

# NOVA NOTES



Halifax Centre



Mar-Apr 1987  
Volume 18  
Number 2

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## Notice of Meetings

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**Date:** Friday, April 17th, 1987 : 7:00 P.M.

**Place:** Nova Scotia Museum. Meeting to be held in the lower theatre. Access from the parking lot and side entrance.

**Topic:** Our 7:00 video presentation will be the **PLANET EARTH** episode entitled **The Sun**, which was broadcast recently on **PBS**.  
At 8:00 our speaker will be **Bill Appleby**, who will be giving a talk on meteorology and how it relates to astronomy.

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**Date:** Friday, May 8th, 1987 .

**Place:** TO BE ANNOUNCED

**Topic:** **HALIFAX CENTRE ANNUAL BANQUET**

Following our custom, the May meeting will be our annual banquet. This year, instead of having our banquet at a restaurant, we have decided to do something different. We will be having a pot luck supper instead. We are still in the process of finalizing the time and place and will probably not have this confirmed until the April Executive meeting. All members will receive a special mailing covering the banquet as soon as possible thereafter.

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

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**About the cover:** The cover this issue shows a reproduction of Galileo's first map of the moon. This was actually the second lunar map drawn with the aid of a telescope; the first being a chart by Harriot. Note that despite the roughness of the drawing, some features are easily identifiable.

# Editor's Report

Patrick Kelly

Most of you may have noticed that the last issue of **Nova Notes** did not include an editor's report (due to lack of room) so this one will be longer than usual to make up for that and for the fact that there is lots of new material suitable for this column which has come up recently.

First of all, I would like to apologize for the delay in getting out the both the January-February and March-April issues of **Nova Notes**. The main reason for the delay was a direct result of my workload for the winter term. In the past, I have always had sufficient free time to work on **Nova Notes**, but this term has been so hectic that it was next to impossible to find time to use one of the Macs and it seemed that whenever I did have the time all of them were being used. The fact that I was still having problems getting the Laserwriter to "co-operate" with me only added to the problem. I was finally able to offer it a deal that "it couldn't refuse". If I gave it proper laserwriter fonts to work with and it gave me page breaks where the Mac said they would be, I wouldn't use it as a deep sea anchor.

Since that time, we (the executive, that is) decided to reinstate the position of Assistant Editor to give me a hand with the newsletter and **Glenn Roberts** has volunteered for the post. He has been a great help in getting this issue together, mostly by typing in articles (the time consuming part). In addition, he has taken over compiling **The Gawker's Report**, which fits in very nicely with his position as Observing Chairman. Glenn has also just moved out to a new "dark site" near Oak Island. For those of you who wish to contact him, please note his new address and phone number on the inside front cover.

Readers who get the **Daily News** may have noticed a new column in their "Inside Today" supplement. One of our newer members, **Rev. Ted MacLeod** is now writing a weekly astronomy column entitled "Starwatch". Under the pseudonym of **Alcor** he plans to write at the beginner's level without all of the usual "technical doublespeak". Having read his first several columns, I am sure that his

column can only grow in popularity. Keep up the good work!

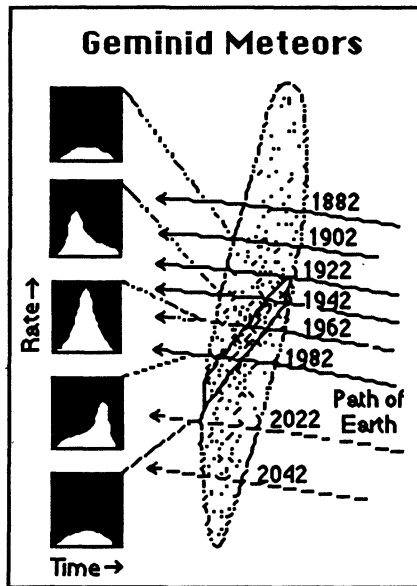
Those of you who are familiar with the organization of the R.A.S.C. at the national level will appreciate the effort that is required to keep the society running smoothly. Considering that most of the actual business is done in Toronto and at the General Assembly, we have been fortunate to have had members from our centre hold National Office positions especially considering all of the necessary time and travel involved. We now have another member who has just been elected to a National Office position. **David Tindall**, who is our present treasurer, has just been elected to the position of National Secretary and will take over this position at the upcoming G.A. in Toronto. Unfortunately for us, we will lose David's services as treasurer, but we know that his many abilities will be a great asset to the R.A.S.C. and we wish him all the best.

For those who were unable to make it to the equinox party after the March meeting, I thought that I might give a brief recap of the evenings highlights. The event was officially opened with the tossing of the sun (a large yellow ballon) over our version of the celestail equator by **Matthew Roberts**, our observing chairman's son. For refreshments we had two punches which were concocted by **Doug Pitcairn**, both of which were well received (and quickly consumed). In addition, there were two choices of astronomically oriented cookies (sun and phases of the moon) and we also had a cake which was cut by our honorary president **Dr. Murray Cunningham**.

Meanwhile yours truly was conducting the "pin the sun on the equinox" contest which had been previously set up, only to realize that we had no blindfold! Fortunately, **Nina Belliveau** came to the rescue and loaned us her scarf. Prizes (including Mars bars) were given out for the five closest contestants along with a prize for the farthest. At least nobody ended up in the black hole! We also were treated to some interesting news from **Bill Thurlow**. Having not seen him at a meeting for a while, we found out that he had been waiting for a new partner for his medical practice to arrive and as they had just started, he was having his first free weekend in months. To console himself, he had ordered a new telescope which had taken quite a

while to arrive as the factory was running behind in production. It had just arrived a few days before the meeting. Bill is now the proud owner of a **17.5-inch Odyssey 2**. It would have been interesting to have been there when it arrived, as Bill recounted that he had not told his wife about its arrival and it was delivered (in some very large crates) while he was out! I just received a gawker's reort from Bill the other day and it looks like he will be finishing the entire NGC at this rate. The only thing that might slow him down is if he accidentally looks at the full moon with his new scope. He might get his night vision back after a week or so!

Lastly, I should mention that I received a phone call shortly after the last issue went out from **Michael Boschat** explaining the mysterious "wedge". At the time, I was not sure whether the wedge was a person, a thing or a theory. As explained in the accompanying chart from **Sky & Telescope**, the wedge is a theorized shape for the actual stream of particles and predicts that the Geminid meteor shower will eventually disappear.  $\Omega$



# Notes Across the Fundy

Len Larkin  
Saint John Astronomical Society

Things are moving ahead well for the Saint John Astronomical Society. Since the November meeting, we've been consolidating the club structure and activities. A tentative constitution and bylaws was presented by Dave Driscoll, was discussed at length and will be voted upon at the March meeting.

Also at our meeting of February 13th, members picked up their handbooks and received copies of a celestial phenomena list, an observing call-out list and an introductory guide to **The Observer's Handbook**.

Rick Hancox gave the premiere presentation of **The Night Sky**, wherein he interwove mythology and fact to give an interesting tour around some winter constellations. I'm sure that everyone present was pleased to hear that Rick will be presenting **The Night Sky** on a regular basis. I supplemented Rick's presentation with some astronomical events for February - the most prominent being the occultation of Spica.

Some of our ongoing club projects are: an investigation of potential observing sites; the organization of a possible tour of the astronomical facilities at U.N.B. , Fredericton; and the gathering of information for future "hands-on" projects.

The cold weather hasn't deterred some dedicated observers (of our 18 member club), and a representative Gawkers' Report is included in this issue of Nova Notes.

We are now meeting in a suitable room, free of charge, thanks to the Recreation and Parks Department of Saint John. I would also like to say thanks again to Darrin Parker, and the Halifax Executive in general, for allowing our club to retain the profit from the sales of the 1987 Observer's Handbooks. The members were very appreciative of the offer.

Pleasant Observing! Ω

# Astronomy in Southampton, England

David Chapman

Before moving from Nova Scotia to Southampton for a two-year stay, I consulted the directory of astronomical clubs that the Halifax Centre keeps in its library, and learned that there were several clubs in the area. Once settled in, I phoned one of the contacts for the Southampton Astronomy Society. The Society meets at the University of Southampton on the second Thursday of each month for a speaker's night and on the fourth Thursday of each month at a member's home - a different one each month - for an observing night. In the event of bad weather, the latter still proceeds, but the activities remain indoors. They have about forty members, five of which are junior members. About half of the members show up at any given speaker's night; perhaps ten or so at the observing nights.

I have been to the January, February and March speaker's nights, and have found the Southampton Astronomy Society to be an enthusiastic and friendly bunch. They have made me feel most welcome and were pleased to receive my "application" for membership (a formal lot, these British). We have had talks on astrophotography, Voyager 2 at Uranus and the origin of the solar system. Most recently we had a brief report on the supernova in the southern hemisphere from a member who regularly scans his weekly **New Scientist** for astronomical news.

They have a library, much like the Halifax Centre's and several telescopes for loan to members. Most members have their own telescopes and are eager to show them off at observing nights. One electronics wizard has entered the video age and those who won't brave the British winter nights can elect to stay indoors and view the sights through the telescope on his TV set! I have not yet made it to an observing session, but hope to soon. The Society publishes a newsletter every two months and a journal three or four times a year. The newsletter announces meetings and reports on club activities, while the journal is meant for longer articles on astronomical topics.



Also on the publishing front, I would like to announce the publication of a new astronomy magazine: **Astronomy Now**. It is published by Intra Press, 16 Garway Road, London, W24NH, United Kingdom (£18 per 12 issues for overseas subscribers). Patrick Moore is on the editorial board. I bought the first issue (April - June 1987) at my newsagent. It is an attractive, well-written publication at par with **Sky & Telescope** and **Astronomy**, although the editors claim that they are not trying to compete with the U.S. publications, but want to provide a forum for astronomy with a British slant. The premier issue had articles on Miranda (the moon of Uranus), pulsars (by Professor Sir Francis Graham-Smith, the Astronomer Royal), the William Herschel Society and astrophotography.

Patrick Moore is quite a celebrity here: everyone knows who he is through his weekly television series "**The Sky at Night**", which is in its thirtyth year. As a consequence, astronomy has quite a high profile as a hobby. Far fewer people confuse it with astrology, although I am told that this happens in the U.K. too; only last week I found astronomy books in the section of a bookshop labelled "occult".

In Canada, most astronomy enthusiasts belong to the R.A.S.C. through membership in an authorized regional centre. In Britain, most of the local astronomy clubs are autonomous and do not have a national organization. The British Astronomical Association (BAA) is a London-based organization for serious amateurs and is organized into various sections: lunar, solar, planetary, variable stars, etc. Most meetings are held in London, but they occasionally have major meetings elsewhere.

I have thoroughly enjoyed my monthly outings to meetings of the Southampton Astronomy Society. I find that being a member of a club is important in maintaining my interest, but also helpful in making new friends in an unfamiliar town. The common interest of astronomy earns instant acceptance and astronomers, as we all know, are a friendly and sociable lot. I also look forward to my copies of **Nova Notes** and the **National Newsletter and Journal**, which keep me posted on activity on the home front. Happy observing!  $\Omega$

# Betelgeuse

**Peter Jedicke**

reprinted from **Astronomy London**

Astronomers have no scalpels. To dissect a star, astronomers have only the information gleaned from the electromagnetic radiation they collect with their telescopes. Clever application of logic to light has nevertheless resulted in a remarkably detailed theoretical view of a star's anatomy. What does the vivisection of Betelgeuse reveal?

One simple measurement is the determination of which color predominates in the visible spectrum of a star. This, in turn, allows a straightforward calculation - Wien's Law - which yields the general surface temperature of the star. Betelgeuse, well-known for the redness of its light, has an astronomically cool temperature of just under 4000 Kelvins.

Knowing how bright it appears in our winter sky, and having determined its distance from the solar system - by measuring its tiny trigonometric parallax - to be some 200 parsecs, astronomers can also calculate its true brightness, or Absolute Magnitude. For Betelgeuse, the figure is -6.

These two facts - its surface temperature and Absolute Magnitude - are plotted on the x- and y-axes of the famous Hertzsprung-Russell (H-R) diagram. Betelgeuse's potent combination of cool temperature and extreme brightness put it far from the average stars, up in the top right corner of the graph.

By similarly plotting thousands of stars, astronomers have grouped them into "branches" running more or less from the top left to somewhere on the right side of the H-R diagram. Astronomers have labelled the uppermost branch with the Roman numeral I, and, when large quantities of stars are included, this branch seems to be split on the right side of the H-R diagram. The upper sub-branch is known as Ia ("Bright Supergiants") and the lower as Ib ("Supergiants"). Betelgeuse, as it happens, is plotted more or less between the two branches. Hence, it is often referred to by astrophysicists as a "Iab" star.

Denizens of these upper branches are known as supergiants because astronomers theorize that they must be many times more massive than the Sun in order to shine so

brightly. A blue supergiant has an extremely hot surface and, although the heat is not generated in the outer surface, it must be held there by relatively dense outer layers. Betelgeuse and the red supergiants, on the other hand, display significantly cooler surfaces.

For all glowing objects, a square inch of surface emits more light the hotter the object is, and less light if it is relatively cool. In fact, the energy emitted depends mathematically on the fourth power of temperature (according to Stefan's formula), and so each unit area of the surface of a blue supergiant may be pouring out energy about 1000 times as fast as an equal area of Betelgeuse's surface.

How, then, can Betelgeuse have the same overall brightness as a blue supergiant? It can only generate the same total amount of light if energy is pouring out from a much larger dissipating area. This is how astrophysicists know the red supergiants to be the very largest of all classes of stars.

Since Betelgeuse is the closest of the few red supergiants which are easily observed, it seemed reasonable to astronomers in the early 1920's that Betelgeuse would show the largest angular disk of any star in the heavens, aside from the Sun. The precise size of the disk in angular units was measured by an interferometric technique in a famous observation by Michelson and Pease in 1922.

They attached small mirrors to the ends of two long booms extended across the aperture of the 2.6 m telescope at Mt. Wilson, and pointed the telescope at Betelgeuse. Other mirrors redirected the light through the instrument and the astronomers were able to observe interference fringes in the two beams of light from the star. By observing the changes in the fringes as the mirrors were moved slightly on the extended booms, they were able to calculate that the star's angular size was between one-twentieth and one-thirtieth of a second of arc.

What is a very tiny angle nevertheless corresponds to an enormous diameter at the distance of Betelgeuse, and more recent attempts using a variety of techniques yield a diameter of one and a half BILLION kilometres. The young Clyde Tombaugh, who discovered Pluto in 1930 and was enchanted with large numbers, once calculated the volume

of Betelgeuse in cubic inches. The modern value: 10 to the 41!

In fact, the size is so large that astronomers have used an image-enhancing technique called speckle interferometry to resolve and photograph the visible disk. Although the resulting pictures are not particularly clear or convincing, they do show large spotted areas which could prove to be actual features on Betelgeuse.

This is not entirely unexpected, because theoretical models of the interior and atmospheric structure of stars - devised some years ago and continually refined since - have hinted that hot gases move up and down on a vast scale in a star. Photographs of our Sun's surface readily show "granulation": pockets of hot material bubbling up from underneath. Such bubbles are typically a thousand kilometres across or more and can be seen to appear and disappear over mere minutes. Such movement of hot matter is called convection, and can be observed even in so common a situation as a pot of water set to boil on a kitchen stove. For the Sun, theory predicts that such vertical motion may extend, in three layers, to a depth of tens of thousands of kilometres below the surface - but the same theory, applied to Betelgeuse, indicates that convection may extend all the way down to the outer edge of Betelgeuse's core.

This has serious implications for the process of nuclear fusion which astronomers are sure is the energy source of stars. The reason a star like our Sun is thought to be reasonably stable over a period of billions of years is that nuclear fusion takes place at the slowly-expanding outer surface of the core. Since there is almost no stirring up of the material in and around the core, the fusion process is slowly eating its way outward from the centre of the Sun in an almost leisurely fashion - if nuclear fusion can ever be said to be leisurely!

Inside Betelgeuse, however, convection has dredged up the recent products of the nuclear fusion cycle, such as the isotope carbon-13. The abundance of this and similar isotopes as observed in the spectrum of the surface of Betelgeuse confirms the theory. Deep convection is a severe disruption to the stability of a stellar core and Betelgeuse is probably undergoing evolutionary changes at a much faster pace than a star like the Sun.

Convection is also at work above the bright surface of Betelgeuse. As long ago as 1939, the Doppler effect was used to determine that the gas in the outer layers of Betelgeuse was moving outward at 15 kilometres per second or more. Significant quantities of gas already escaped, long ago, and now form a spherical envelope or shell around the star. The first direct evidence of such circumstellar shells around supergiants came from observations of the double star Alpha Herculis. By the nature of their spectra, one star was known to be a red supergiant and the other a main sequence star similar to the Sun. In 1956, Deutsch determined that light from the main sequence star was being partly absorbed by matter surrounding the supergiant. The two stars are separated by 4.7 seconds of arc, indicating that the shell around the supergiant extends at least 100 BILLION kilometres out from the star!

For Betelgeuse, which does not have another star along the line of sight for astronomers to measure, a different measurement was required. Such evidence was finally found in 1975, by A.P. Bernat and D.L. Lambert at the McDonald Observatory in Texas. They detected a particular wavelength of light associated with atoms of neutral potassium, which were suspected to be present in a circumstellar shell. Their telescope was aimed slightly away from the brilliant pinpoint of Betelgeuse's light, and their subsequent calculations indicated that the gas envelope covers as much as five seconds of arc - a size which would make the shell visible even in modest telescopes, if only the light from it were bright enough. In fact, similar observations a few years later extended the outer edge of the envelope around Betelgeuse to over a TRILLION kilometres - light from the surface itself would require over two months to traverse the gas shell! In the outer reaches of this incredibly vast globe, the density of the potassium atoms which were observed is almost ridiculously low: each individual atom is the lone occupant of a volume roughly the size of a household refrigerator. This may not seem like much, but there are about a million trillion trillion such imaginary almost-empty refrigerators in the gas shell.

It is also possible to measure the speed at which atoms at various depths in the shell are travelling by selecting specific wavelengths associated with the particular atoms at

those depths. Surprisingly, there is one layer which does not seem to be expanding. Beyond this layer, the outward convection resumes, and astronomers estimate that Betelgeuse is losing the equivalent of the Sun's mass in only a few million years.

Since Betelgeuse, for all its colossal size and volume, only has a total mass of some 15 times that of the Sun, the star cannot keep up this cosmic spendthriftiness for very long, as stars' lifetimes are measured. It seems likely that Betelgeuse will undergo some drastic changes in the next few million years - possibly even a supernova explosion. So rush out and get your smoke detectors today!  $\Omega$



## Meteor Observing By Radio

**Michael Boschat**

It is a clear, moonless night in August, with a nice, warm temperature, but it is too hot to observe (this applies to meteor showers in December, when its too cold), so how can one observe meteors comfortably? Well, if you have either a shortwave or FM radio, you are all set to observe the showers. How do you do that? Very simple, tune your shortwave to WWV or CHU time signals; if you use an FM radio, go to an unused station (say 109 MHz). Now listen to the signal; if and when a meteor goes by, it ionizes the air, the station signal is bounced off the trail, and a station which is not heard will come on for a few seconds then fade, and you will hear the "sssing" of the frequency until another meteor goes by. As for WWV or CHU, the same applies - a brief increase in their signals.

Another method is to use either channels 17,24, or 52 on the UHF part of your TV. In this case, the video will appear briefly for a few seconds, then you get the snow and hissing sound back (the transmitters are below the horizon, which is what is required for radio meteor detection).

The type of antenna is not really important, but if you get into radio meteor work, you can use a directional type

antenna (the ones from Radio Shack or Sears for \$40.00 are good; get a VHF-UHF one, then your range will be increased).

At present, I use an FM radio, and have heard many meteors in an hour; with the TV on Channel 17, only a few meteors. The reason is the speed of the meteors vs. the MHz used; with a higher MHz, you get the faster meteors, while with a lower MHz, you get the medium to slow meteors. So far, it has been the slower meteors outdoing the faster ones.

Try the above methods on upcoming meteor showers, and give a report on your results at a R.A.S.C. meeting or observing session.  $\Omega$



## TV Filters for Meteor Observing

**Michael Boschat**

A brief review of what is needed to detect meteors using a television set will be given in this article. Basically, what you need is a clear channel where all you get is "snow" except for occasional bursts. The lower the frequency of the channel, the more frequently meteor bursts will be heard. Since channel 2 has the lowest frequency of all stations, it is best suited for this purpose. However, depending on your location, you may find that you can pick up channel 3 broadcasts on channel 2. In order to eliminate this source of interference, two things are required. A filter, to eliminate the signal from channel 3 and eventually, some sort of preamplifier to hear any meteors.

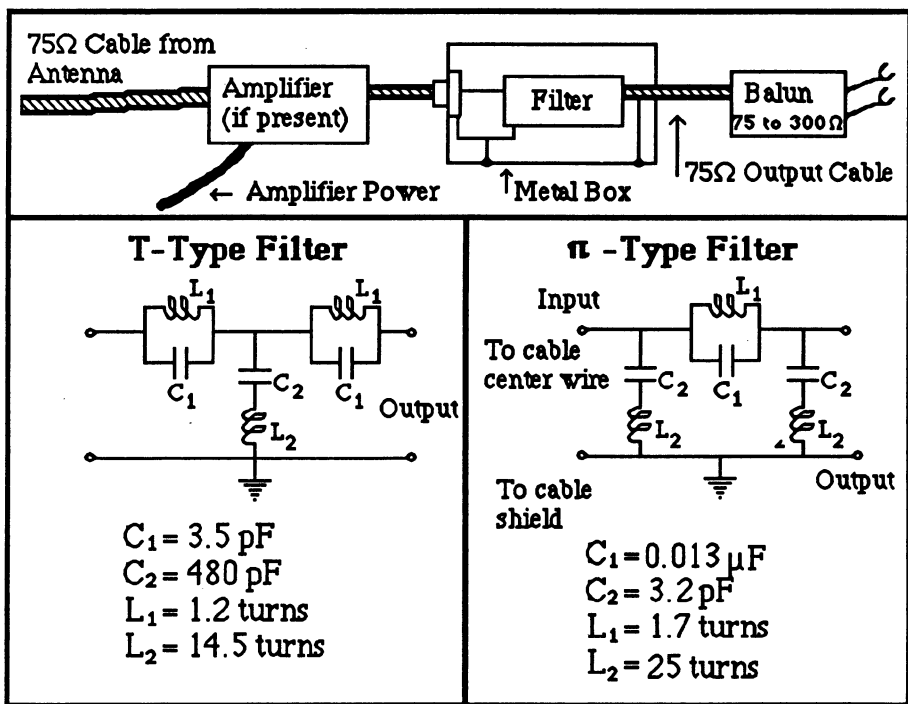
On the assumption that any amplifier that you purchase will have a  $75\Omega$  input/output impedance, there are two filter designs that will eliminate channel 3. Either of these needs to be mounted inside metal boxes that can be grounded to the ground side of your coaxial cables. Otherwise the channel 3 signal will get back onto your wires. The parts needed can be purchased from Radio Shack or any other electronics supply store.

See the accompanying figures for details. Here are

some notes on construction which you will probably find useful: The coils are made from number 25 wire, that must be insulated or enameled. To get the turns, wind it around an ordinary lead pencil. The coils  $L_1$  and  $L_2$  should **not** be mounted close to each other. You may have to add several capacitors in parallel to get capacitors of the required values. You may have to tune the filter by varying the turns of the coils if the capacitor value does not quite match the required values.

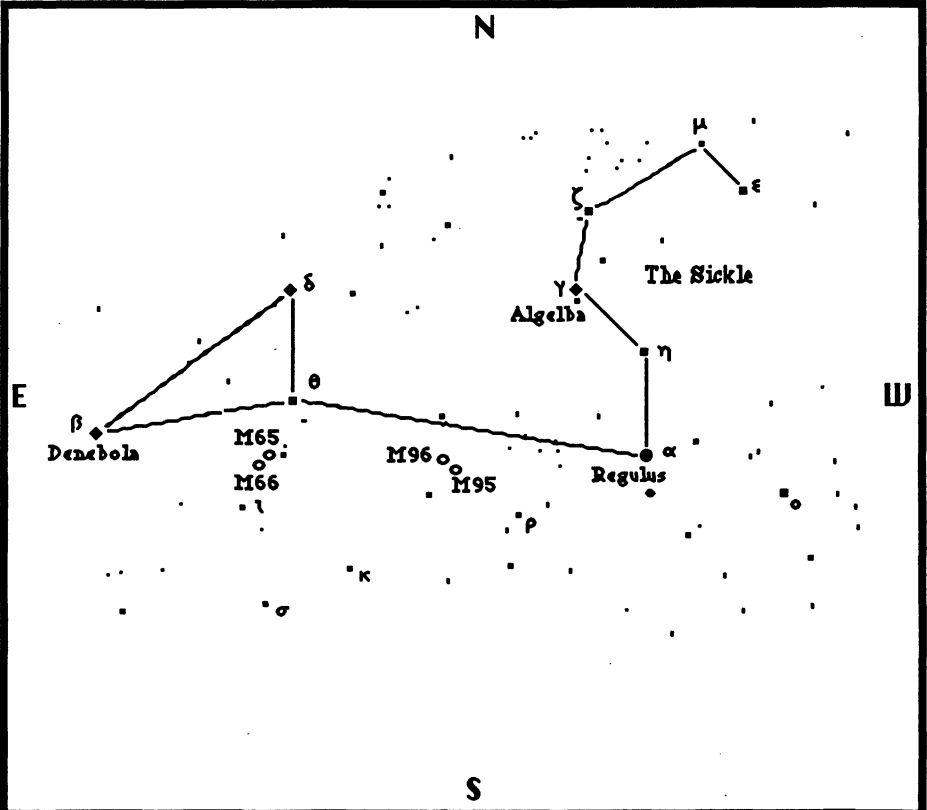
With the filter in place you should be able to hear faint signals much better. You will be able to see brief images on your television from stations in New York or Boston. A three element yagi or dipole antenna can be used to improve the signal. Point it southwest and check the TV. This type of arrangement will be useful for all meteor showers, irregardless of the weather.

I would like to thank Dr. David Meisel, director of the American Meteor Society in New York for his assistance.  $\Omega$





## Constellation of the Month - April



**April 15th**

**0h00 UT / 9:00 P.M. ADT**

### Leo - the Lion

<u>Object</u>	<u>Type</u>	<u>Mag</u>	<u>R.A. (2000)</u>	<u>Dec</u>
M65	Galaxy	9.3	11h 18m	+13° 13'
M66	Galaxy	8.4	11h 19m	+13° 07'
M95	Galaxy	10.4	10h 43m	+11° 49'
M96	Galaxy	9.1	10h 46m	+11° 56'
NGC 2903	Galaxy	9.1	9h 32m	+21° 30'





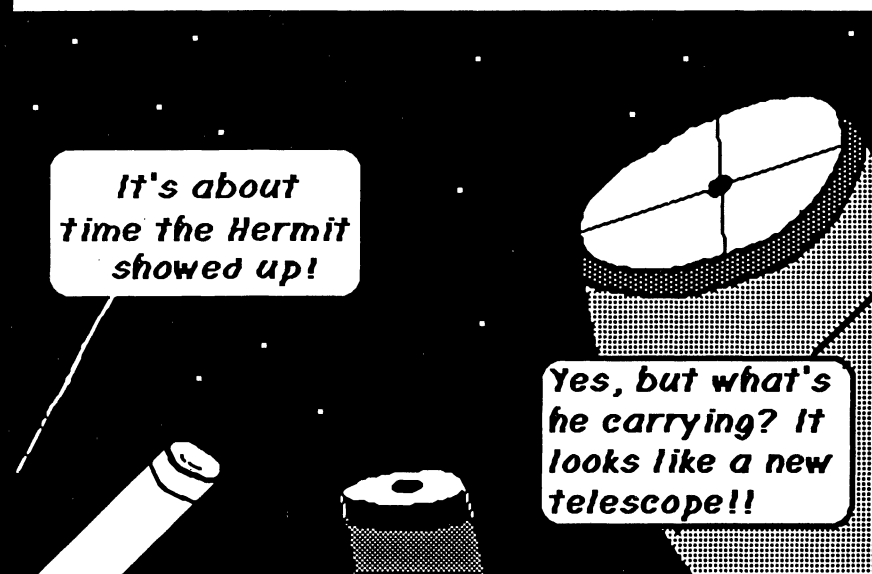








# GA☆ZER



*It's about  
time the Hermit  
showed up!*

*Yes, but what's  
he carrying? It  
looks like a new  
telescope!!*

*Well, if it is, it's  
the strangest looking  
scope I've ever seen.*

*HEY, HERMIT!  
WHAT KIND OF  
SCOPE IS THAT?*

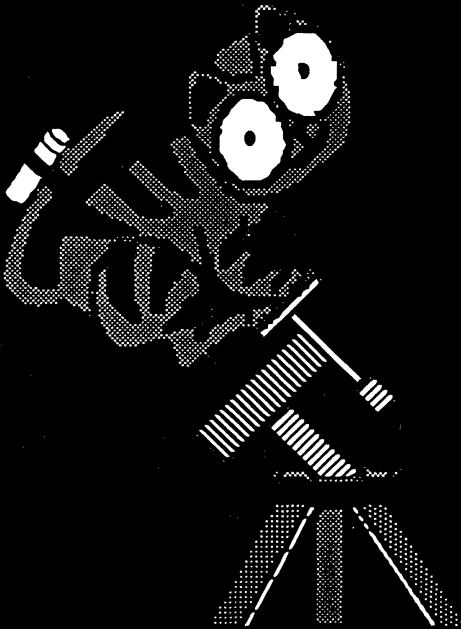


*It's a binocular cat!*

*You heard me! If you don't believe me, come over and see for yourselves!*

*A WHAT?*

*Come on, guys. This I've just got to see.*



*Well, I'll be!*

*It's amazing!*

*Where do you put the eyepieces?*

## NOVA NOTES INDEX

**March - April 1987**

**Volume 18, Number 2**

1987 Halifax Centre Executive.....	Halifax. Centre	29
Notice of Meetings.....	Halifax. Centre	30
Editor's Report.....	Pat Kelly	31
Notes Across the Fundy.....	Len Larkin	34
Astronomy in Southampton, England.....	David Chapman	35
Belelgeuse.....	Peter Jedicke	37
.....reprinted from <b>Astronomy London</b>		37
Meteor Observing by Radio.....	Michael Boschat	41
TV Filters for Meteor Observing.....	Michael Boschat	42
Constellation of the Month.....	Glenn Roberts	44
Gawker's Report.....	Glenn Roberts	45
"Herman" Cartoon.....	Gary Unger	50
Gazer.....	Pat Kelly	51

NOVA NOTES is published bi-monthly by the Halifax Centre of the Royal Astronomical Society of Canada in January, March, May, July, September and November. Articles for the next issue should reach the editor by May 8th, 1987. Articles on any aspect of astronomy will be considered for publication. The editor is:

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# HALIFAX CENTRE - R. A. S. C. 1987 CALENDAR OF EVENTS

## May 1987

S	M	T	W	Th	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	<u>30</u>
31						

## June 1987

S	M	T	W	Th	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				

## July 1987

S	M	T	W	Th	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	

## August 1987

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

Key to calendars:

Meetings: outlined

Special days: **shadowed**

Observing sessions:

**bold and underlined**

- Special Days:
- May 4 - Venus 0.6° south of Jupiter
  - May 5 -  $\eta$  Aquarid Meteors
  - May 8 - Annual Banquet - watch for details
  - May 15 to 18 - General Assembly in Toronto
  - July 29 - South  $\delta$  Aquarid Meteors
  - July 31 - August 3 - Camping Observing  
Weekend
  - August 12 - Perseid Meteors

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