FROM

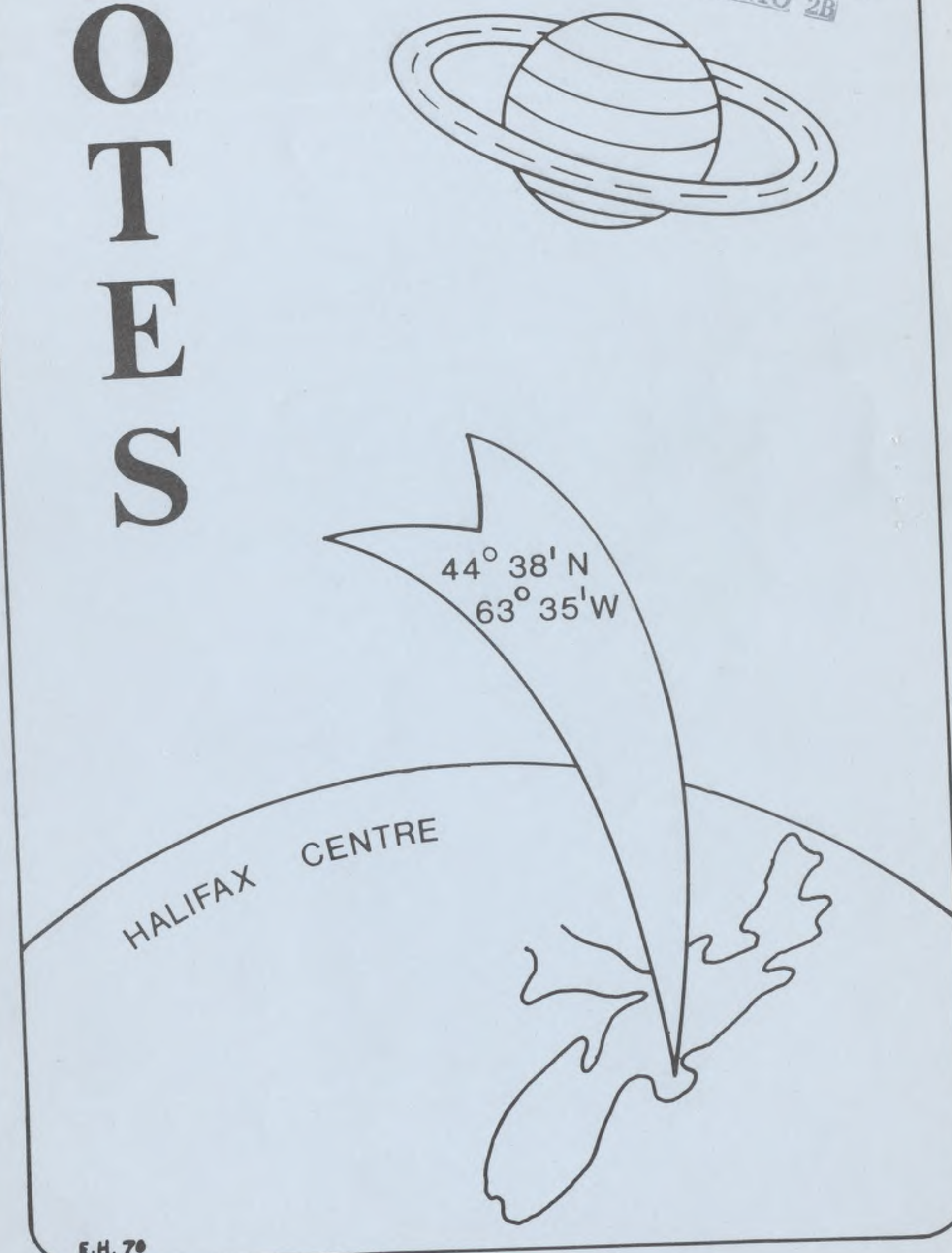
HALIFAX CENTRE R.A.S.C.
1747 SUMMER ST.
HALIFAX, N. S.

Mar 74

TO

ROYAL ASTRONOMICAL SOCIETY,
252 COLLEGE ST.,
TORONTO, ONTARIO.

NOVA NOTES



Editor's Page

It took me 42 seconds to fill mine out! I'm talking about those Postal Code forms. Where is yours? I have 13 out of 80 that I sent out!!! The first one came back the day after I sent Nova Notes out...it was Father Burke-Gaffney's. Thank you,Father... Will at least ONE of you send me your postal code?! I've been worried all during study break that my desk was going explode,fall through the floor or do something terrible,since I have THIRTEEN of those "Postal Code Cards". Whowee! Try saying "Postal Code Card", quickly,three times... Tell me,what does a "postal cole cord" look like?

One member of the Executive that we don't usually hear from is the Treasurer. Well this month Peter Stokoe has ventured outside his vault. He has discovered that wounderful invention,the typewriter! Eager to try his hand at it,he typed up the Treasurer Report. Look for it in this issue(if I get a chance to look for it,on my desk!).

Nebulous just about has his article ready. He says he will run it during the summer issues of Nova Notes. It will be going by John Shaw's title. Well,has Nebulous got you guessing?

Do you read and enjoy Sky & Telescope? If you do and you do,then you are going to love this month's meeting. Show up,you'll be glad you did...

Keep those letters and articles coming in...I can use everyone of them! You can mail them (6¢) to either my home address or the Museum. Send them to:

The Editor,"Nova Notes"
c/o The Nova Scotia Museum
1747 Summer St.
Halifax, N.S.

or

(the same guy)
P.O. Box 201
Bedford, N.S.
B0N 1B0

Peter Edwards
The Editor

Minutes of the Meeting
February 15, 1974

In the absence of the senior executive, Walter Zukauskas opened the meeting at eight o'clock. About fifty people were in attendance.

Peter Edwards announced that the missing pages in the February Nova Notes will be appended to the March number. Careful reproduction of some astrophotos demanded the delay.

We received word through Randall Brooks that the National Council has accepted our invitation to hold the 1975 General Assembly in Halifax.

Dr. Reynolds introduced the evening's speaker, Dr. E. W. Guptill, physicist, yachtsman and navigator. To describe the tone and style of this talk is virtually impossible, for these are uniquely Dr. Guptill's. Baldly summarized, he illustrated the apparent complexity of celestial navigation with its profusion of tomes and terminology. Compounding this complexity are the practical hazards of navigating at sea--rolling boats, fog, crew members and boat owners. Dr. Guptill recounted a few of his experiences as a navigator in the Marblehead-Halifax yacht races. Then stripping away the complications, he showed us the essential simplicity of celestial navigation. Armed with only a sextant and clock, a table of stellar coordinates and some elementary geometry, we can fix upon two or three "celestial lighthouses" and find our place in the world. By all accounts, this talk was found enjoyable and enlightening.

Following a short break, Peter Edwards gave us a full color slide show. From the wide views of Orion to the close-ups of Saturn, the variety of subjects and techniques shown by Peter helped make this presentation enjoyable and encouraging for the rest of us. Peter's comments enlivened the proceedings.

Refreshments helped sustain the conversation until adjournment at about ten o'clock.

W. Z.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA
HALIFAX CENTRE

TREASURER'S REPORT
FOR YEAR ENDED DECEMBER 31, 1973

Balance from 1972	$ 85.50
REVENUE	
Membership Fees	367.50
Educational Activities	143.22
Sale of Handbooks, etc.	5.50
Interest	.28
Life Member Grants	12.00
Miscellaneous	40.00*
Total	$ 654.00
EXPENDITURES	
Fees Remitted to N.O.	$ 220.50
Meetings and Newsletters	64.35
Equipment and Supplies	165.30
Educational Activities	44.94
General Expense	1.40
Miscellaneous	40.00*
Total Expenditures	$ 536.49
Balance carried to 1974	$ 117.51

* Collection for and donation to Children's Hospital Child Life Program.

Peter K. Stokoe

Treasurer,
RASC Halifax.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA
HALIFAX CENTRE

ITEMIZED STATEMENT OF REVENUE AND EXPENSE FOR YEAR ENDED DECEMBER 31, 1973

R E V E N U E

Membership Fees		367.50
Regular memberships for 1972-3	20.00	
Student memberships for 1972-3	10.00	
Regular memberships for 1973-4	337.50	
Educational Activities		143.22
Gift to Speaker's Fund (for expenses of visit of Dr. Iwanowska)	20.00	
Summer Telescope Workshop	123.22	
Sale of Handbooks, etc.		5.50
Sale of Handbooks	5.50	
Interest		.28
Interest on Bank of Nova Scotia account	.28	
Life Member Grants		12.00
Life Member Grants for 1973-4	12.00	
Miscellaneous		40.00
Collection for Child Life Program	40.00	
TOTAL REVENUE		$ 568.50

E X P E N S E

Fees Remitted to [illegible]		220.50
Memberships for 1972-3	18.00	
Memberships for 1973-4	202.50	
Meetings and Newsletters		64.35
Postage stamps for Nova Notes	60.00	
Postage stamps for the Handbook	4.35	
Equipment and Supplies		165.30
Shipping charges for mirror grinding machine	21.80	
Motor for mirror grinding machine	20.28	
Summer Telescope Workshop	123.22	
Educational Activities		44.94
Expenses of visit of Dr. Iwanowska	44.94	
General Expense		1.40
Bank chequing charges	1.40	
Miscellaneous		40.00
Donation to Children's Hospital Child Life Program in memory of the late Dr. Helen Cunningham	40.00	
TOTAL EXPENSE		$ 536.49

PRESENT IDEAS ON BETA LYRAE - Part 2 R. C. Brooks

The models presented last month were based primarily on spectroscopic observations and were formulated between 1957-68. However, photometry has not been neglected and several models have arisen from this work. 1959 saw an international effort on observing β Lyrae with the result that the light curves are well determined. More recently (1972) the Orbiting Astronomical Observatory (OAO) has measured the light curve at several λλ's down to 1380 Å with some interesting and unexpected results. But first let's look at the ground based observations and resulting models (1960-69).

One must first be aware of some necessary precautions when interpreting photometric data for β Lyrae. It has been determined that the U colour is variable by $.3^m$ over several periods and by as much as $.05^m$ over a night. This is now being observed for a period of years. There are two possible causes: 1) gas streams in the system are being eclipsed and hence emissions are blocked or 2) there is some evidence that comparison stars are variable --in particular α Lyrae.

From the light curve (Fig. 2) in last month's issue you can see that the decline to PE is sharper than the rise--this was first observed by Stebbins in 1916 but even more distinctly than in recent observations. The assymetry is tentatively correlated to the assymetry of the gas streams as shown in the model (Fig. 3). Stebbins also noted that the width of PE varied from period to period and again the varying density of the gas streams seems to be the appropriate solution. By subtracting the B & V and U & B channels colour changes can be monitored. For B-V, PE is $-.07^m$ (more red) and may be due to the colour of the F* ; however, during SE there is no change but following SE the system shows a colour change of .02 due to the gas streams. During PE U-B is $-.13^m$ and at SE $-.07^m$. Other colour effects are observed, such as a difference of .02 mag. between maxima after SE and after PE. Danjan observed that the maximum magnitudes M_1 and M_2 (1 referring to maximum after PE and 2 to maximum after SE) are periodic, ie. $M_1 > M_2$ then $M_2 > M_1$, and have a period of 155.7^d. From 1945-6 observations Guthenick concluded that PE is an annular eclipse and SE is total as the model would suggest if the plane of the system were in our line of sight (ie. i 90°). Wood and Walker in a 1960 paper suggest that PE is total and constant for .03 of the period.

The first model is by Wolf and Bolton and in it they assumed a total eclipse at PE with the result that their assumed spectral type, B9.5, is very dependant on the rectification theory used to determine it from the light curve. They analyse colours and temperatures on the assumption that limb and gravity darkening compensate one another and that the stars radiate as black bodies. Thus the B9.5 primary with an assumed T = 10,500°K yields an A7 secondary at 7700° ± 400°k. The question was raised after the theory was published whether they considered the possibility of the B* being subluminous since spectra indicate an earlier type primary and hence supposedly hotter, say 12,000°k. (In contrast in the most recent paper on β Lyrae, however, the B* is considered overluminous). The second theory is by the same two and in it they considered cases where the ends of the eclipse were hotter and cooler. This suggested that an anti-reflection effect was working which was not compatible with Danjan's earlier observation that reflection contributed about 1% to the temperatures observed at the ends of eclipse. The errors on his calculation were small enough that an anti-reflection effect was not possible and this theory was quickly discarded.

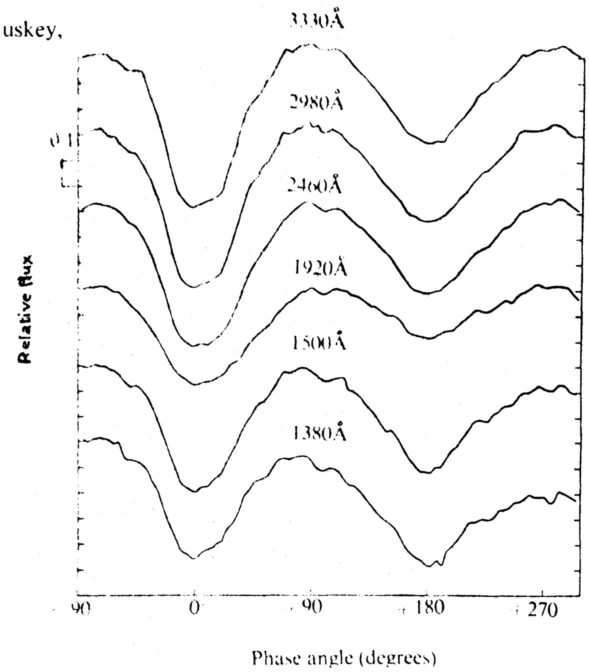
The third model was formulated in 1962 by Huang. In his model the geometrical ellipticity of the B component is theoretically calculated to be .19. Just how realistic this is is not apparent since it does not allow the stars to fill their Roche critical potential. Haung uses the rate of mass transfer to show that the photosphere of the primary is very close to the contact lobe (2nd Lagrangian point). The rate of mass transfer is taken as 10^{21} gm s^{-1} which would yield a photosphere density of 10^{-10}gm/cm^{-3} and a velocity of 10 km s^{-1} (v. of sound). The radius of the photosphere is thus 10^{12} cm with an atmospheric scale height of 10^{9} cm. which just fills the Roche Limit. To represent the F* he uses .19 ellipticity and a transparent star but these predict neither colour nor spectroscopic changes. A disc (7700°k, $2R_{\odot}$) with a star at the centre predicts both. In summary, the basic differences between spectroscopic and photometric models are these additional features needed for the photometric models: 1) a disc of gas about the F* 2) the secondary must be subluminous 3) the Primary is hydrogen deficient due to the gas streaming.

1971 saw the first attempt at explaining β Lyrae by using a black hole secondary and since then several articles have been published arguing the pros and cons of this theory. It is an interesting exercise to follow the pattern of arguements chronologically to see how ideas evolve in astronomical research. In Devinney's Sept. '71 paper the central issue concerned the absolute masses of the two components. The spectra give only the mass function ($8.5M_{\odot}$) and there are any number of solutions for the masses. The ratio of masses, q, (M_{BRT}/M_{FNT}) cannot be > 1 for the following reasons: 1) Sahade considered the possibility where the emission features were due to the secondary. If such were true, the mass ratio would be considerably less than one; 2) the M_V (-3.4) of the bright component has been found independantly from the spectrum and from distance determination. Such a luminosity is inconsistant with the required mass if q > 1; 3) by using the distance with an assumed brightness temperature to find the area of the primary, one may find the 'absolute' radius. This can be compared to the radius of the orbit and again gives q < 1. The following table gives the minimum absolute masses which satisfy the observed mass

Table 1

M_{BRT}/M_{FNT}	M_{FNT} (solar masses)	$M_{BRT(B8)}$ (solar masses)
0	8.5	0
1/4	13.3	3.3
1/2	19.2	9.6
1/1	34.0	34.0
2/1	76.5	153.0

Fig.4 OAO light curves of β Lyrae given by Kondo, McCluskey, and Houck.



function; however, it is immediately obvious that the F* must be very strongly underluminous. Divinney's aim was to determine the mass ratio from the rotational and tidal distortion observed in the light curve. This method requires knowledge or estimates of several parameters such as T, limb and gravity-darkening etc. Also using the observation that the F* contributes only about 8% of the system's light, (determined from the idea that if one member does not appear in the spectrum then it is a factor of 6 lower in luminosity--a criticism could be made that if the lines of the faint star were broadened by rapid rotation of the star, then they would not be as easily detected and result in an underestimate of the luminosity), he concludes $q \approx 1/2$ is a realistic upper limit. Approximating the masses as 10 and 20 $M_\odot$ gives a value for M_{BRT} close to Abt's determination for a star slightly evolved on the colour luminosity diagram. He concluded that the secondary must be remarkable and if a black hole, it collapsed without disruption and would, therefore, have been about 20 $M_{\odot}$ before collapse.

The next paper advocating a black hole secondary (Wilson, 1971) is based on OAO photometric observations (Fig. 4) which showed that at shorter wavelengths secondary eclipse becomes progressively deeper and at even shorter λλ's may be deeper than the primary eclipse. One of the principles in interpreting eclipsing binary light curves is that the ratio of the depths of the two eclipses is determined by the ratio of surface brightnesses. For a normal binary the brighter component has the higher temperature and, hence, eclipse of this component is deeper at all λλ's. However, in β Lyrae the F* is very 'blue' as indicated by the OAO data and indicates a high temperature, but this does not agree with the eclipse depths in the visable region. Perhaps the solution to this is that the light temperature radiation is being selectively absorbed and scattered in the disc surrounding the secondary. It may be that if we were not in the plane of this disc, we would observe the secondary to be overluminous rather than underluminous.

Next month, the arguments put forward in 1972 to the present will be discussed. These generally have attempted to explain the underluminosity (if it exists) using various mechanisms. The most recent paper suggests the primary is overluminous.

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APOLOGY:

The Editor would like to extend his sincere apology to Miss. Mary King. Miss. King sent in an article entitled "Occultation of Saturn in Eastern Canada". This article was post marked Feb. 7, '74, but I,unfortunately,only received it today,March 7,'74. The reason for the delay,was that those who sort the N.S. Museum's mail thought that our locker was locked! It was not,and will not be locked in the forseeable future. Since before Christmas until yesterday,the Museum,in our best interest,would redirect all our mail to one of the senior executive.

The occultation occured Saturday,March 2nd, 1974. Halifax was just south of the southern limit for Saturn. Only Titan was occulted.

Peter Edwards
The Editor

CAN ANYONE HERE
OBSERVE VARIABLE STARS?

Any amateur astronomer can spot a VSO'er (= variable star observer) at fifty yards. He is the fellow with the bags beneath his bloodshot eyes. He is the fellow with the palid complexion, the stooped shoulders and the crooked neck. These are the side-effects of being dedicated, and any amateur knows that all VSO'ers are dedicated--they have to be. It takes years of experience to become at all reliable. And even after all that effort, most of us just do not make the grade, for we do not have The Gift. The Gift allows the VSO'er, chamaeleon-like, to examine a variable with one eye and its comparison star with the other. The eye pupils of Gifted VSO'ers pulsate in phase with the stars being observed. And because he is Gifted, a VSO'er can spot an amateur astronomer at five hundred yards.

Figure 1 is presented to debunk the folklore. It compares my visual estimates of stellar brightnesses with the published AAVSO (= American Association of VSO'ers) values for the same dates. Plotted horizontally is the discrepancy between mine and the AAVSO values in tenths of a magnitude; plotted vertically is the frequency of occurence of each discrepancy. A positive discrepancy shows my estimate to be too faint; a negative discrepancy indicates the opposite.

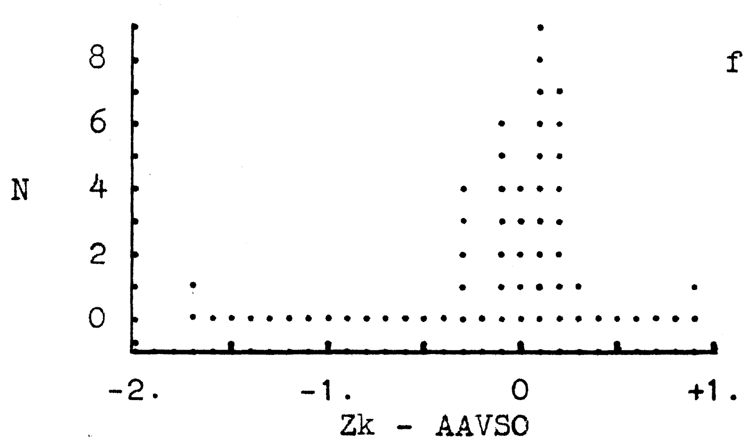


fig. 1

Most frequently I estimated a variable's brightness too faintly, by about 0.1 magnitude, an amount which is encouragingly small. More heartening, however, is the way most of the observations cluster about this value. Two-thirds of the estimates fall within 0.1 magnitude of it, and fully 80% of all the observations fall within 0.2 magnitudes of it.

The significance of these figures stems from the following conditions. These were the first VS observations I made-- inexperience was dominant. These three dozen estimates were made over a ten month period during 1962-63, hardly qualifying as a dedicated effort. Both my eyes point in the same direction.

For lack of The Gift, some interesting results were produced. The point in fig. 1 showing as an error of -1.7 magnitudes arose from an estimate (= wild guess) of R Bootis. My log notes that R Boo was at "the limit of visibility" and its estimate "very uncertain". I'll say! Although on my list as 11.0, it was actually at magnitude 12.7, far below threshold for any 3" telescope. V Bootis presents a case of the best laid plans of mice and men going systematically astray. Figure 2 tells the story. Although

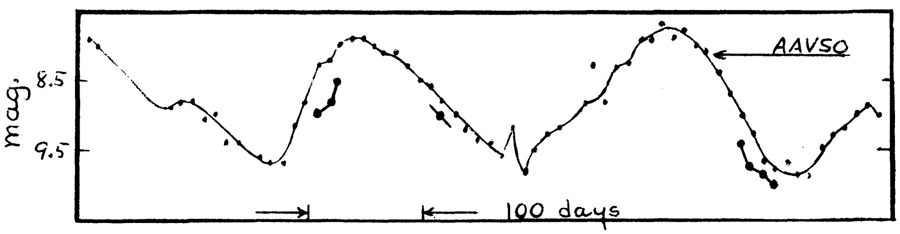


fig. 2.

an easy variable to observe, I consistently saw the variable as 0.6 magnitudes too faint. However, the shape of my light curve follows that of the AAVSO rather well, and the removal of the 0.6 error allows the curves to be combined nicely. So, although the actual magnitudes are incorrect, it is still possible to find the period and amplitude of variation, times of maximum and minimum brightness, and so on.

Once you have decided you will not be a total bust at VSO'ing, you can take a couple of precautions to help ensure your success. Pick easy variables-- those which have respectable amplitudes, which are surrounded by a good number of comparison stars well placed and of suitable brightness. Excessively crowded fields are distracting, and extremely red stars (often so-called carbon stars) can drive you to distraction. Take your time. At first it may take 15-30 minutes to find your variable, sort out your comparison stars, make an estimate, check your estimate, re-check it, and "be sure" you have got it right. ("How can the darn thing be brighter than 9.6 and fainter than 10.4 at the same time?") Although there will be many doubts, you will be able to be a VSO'er, and with time you will grow moreproficient and you may become more "sure". However, many of us never became more"sure". Perhaps the only ones who become "sure" are those who possess The Gift.

W. Z.

HA VE YOU READ ? ?

NATURAL HISTORY Jan. 1974. This journal may be a little harder for you to find but the effort will be worth it this month. On p.28 is a good summary article of general interest on the MOON. There are beautiful pictures but the text has a clear summary of the geologic findings. Have you heard of KREEP? or arm alcolite? (this last is named after ARMstrong, COLlins,and ALdrin) The conclusions that the moon is neither hot nor cold is most amusing.

ANNALS OF THE N.Y. ACADEMY OF SC. VOL 224 which just arrived and is worth looking up. One little item points out the sense of humour of astronomers. On page 70 G. Burbidge has a short three page article on the red shift of QSOs and with the 36 references to make it more serious but look at his delightful arguments.

NATURE Dec 21 1973 p 453- Planetary alignments solar activity and climatic change. Just think of the tidal forces on the sun when various planets align. Jupiter and saturn only rarely and with the inner planets also lined up the solar storms would be effected and considerable climatic changes would occur.

SCIENCE Jan. 18 74 Page 187. This is an update on Mars and its similarity to our moon. This is probably the best summary of Mars we are likely to have for a while.

BY JOVE !! Precisely 130,000 Kilometers from Jupiter. The report with pictures, mathematics and all is in the January 25th SCIENCE and is well worth going after. There is a good diagram of Pioneer 10 and on page 302 is a summary of the mission. The next long series of articles is on each individual research project and results. This is a beautiful series.

If however the mathematics is too much, then turn topage 293 for the latest on the innermost satelite of Jupiter, Io. What a magical satellite it is. It swims in a cloud of hydrogen, it glows with sodium, it gleams brightly right after coming out from the shadow of the sun.

Murray Cunningham

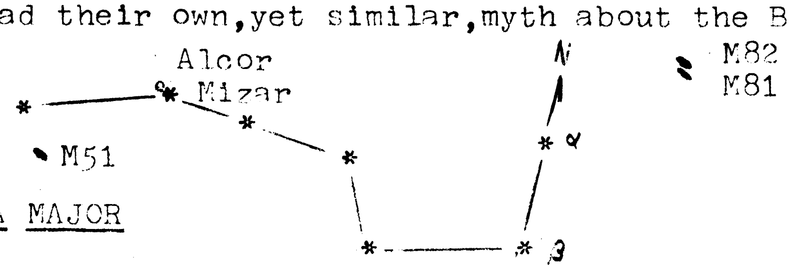
Featured Constellation for March

Around 10:00 P.M. these nights,a very familiar sight can be spied,high in the North-east. How good are you at guessing? O.K. ... What constellation has the "North American Indian 'Eye Test'"? This constellation is circumpolar and one can find M81 & 82 at one end and M51 at the other end. The α and β stars are nearly lined up with 11^{hr} of R.A. If you don't know yet,I'll give you one more clue,but then you must start coming to the R.A.S.C. meetings! It is also known as a farm implement...NO! you cannot look below for the answer...

Well,of course, it's the plough,the big dipper,or ,if you prefer,Ursa Major,the great Bear!

Some of the most beautiful stories about the Dipper have been told by the Mic Mac Indians of the Maritimes. Did you know that, one of the tests before a boy could become a hunter,he had to resolve Mizar and Alcor? And this was without binoculars. If his eyes were that good,they were good enough to hunt with.

The Mic Macs always pictured the cup of the Dipper as the entire bear. He was pursued by seven hunters (three went home each winter,ie.set). The hunters were all named after birds,the first being called Robin. The way the story goes,Robin shot the bear at the end of the summer. The blood spirted out at Robin and gave him a red breast! The rest of the blood showered down to earth and turned the leaves. How that for imagination? Every other Indian Nation had their own,yet similar,myth about the Big Dipper.



URSA MAJOR

P.E.