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1978 Halifax Centre Executive

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UP COMING MEETINGS:

Friday 17 November at the Nova Scotia Museum, Summer ST.

Speakers: Dr. Gopal Kilambi and Walter Zukauskas

Topic: VARIABLE STARS

Dr. Kilambi, a research associate in the Dept. of Astronomy at SMU, will discuss some theoretical aspects of intrinsic variables. Intrinsic variables are stars which vary in brightness because of some astrophysical process within the star. The underlying causes of temperature and physical changes will be considered particularly amoung variables found in globular clusters. Walter will balance the talk with some observational considerations which will allow you to determine the type of variable you are observing this month and, with this determined, and with a few physical relations in hand, you will be able to discover some more interesting facts about the stars on your own.

MEMBERSHIP DUES: Don't delay too much longer, in fact do it now so you don't forget, and send us a checque for this year's membership. The Handbook will be out very shortly, so to ensure you get yours in time send the Treasurer (address above) $16 for regular or $10 student (under 18) membership. Life membership is still good value at $200.

BURKE-GAFFNEY AWARD for 1978

RULES:

1) Topics: Awards will be given for articles relating to astronomy, astrophysics or space science. Topics should interest average to well informed amateurs and may be of current or historical interest.

2) Presentation: Articles should be 1000 - 1500 words, written in proper grammatical form and presented type-written (if possible) and double spaced. Diagrams need not be in finished form but should be complete and ready for drafting. Photographs may also be submitted and if possible the original negative should accompany the submission.

3) Eligibility: Any member of the Halifax Centre in good standing may submit articles with the exception of those with graduate degrees (any field of study).

4) Judging: Articles will be judged on scientific accuracy, originality and with a strong emphasis on the overall literary merit. Judging will be carried out by the President, Editor and one other person appointed by the Halifax Executive.

5) Prize: The award will be given once annualy with the winner having a choice of one of the following: Ottwell's Astronomical Calendar (1979); a year's subscription to the Griffith Observer; or The Amazing Universe by Freidman (published by the National Geographic Society).

SUBMISSION OF ENTRIES:

For 1979, all articles must be obtained by 25 March with the winner being chosen by 1 April. Mail entries to:

R.C. Brooks
Editor, Nova Notes
71 Woodlawn Rd.
Dartmouth, NS
B2W 2S2

NOTE ALL ENTRIES FOR THIS AWARD WILL ALSO BE CONSIDERED FOR THE SIMON NEWCOMB AWARD (SEE NN's p.84 JULY/AUG '78)

Minutes of the August and September Meetings

Unlike most monthly meetings, the August one was held outside of Halifax. Thanks to Bill Parnell, arrangements were made for a tour of the Mill Village satellite communications station. At 3 pm on the 25th cars from Halifax and other corners of the province converged on the huge golf ball at Mill Village. Dave Stuart, general manager of the Teleglobe Canada station, then gave about 18 members of our center a V.I.P. tour. We saw many things: klystrons, wave guides, cables, air locks, and banks of electronics to name a few. Although the two, skyward-pointing paraboloids are reminiscent of radio telescopes, it was a bit strange to realize that there is no astronomy here, only routine, sophisticated, intercontinental communications.

The September meeting was back at the Museum on the 15th. The executive spent their usual busy but enjoyable hour prior to 8 pm. At 8, Dr. Gary Welch, chairman of the astronomy department at Saint Mary's, gave a fascinating account of recent observational and theoretical studies on the center of our own galaxy, the Milky Way. Radio telescopes have located a tiny, apparently very massive, energetic source of synchrotron radiation (a black hole?) at the Milky Way's center. You can plot this point on your star charts at $\alpha = 17^h42^m29^s$, $\delta = -28^\circ59'18''$ (1950.0), about 4° off the spout of the Sagittarian teapot in the summer evening sky.

R. L. Bishop
VP/Secretary

Beta Tritium

The light from stars such as Beta Cygni or Beta Orionis contributes much to the beauty of the night sky; nevertheless, this light is too feeble to be of much use as illumination while fumbling for an eyepiece or a slow motion control on a telescope. Recently I came across one form of beta light that appears to be ideally suited for stumble-free navigation around a telescope on a dark night.

While browsing in a yachting equipment store, I found small, sealed, light sources which require neither batteries nor wires. Called "Betalight Marine Markers", they are meant to be used around the deck of a boat as nighttime markers. I bought one, partly out of curiosity, and found that it is ideal for locating eyepieces in a dark box, for marking tripod legs, control knobs, etc. The light output is sufficient to be useful yet does not interfere with dark adaption.

Phosphorescent powders excited by the radioactive decay of radium and its daughter isotopes have been used on watch dials for more than half a century. However, since the associated gamma radiation must be kept within safe limits, the light output is quite feeble. Within the last couple of years a different type of light source has appeared. The "betalight marine marker" is one example, "permaglow" backlighting for L.C.D. watch dials is another. The concept is the same as for the earlier radium light sources: a radioactive substance excites a phosphorescent powder; however, instead of radium, hydrogen is used.

Three types of hydrogen nuclei occur:

Isotope	Natural Abundance	Stability	Common Name
${}_1H_0^1$	99.985 %	Stable	Light Hydrogen
${}_1H_1^2$	0.015 %	Stable	Deuterium
${}_1H_2^3$	---	Half-life 12.3 years	Tritium

The two subscripts give, respectively, the number of protons and the number of neutrons in each atomic nucleus, while the superscript is the sum of these two numbers. Not only is H^1 the more abundant of the two stable isotopes of hydrogen, it is also the most abundant nuclide in the Universe. Since H^3 (tritium) is unstable with a half-life comparable to that of a dog, it does not occur naturally.

Although the radium source used on watch dials (Ra^{226}) has a half-life of only 1620 years, it does occur in nature because it is in the alpha decay sequence of the most abundant isotope of uranium, U^{238}, which has a half-life of 4×10^9 years, about the same as the age of Earth. Since all uranium nuclei have been synthesized from lighter ones by supernovae, those of you who have the older style luminous watch dial are literally viewing the embers of ancient supernovae explosions from which the stuff of the Solar System was later assembled. Owners of the newer, brighter, "perma-glow" digital watches have a somewhat less romantic glow: tritium is produced in nuclear reactors (typically by neutron absorption in H^2). True, reactors are fuelled with uranium; however, the connection between the glow due to tritium and those incredible blasts of ten billion years ago is much less direct.

Why can tritium light sources be safely made much brighter than radium light sources? The answer is that the decay of a tritium nucleus does not involve any high energy photons (gamma rays):

$$_{1}H^{3} \longrightarrow {}_{2}He^{3} + {}_{-1}e^{-} + \bar{\nu}_{e}$$

For historical reasons this type of decay is known as "beta" decay, and the electrons (e^-) so produced are known as "beta rays". The helium nucleus (He^3) is formed in its ground state, and is stable. The rather low decay energy of 18 keV is shared in a random way mainly by the electron (e^-) and the anti-electron-type neutrino ($\bar{\nu}_e$). Thus the electron has the same sort of energy as an electron in a TV picture tube: sufficient to cause a phosphor which it strikes to glow brightly, but not so high as to cause a significant radiation hazard. Although the neutrinos from these sources completely riddle everything in sight, they are so extremely penetrating that they rarely strike anything. Thus they present no radiation hazard. Hence tritium lights are brighter yet safer than radium lights. They do have one minor disadvantage: with a half-life of 12.3 years they become appreciably dimmer after a decade or two.

In summary, a new light has appeared. Bright enough to be useful yet with negligible light pollution, it is rugged, compact, inexpensive, and will operate for many years with no attention. Those of us who carry telescopes into the dark will likely find several uses for the light of Beta Tritium.

Roy L. Bishop
Maktomkus Observatory

MORE ON TELESCOPE DUTIES

Ed. note: The following constituted the Halifax Centre's submission to the enquiries of the Tariff Board concerning the exemption of astronomical equipment duties. Dr. Bishop was responsible for the work in its preparation and we wish to thank him for doing so on our behalf.

This letter is a submission from the Halifax Centre of the Royal Astronomical Society of Canada in regard to a type of hobby equipment: astronomical telescopes and their accessories. Our position is that telescopes which are imported for astronomical study and research should be exempt from federal customs duties and sales taxes. In support of this we offer the following arguements:

1) Astronomy is the oldest of the sciences and touches directly on many other sciences such as physics, chemistry, and mathematics. Moreover, astronomy commands more popular attention than any other science. As a consequence, astronomy is an excellant vehicle for bringing young people into contact with science, both as an activity and as an intellectual endeavour. Duties and taxes on astronomical telescopes serve only to make this more difficult.
2) There are no manufacturers of amateur telescopes in Canada. Thus the federal surcharges neither protect nor encourage a Canadian telescope industry.
3) The Canadian market for astronomical telescopes is small, (e.g. the entire membership of the only amateur and professional astronomical organization in Canada is about 2000). Thus if federal surcharges were removed, the monetary loss to the government would be trivial.

We are aware that there are significant sales of small telescopes through camera and department stores. However, virtually all of these instruments are not of adequate optical or mechanical quality for serious astronomical use. A simple way to restrict tax relief to instruments of sufficient quality for astronomical use would be to limit such exemptions to telescopes valued in excess of a certain amount (e.g. $250).

Roy L. Bishop, V-P/Sect'ry

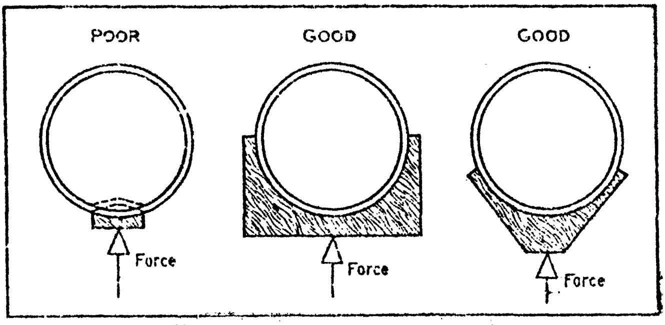
HINTS for TM's

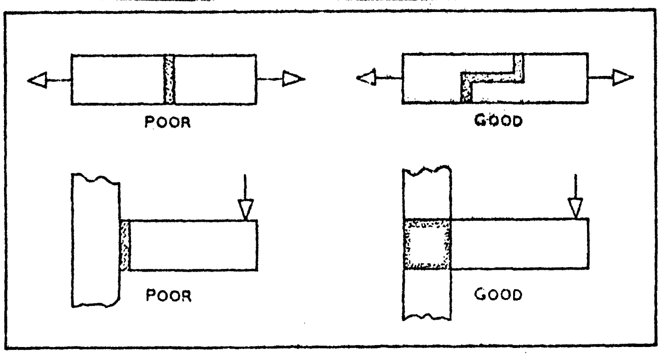
DESIGNING A TUBE AND MOUNTING

Most TM's build a telescope with the intent to make it portable. Often, their telescopes are less stable and more massive (hence less portable) than one would like. The following ideas are common design principles and use of the best features will help ensure a steady, light and asthetically pleasing telescope. The success of the mechanical parts of a telescope depend on the proper choice of materials and suitable geometrical configurations.

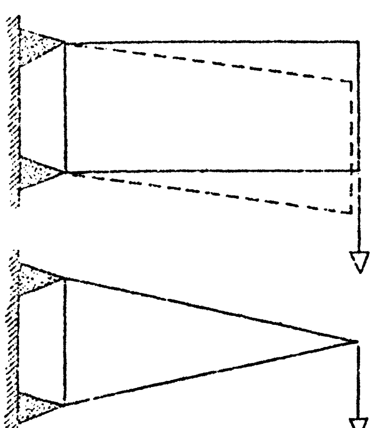
In general you should aim for the following: stiffness and good damping. By stiffness is meant resistance to changing shape, eg. avoid combinations where the structure will bend, twist, stretch or contract. Stiffness goes hand in hand with damping in that a mechanical structure of high stiffness will also have good damping characteristics. Damping is the ability of the structure to stop vibrating quickly after it has been bumped, blown by a gust or just handled to focus. For a given weight, wood has better damping characteristics than metal and with cost considerations, is the best material for amateur telescopes. With carefully planned and executed joints, you can increase the stiffness and damping even further. The trick is to make contacting areas large so stress is spread over the larger area thus decreasing the amount of deformation. Stress is defined as being equal to the applied force/ resisting area (ie. the larger the area, the smaller the stress applied between components).

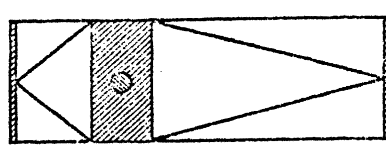
The shape of individual components as well as the final design of the telescope will determine its effectiveness for your use. It is recommended that you use solid or hollow materials, eg. shafts, dowels or tubing of round, square or triangular cross section. Materials of open cross-section are weak and should be avoided, eg. "I" beams rectangular shapes with a side missing, etc. Such materials will suffer torsion or twisting very easily.





For telescopes up to 20 cm in diameter, the easiest design is a rectangular structure as shown by Larry Bogan's drawings (Nova Notes, Vol. 9, No.1 Jan/Feb 1978). For a 25 cm or larger instrument, concern for deflection of the tube under the force of gravity is important. If you desire a closed tube style, then a metal or fiberglass tube is your best choice. An alternative, however, is an open tubedesign using Serrurier trusses. All large telescopes are now made using this principle and for a given weight will give the greatest stiffness (and damping) and

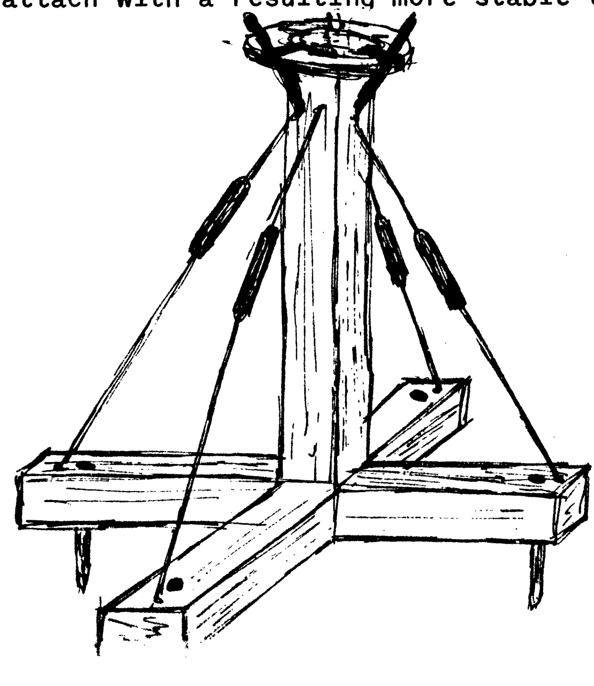


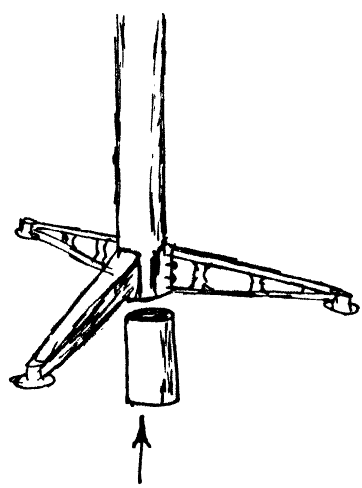


Serrurier Truss

the least distortion under stress. By keeping the ratio of the height of the triangle to the base large (0.2 or larger) Changing the ratio from 0.2 to 0.3 increases the stiffness from 8 to 17 and to 30 for a base to height ratio of 0.4! John MacNeil has finished a plywood and hardwood dowel tube for my 30 cm mirror in a slightly modified Serrurier scheme. With about 100kg of weight on the upper end, the deflection is less than 1mm over 1.3 m attesting to the great stiffness of the design.

If you have a telescope which you find shaky, then the following ideas can be used to improve it. My 2nd telescope was a 3" Tasco refractor which was adequate optically but dreadfully inadequate in the rigidity of its mounting. I now use a tripod of my design which is a great (but not quite perfect) improvement. The equatorial head mounts on a circular platform and is held down by 3 turnbuckles which may be tightened down very securely. This sits on a 4" square pillar which in turn sits on 2 crossed 4" square legs. The stiffness here is increased by attaching wires with turnbuckles on the top of the pillar to the ends of each of the horizontal legs. 10" spikes ensure some additional stability when driven through the ends of the legs into the ground. Cave and Criterian tripod owners could profit by placing a wood cylinder which fits snugly up the bottom 5 or 6 inches of the pillar as is shown in the drawing. This will add stiffness where the legs attach with a resulting more stable telescope.





PERIOD CHANGES FOR CEPHEIDS

Cepheid varialbes are pulsating stars; they shrink and swell, heat and cool, brighten and dim with a characteristic period P. Although P differs widely from cepheid to cepheid (from a day or so to a few score days), the P for each individual is constant to a high precion. The minute variations that do appear, however, are of great interest, but their discovery and measurement require prolonged study. This is where the amateur can help.

Eddington, many years ago, pointed out that the pulsations of a cepheid can be thought of as a sound wave propagating out though the star. Thus the period would be roughly equal to the radius of the star divided by the speed of the sound wave. But the sound speed is proportional to the square-root of the density. Thus

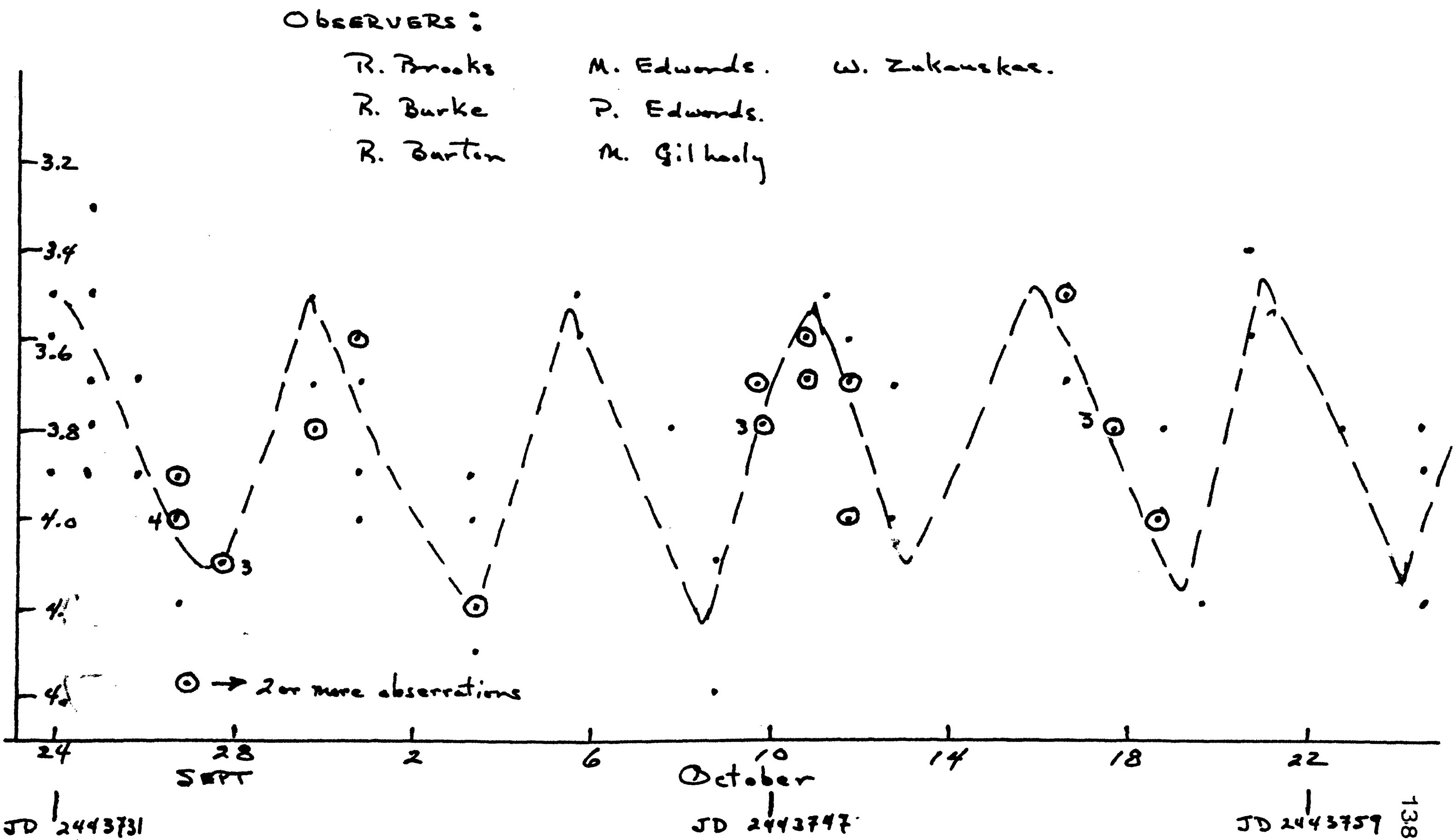
$$P = (1/\rho)^{\frac{1}{2}},$$

where ρ is the mean density of thestar.

As a star evolves, it traces in the H-R diagram a path through the "instability strip", a region where pulsation can occur. As the star "crosses the strip" its density must vary, since the mass (probably) remains constant, but the radius changes. Denoting δP and $\delta\rho$ as the period and density variations respectively we see that

$$\delta P/P = -\tfrac{1}{2}\cdot\delta\rho/\rho .$$

Careful observations of δ Cephei, for example have shown period changes of about 0.00005 days in a 5.37 day period, about one part per million. How real are these changes? Are they due to the evolution in the structure of δ Cephei? These effects are cumulative. Only continued observation will reveal them clearly. (Zk)


Observers:
R. Brooks
R. Burke
R. Barton
M. Edwards.
P. Edwards.
M. Gilhooly
W. Zakauskas.
3.2
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⊙ → 2 or more observations
24
28
Sept
2
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10
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JD 2443731
JD 2443747
JD 2443759

FROM the CENTRES

ASTRO QUIZ

(from ORBIT, Hamilton)

It's time to dust the cobwebs out of your mind, so put on your thinking cap, sharpen your pencil and try these on for size.

1) Which star is also known as the 'Garnet Star'?

2) What constellation crosses the ecliptic, yet is not included in the Zodiac?

3) Which constellation represents the 'Foal'?

4) Who discovered M104?

5) How bright would the Sun appear from Arcturus?

6) What constellation would the Sun appear in from Alpha Centauri?

7) How long is a galactic year?

8) If a star has a spectral class of M5e, what does the 'e' stand for?

9) A star has a parallax of 0.76 arc seconds. How far away is it?

10) Which Messier object has the most southerly declination?

11) Of the 10 brightest stars, how many are red (type M)?

12) What type of variable star is Beta Cygni?

Answers to Astro Quiz:

1) Mu Cephei; 2) Ophiuchus; 3) Equuleus; 4) Pierre Mechain; 5) 5th mag.; 6) Cassiopeia; 7) 250 million yrs.; 8) emission lines present; 9) 4.3 light years; 10) M7 11) one, Alpha Orionis; 12) Beta Cygni isn't variable.

RECENT SUNSPOT ACTIVITY

Steven Morris

Sunspot activity has continued to increase over the last few months. Interestingly, recent large sunspot numbers have not been caused by the appearance of one or two major groups. Instead one finds many very small groups across the face of the Sun. For example, Fig. 1 shows the Sun on September 23, when there were only 36 sunspots spread into 10 sunspot groups. It becomes a thorny problem for observers to estimate if a loose cluster of sunspots is one group or several, and can cause different observers to estimate very different sunspot numbers.

Fig. 2 is a combination of graphs in previous issues of Nova Notes. Mike Gilhooly, a student at Nova Scotia Technical College, has begun observing the Sun with an 8" reflector and his results are included here. His data neatly fill the late summer gap that occur in my own data while I was away.

There was an interesting news note in the September issue of Sky & Telescope on the height of the next sunspot maximum is strongly correlated with the amount of disturbance of the Earth's magnetic field at the time of the

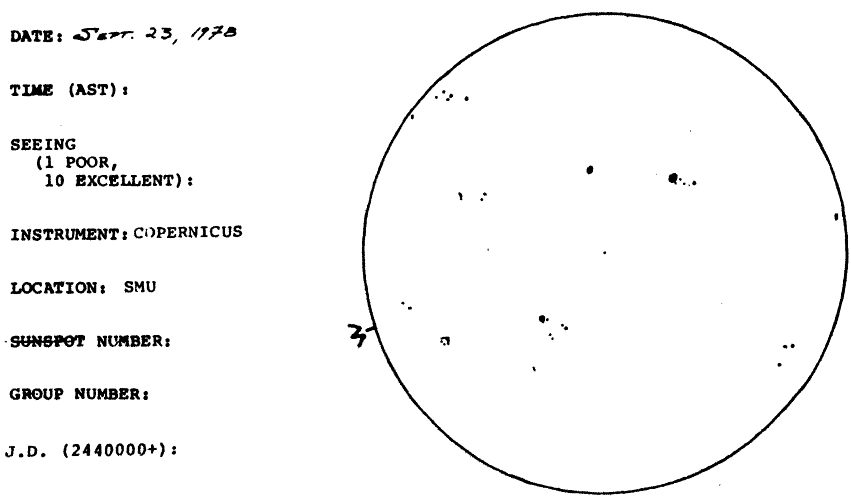

Fig. 1

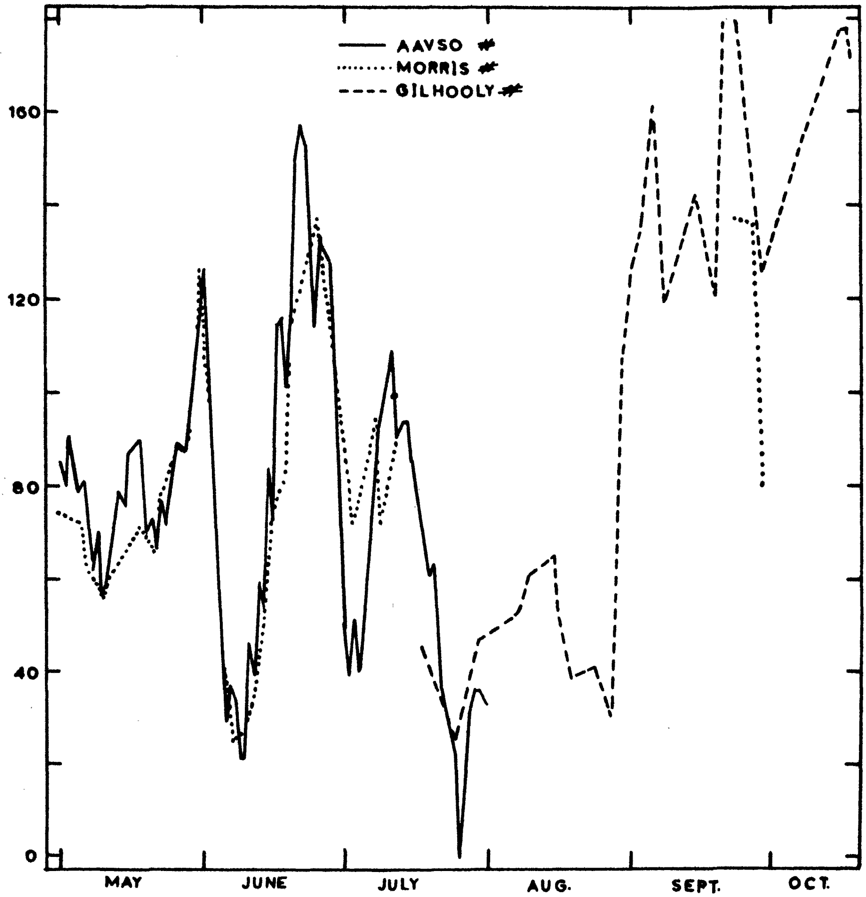

Fig. 2

previous minimum. From the available data, it seems that the coming maximum will be the highest so far this century, with an average sunspot number of 206. As high sunspot maxima tend to have short rise times, it is predicted that this maximum should fall near the end of 1979--only one year away. Can our ozone layer battle the assault? Stay tuned....

A NEW TYPE OF STELLAR OBJECT

Bruce Torquemada

A recent (1972) sky survey involved with the updating of Atlas Eclipticalis has resulted in the discovery of a new type of stellar object. This object, AE 18824 (aka HD 194697, aka DM 14049) is located at $20^h\ 21.9^m$, $-41°09'$ (1900) and was, until this survey, believed to be a m_{pg} $11^m.8$, K5 star.

However, this survey, at the proper location, found an $11^m.1$ KO star. This anomaly was only discovered 4 to 5 months after the AE plates were taken and,to double check, another plate was taken. This seemed to indicate that the star has continued to brighten and to change to still earlier spectral type, it being $10^m.5$ and G6 at this time.

The phenomena of stars changing classes is not an unknown one (cf FW Sgt) but this is the first in which the spectral class changes to an earlier one. This new type of object, called an AE 18824 object, obviously bears watching and so has been monitored since March 1973. The resultant variations in spectral type and magnitude are presented in figures 1 and 2.

Figure 1 shows that the star has gone on to be as early as AO, the changes occuring smoothly, as was the subsequent change back to (so far) G2. Speculation is that the star will eventually'bottom out'at about M3 (based on the second derivative of the descent part of the curve of Fig. 1), but whether the star will remain there or begin to become earlier again is unknown and most discussions on this topic usually degenerate into namecalling and fist-fighting. Figure 2 illustrates the light curve for this object. There are several oddities inherent in this diagram. One is that the light received from AE 18824 for the different spectral types is in variance with expected apparent magnitudes from spectral type. A possible explanation is that the star's distance is changing rapidly to produce this effect, but no change has been seen in the radial velocities and no one seriously believes it, except of course for Dr. Smilby but he's a clot anyway and belives the star will stay M3 when it reaches that spectral type. Another oddity is that the light curve doesn't follow the trend of Fig. 1, reaching a maximum over a year earlier and being asymmetric. For example, when AE 18824 is FO (1974.0 and 1977.3), the magnitudes are respectively 9.6 and 11.4. Also the shape of the light curve is strongly suggestive of the shape of the black body radiation curve. Second derivative analysis of this curve gives the date of minimum apparent magnitude as about half a month after the AE 18824 object reaches its latest spectral type. Whether or not the light curve will rise is again open to discussion, with fools like Smilby expecting the magnitude to remain constant at 13.1 magnitudes.

Possible mechanisms causing these variations have been considered, the two most likely being:

a) the AE 18824 object is changing mass, becoming more and then less massive. This would explain both spectral type and magnitude changes, and the odd shape of the light curve suggests that while the AE 18824 object is losing mass something is obscuring part of its light;

b) the AE 18824 object is changing temperature. This also explains both observed phenomena, with the light curve asymmetry being due to something partially obscuring the object as it cools off.

The researchers are positive that one or the other (or a combination of the two) of the possibilities is responsible for the behaviour of the AE 18824 object. From all this, it is now possible to characterize the class of AE 18824 objects by the following criteria:

i) with a period of about 9 years, or possibly more or less, the spectral class changes from M3 or so to maybe AO or thereabouts and then back, I guess, the manner of change being smooth, more than likely;

ii) with the same period (knock on wood!) the objects brighten by $3^{m}.5$ God willing and then decrease by hopefully the same amount. The light curve is reminiscent of a black body curve. To some people anyway.

Using these rigid criteria, a search has begun for another AE 18824 object, but as yet none have been found. The search is hindered somewhat by the fact that all stars between spectral types AO and M3 must be considered as possible members. Also the possibility exists that other

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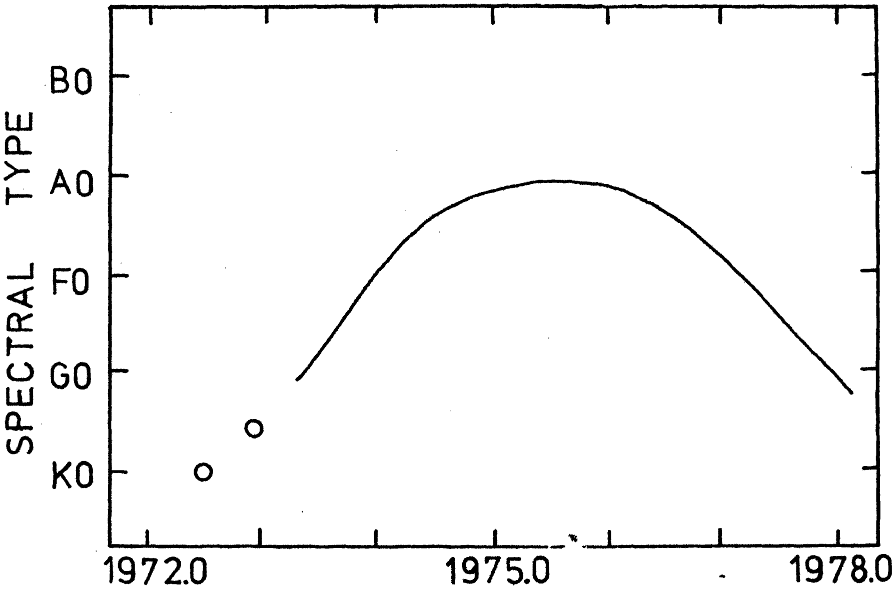


FIG.1 DATE

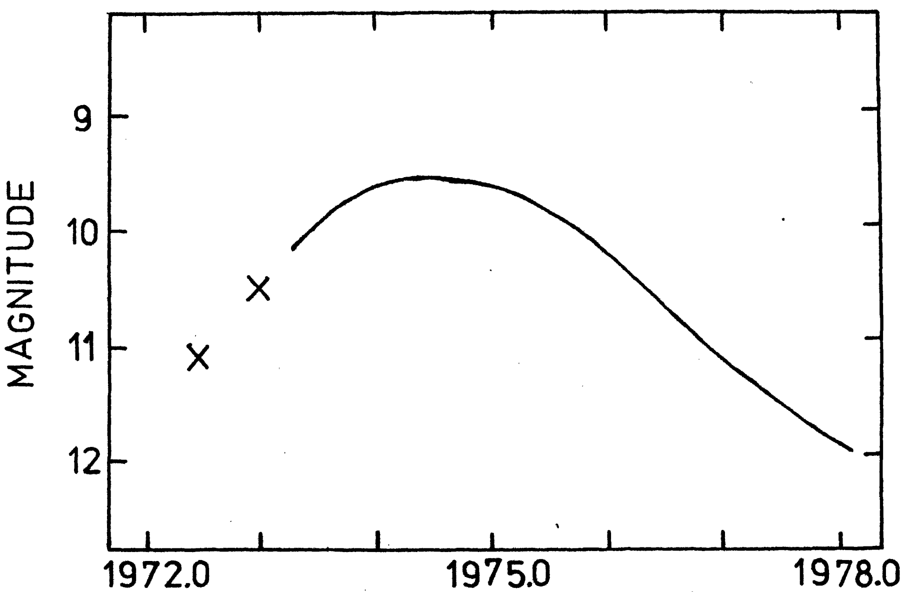


FIG.2 DATE

NEW DISCOVERIES IN METEORITES

- Diane Brooks

A unique meteorite of the rare achondrites group has been identified. It belongs to the collection of meteorites which was recently recovered in the Antarctic by a group of American and Japanese scientists under the leadership of William A. Cassidy of the University of Pittsburg.

The composition of this 482.5-gram achondrite is olivine (55 percent), pyroxene (35 percent) and maskelynite (8 percent). Olivine and pyroxene are created through volcanic action. Maskelynite is a glassy substance derived from feldspar which is produced by severe shock waves, like those experienced during a cosmic collision. It is, therefore, thought possible that this latest Antarctic recovery may chronicle the first stage of planet formation, as well as a violent collision which occurred much later. As a group, achondrites are very similiar to igneous rocks and, subsequently, are suspected to represent the beginning of planetary evolution.

Another discovery involves a C2 carbonaceous chondrite--the Murchison meteorite which fell in Australia in September of 1969. Alien dust grains, predating the formation of the solar system, have been found in its composition. Because these grains demonstrate enrichment of noble gases produced at temperatures of 1200-1600°C, it is thought that they originated in a red giant star. Isotopes of xenon, krypton, neon and helium reveal enhancement to various degrees. The noble gases were probably present in a mineral, possibly carbon, which was ejected from the outer shells.

The anomalous isotopes provide strong support for the theory that the Murchison meteorite shows signs of three nuclear reactions thought to occur in red giants. These reactions are: 1.) hydrogen shell burning; 2.) helium shell burning; and 3.) the s-process, or capture of neutrons over a long period of time.

SHIVERING THROUGH FALL SKIES--Part 2

Jody LeBlanc, OC

Well, it's come full circle since I started writing these through seasonal skies articles. Once again my ski-doo suit and thermos of tea has become part of my observing equipment, and once again I begin to wonder whether stamp collecting might not be a more comfortable hobby. I won't reiterate my words of last season on cold weather observing, but I've one observation to make--quite a few of my school's astronomy club have jumped on the ski-doo suit bandwagon, knowing a good thing when they see it. Try it, you'll like it!

Since fall and winter always seem to bring a decrease in a person's free time, less and less astronomy seems to get done. (At least that's how I've always justified staying inside on really cold nights.) With this in mind, I think it would be a good idea to highly organize time spent at the telescope in order to ensure maximum results with minimum frostbite. In a way, this bothers me, as I tend to view astronomy as being a very loosely organized, rather "hodge podge" type of affair, with this situation giving me the most enjoyment. Still, I'd be hard pressed to lie back and admire the wonderous beauty of the Universe when I can no longer feel my toes.

This fall I've been forced to become much more organized than usual, not only being co-president of the school's astronomy club but also heading an observing group of club members dealing with only two specific areas--deep sky objects and photography. No more catch-as-catch-can planet observing interspaced with whatever catches my fancy, I've got to be organized enough so that those club members will think I know what I'm talking about.

So maybe a little organization wouldn't be a bad idea--I must admit that most of my best concrete observational results come from cold weather observations, although perhaps I had more artistic or philosophical or meta-physical (or whatever) kind of enjoyment during summers. In short, I fooled around and had a great time during the summer but only did anything halfway serious in the winter.

As my third (and final) plug for HWAC, we're building an observatory for our 8" Meade. What's so special about that? It's turning out to be a rather uncoventional design (!) being a transportable combination roll-off roof/ square, removable dome type. We may patent it--if it works. Yet more organization--sigh.

Once more I've made it through an article without actually saying much about observing. Before I end I want to thank my fellow friend astronomy club member Glem Graham for filling in for me last issue. Glen is a great guy, even if he does have a habit of getting lost at the most inconvenient times!

One final question. Has anybody tried battery-powered socks?

(Good semi-organized observing)

cont'd from p. 143

AE 18824 objects may have different periods, possibly up to thousands or hundreds of years. But these are considered minor handicaps, and it is expected that there will soon be a plethora of AE 18824 objects discovered, to go with the lone one now known.

Note added in proof:
Recent observations have shown that the AE 18824 object, AE 18824 has gone out, and is now excluded from the class of AE 18824 objects since it no longer follows the criteria of this group.

THANKS TO THE PARNELL'S

We would like to extend our thanks to Mr. & Mrs. Bill Parnell for organizing and hosting our August meeting at their home and observatory in Liverpool. Bill also acted as our liason in organizing our outing to the Earth Satellite Tracking Station at Mill Village. Personally I had one of the best views ever of some Messier objects through Bill's telescope and the 2 dozen people who attended will remember the trip for some time.

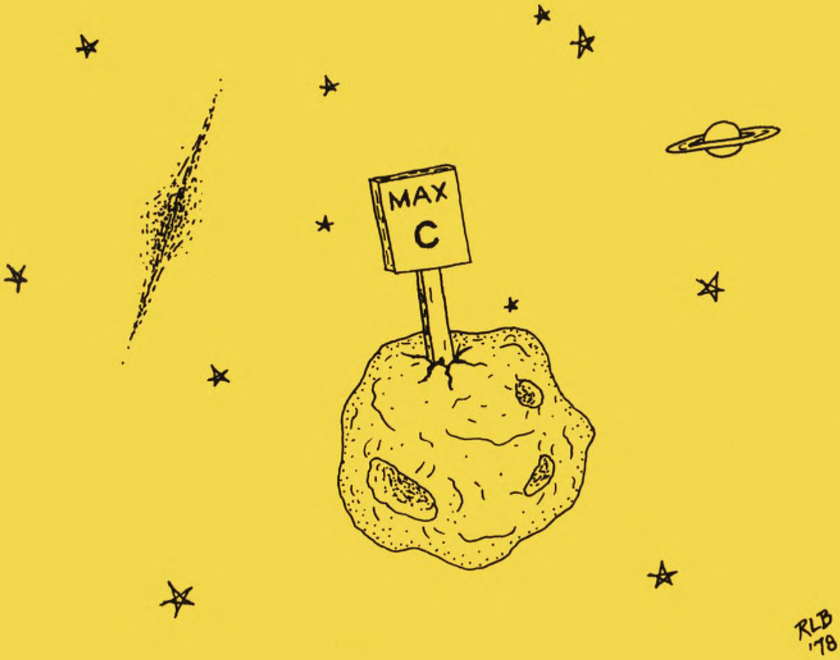
THE FREEDOM OF THE MOON

by: Robert Frost

I've tried the new moon tilted in the air
Above a hazy tree-and-farmhouse cluster
As you might try a jewel in your hair.
I've tried it fine with little breadth of luster,
Alone, or in one ornament combining
With one first-water star almost as shining.

I put it shining anywhere I please.
By walking slowly on some evening later,
I've pulled it from a crate of crooked trees
And brought it over glossy water, greater,
And dropped it in, and seen the image wallow,
The color run, all sorts of wonder follow.

(Contributed by Roy Bishop)



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