light pollution abatement committee to jump right in. This is one area that the RASC is sadly lacking in showing support. We need more people to help fight this good fight.

In future issues of "Orbit" look for more information about the upcoming G.A. in Montreal. I, for one, will be there.

February does not look like it is going to be any better a month for observing than January and December were. Hopefully, by the time March break rolls around, the skies will occasionally clear and I will have more to report on. I hope to be playing with a IMG1300 CCD camera again for the new Moon period in March and maybe with a bit of experience under my belt and some luck, I will get more to show for it this time.

Clear skies!

MK

Coming Events:

March 7, 2002 - General Meeting at 8:00pm at the Steam Museum. Program TBA.

March 14, 2002 - Board Meeting at 8:00 at the observatory. Come on out and shape the future of the centre.

April 4, 2002 - General Meeting at 8:00pm at the Steam Museum. Program TBA.

April 11, 2002 - Board Meeting at 8:00 at the observatory. Come on out and shape the future of the centre.

May 2, 2002 - General Meeting at 8:00pm at the Steam Museum. Program TBA.

May 9, 2002 - Board Meeting at 8:00 at the observatory. Come on out and shape the future of the centre.

May 25, 2002 - Centre Banquet. Special Guest Matt BenDaniel. Details below.

Directions to Observatory:

From Hamilton or Guelph:
- Hwy 6 N of Hamilton,
- Take Concession 7 East eastbound, cross Centre Rd.
- Continue on 7E, past the rail tracks, proceed to near the end.
- Our gate is on the south side on the last lot (south west).

From Mississauga or Milton:
- Britannia Road past Hwy 25, Guelph Line, Cedar Springs to end
- South 1 block on Milborough Town Line to Concession 7 East.
- Right on 7th Concession, then first driveway on left.
- Our gate is on the south side on the last lot (south west)

From Burlington or Oakville:
- Dundas Street (HWY #5) to Cedar Springs Road
- Cedar Springs Road to Britannia Road
- Left (west on Britannia road to Milborough Town Line
- South 1 block on Milborough Town Line to Concession 7 East.
- Right on 7th Concession, then first driveway on left.
- Our gate is on the south side on the last lot (south west)

Hamilton Centre Observatory
43° 23, 26" N 79° 55, 22" W **Telephone 905-689-0266**

Club web site - http://www.rasc.ca/hamilton/

Bus Trip to GA

The RASC Toronto Centre is organizing a bus tour to the GA in Montreal and you are invited!

The bus will be picking up in Hamilton on Thursday, May 16th (between 6:30 & 7:00 p.m.). We will be stopping in Toronto and Kingston along the way. The cost will be $95.00 per person round trip which will include snacks and entertainment. An optional day program for people not attending the National Council meeting will also be included.

Cheques payable to the RASC Toronto Centre must be received by April 26th, 2002 to confirm the trip. Bookings will be non-refundable but exchangeable.

We hope to have a lot of fun on this trip and look forward to seeing a lot of representation from the Hamilton Centre. For more information, contact:

Denis Grey
dgrey@fido.ca

RASC Toronto Centre
416-832-3031

Hamilton Centre Banquet

The Hamilton Centre is pleased to be hosting a spring banquet on Saturday May 25, 2002. Our special guest speaker at this event will Matt BenDaniel, an extraordinary astrophotographer. A software engineer with a degree from MIT, Matt also teaches a Telescopic Astronomy course at the Boston Museum of Science. He has had numerous articles and photographs published in Sky and Telescope. To see some samples of his work visit "www.starmatt.com".

Date: Saturday May 25, 2002
Location: The Atrium, 5420 North Service Road, Burlington, Ontario.

Take the Burloak Drive exit off the QEW in Burlington, Proceed North on Burloak Drive. It is the first multi-story office building on the west side of the road (Providence Building) The Atrium Restaurant is on the main floor.

Price: $37.50 (a great deal!)

Agenda: 5:00 - 6:00 Happy Hour (cash bar)
6:00 - 7:30 Banquet
7:30 - 8:30 Guest Speaker