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NOVA NOTES are printed bi-monthly (Jan, March etc.) through the courtesy of the Nova Scotia Museum. Contributions on any aspect of astronomy are welcomed and should reach the Editor by Saturday, 24 April for the May/June issue. If you do not receive NN's or Meeting NOtices, please notify the Editor. Our mailing lists are computor generated and on occasion names are missed which will result in your not receiving 3 sucessive notices.

UP COMING EVENTS:

Friday, 21 March, 8:00pm at the Nova Scotia Museum

Spectra and Spectrographs; Dr. Ted Bednarek and Dr. Gary Welch, both of the Astronomy Dept. at SMU, will combine to tell us of the importance of these tools in understanding the physical nature of astrophysical bodies—not only stars but also galaxies and interstellar material. The various types of instruments used to obtain spectra will be described along with the reasons for having different dispersions or magnifications of a spectrum. They may even have a sample of a spectrum taken with the image tube spectrograph now being constructed for the observatory. Following the formal discussion, you will have a chance to try your hand at interpreting some spectra!

May 20 to June 13—[illegible]

MINUTES OF DECEMBER 1975 MEETING

Our regular monthly meeting was held at 8:00 p.m. on Friday, Dec. 19 in the Nova Scotia Museum. Dr. Bishop, in his opening remarks, drew our attention to the imminent approach of two comets: Bradfield 1975p and West 1975n. Hopefully, one or both will out perform Kohoutek! Final election ballots were called at this meeting; the election of Debby Burleson as Vice-President and Peter Reynolds as Secretary was subsequently announced.

Our speaker for the evening was Dr. Larry Bogan and his subject was The Cylindrical Astrolabe. An astrolabe is essentially a two-dimensional version of perhaps the more familiar celestial sphere, a device for the determining horizon system co-ordinates (i.e., altitude, azimuth) of celestial bodies, meridian crossing times, etc. Larry's astrolabe is cylindrical in the sense that it is based on a cylindrical in the sense that it is based on a cylindrical projection of the celestial sphere. That is, wrap a piece of paper in the form of a cylinder around a celestial sphere (making contact at the equator) and project all bodies onto it; then remove and unfold. Such star charts can be obtained from Sky Publishing Co. (49-50-51 Bay State Road, Cambridge, Mass. 02138) for 25¢ each (covering the range $-60^\circ < \delta < 60^\circ$). On a second (transparent) sheet must be plotted the corresponding horizon co-ordinates. These are computed for a given latitude by solving the astronomical triangle (zenith-star-north celestial pole). The two sheets are then superimposed and the passage of time is simulated by sliding one with resect to the other in the equatorial direction.

Larry described several other interesting applications of this cunning device, and during the coffee hour following the formal presentation helped many of us try our hand at some co-ordinate determinations.

MINUTES OF JANUARY 1976 MEETING

The regular monthly meeting was held on Friday, January 16 at 8:00 p.m. in the Nova Scotia Museum. The President, Dr. Bishop, opened the meeting with a few general announcements. A major item for discussion was the upcoming

Museum Societies' Show and the astronomy display our Centre has agreed to provide. Also discussed was the possibility of resurrecting the Museum's planetarium, now safely (but not usefully) stored away in the Museum.

The speaker for the evening, our President, Dr. Bishop, was introduced by Editor Randall Brooks. There followed a very enjoyable and instructive discussion-demonstration of a number of small telescopes. The first group of instruments on display was a trio of 3-inch refractors. These wide-field, low-power scopes were designed by Dr. Bishop and were built in the machine-shop at Acadia Univ. Equatorially mounted with large clear setting circles, they are ideally suited for student use. Next on display was an old and probably quite valuable transit instrument, owned by Alaster Jakeman of Milford Station. Such instruments were used to time meridian crossings of celestial bodies, and this particular one (obtained by Mr. Jakeman from a Halifax antique shop) is obviously of high quality. Next in line was a 5-inch, 25 power rich-field refractor built ten years ago by Dr. Bishop, followed in turn by a 2-inch 'telescoping' leather-bound brass model dating from twenty years ago, and the last (and perhaps least) a small (15 mm) affair which throughout the demonstration had remained hidden in Dr. Bishop's pocket.

Discussion and refreshments followed. Many of us lingered for another hour or more in order to have a very good look at this fine and rather unique display.

P.H. Reynolds
Secretary

NOTES:

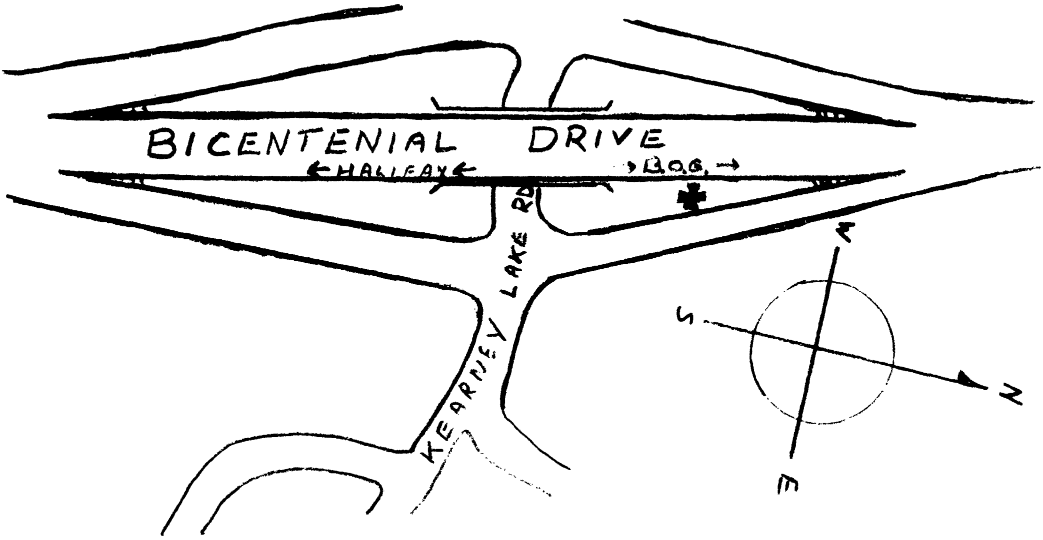
Halifax may soon have representation on the National executive of our Society. Dr. Peter Reynolds has been nominated for the position of Second Vice-President. Hence, when you receive your ballot in the mail don't delay sending it in and help insure Dr. Reynolds' election. Also, Debby Burleson and Randall Brooks are the co-ordinators for the Museum Show. If you have ideas , call them. It will be they who will be buttonholing you to help out when the time comes. Lastly, Chris Purcell has been chosen as our Centre's official representative to the General Assembly in Calgary, May 21 to 24.

The Great Kearney Lake Meteorite

Remember the Hoba West, found in South Africa? It had a mass of 60 tons! Perhaps the Ahnighito, found in Greenland, will ring a bell. It had a mass of 36 tons.

Now don't say it could never happen here, we got evidence!!...in Arizona. Meteor Crater was formed in prehistoric times by a meteorite, estimated at a mass of 50,000 tons. The crater is about 3/4 of a mile wide and...RING...600 feet...RING...deep...RING...YOW!! It's the Hotline! "Hello, R.A.S.C. Meteorite Hunters (Halifax Office) Inc. 'You blab 'em, we grab 'em'." ..."You say a fall site at Kearney Lake!!, I'll get on it right away Chief!"

At noon time, January 2nd, 1976, I recieved a message from your Editor, stating that at 1:00 A.M. January 1st, 1976, a lady in her early 50's, was driving North on the Bicentenial Drive, with her husband, when they both saw a meteor fall towards the ground, somewhere in the area of the Kearney Lake Turn-Off. When they passed by, she claimed she saw a tall column of steam rising, about 50 feet off the right hand side of the road. Within minutes a team of four crack (some say this should be crack pot) meteorite hunters were converging on the site.



Randall and Diane Brooks arrived in squad car #073, Mike and myself arrived in car #000½ ! We immediately broke up into four separate groups to scour the area around the turn-off.

We were looking for evidence of melted snow,burnt flora,stunned fauna,punctured beer cans or hub-caps or maybe,just maybe, a flat rounded piece of rock,appearently igneous in nature.

Half an hour later,when none of these were located,we regrouped. Randall felt we ought to telephone the lady for a further interrogation period. The grilling room was the outer office of the Fr. Burke-Gaffney Observatory. There, we got her on the end of a telephone line. The story she related to Randall was unchanged.

We returned to the site and searched the triangle with the "K",(see previous page) for almost an hour but with no success. At 5:00 P.M. January 2nd,the search was terminated.

When I returned to my office,I called the lady once more. In that conversation ,she said she saw an array of points of yellow-white light that seemed to come straight down... she didn't see them hit the ground and the little she had to drink hadn't effected her! This array put her in mind of a Christmas tree, as it had at least 50 lights. What seemed to impress her the most was the column of smoke or steam. She refered to that many times.... DIAL;CLICKCLICKCLICK....in her....DIAL;CLICK CLICKCLICK....conversation. DIAL;CLICK..DIAL; CLICKCLICKCLICK....ring....ring....ring... "Hello,I'd like to speak to the Editor please." ....."Hi! Randall?....I want to place an ad in Nova Notes;it goes as follows....

[illegible]

...for [illegible]

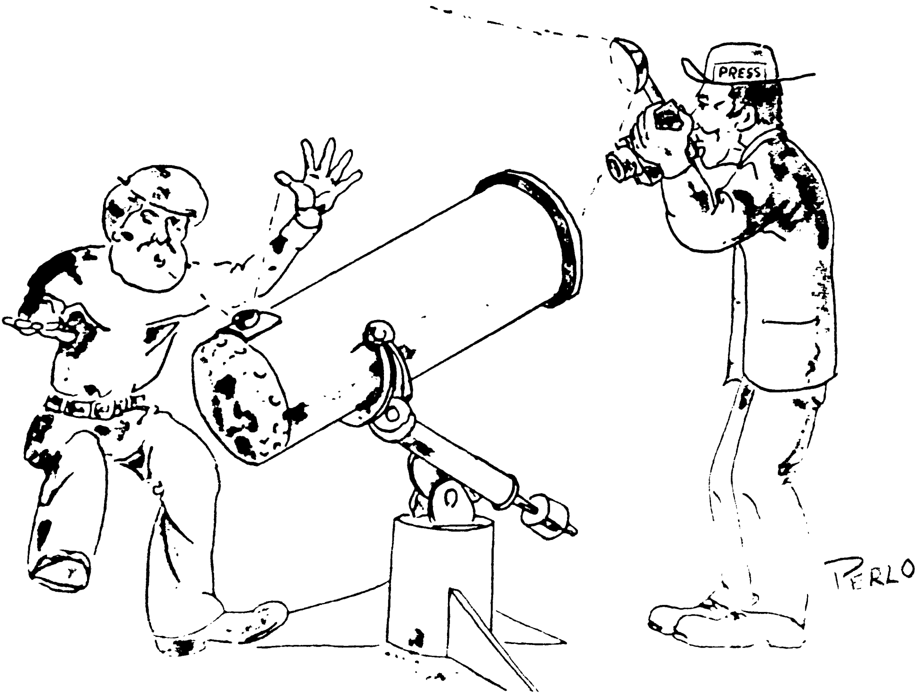
The [illegible] meteorite, [illegible] [illegible]
[illegible], will [illegible] [illegible]
Will pick-up within 10 kilo[illegible]
[illegible].

Contact:
[illegible] Meteorite [illegible]
[illegible]
1747 [illegible]
[illegible], [illegible]

"[illegible], [illegible]"

-[illegible]

Press Release... the new light amplifying telescope was unveiled tonight at...



TELESCOPE RAMBLINGS

THE MANY MERITS OF MODEST MAGNIFICATION

"How much does it magnify?" This ubiquitous question not only reveals the limited knowledge of the speaker, but also serves to demonstrate the extent to which mass advertising has mislead the public. I wonder how many more children would be turned on to astronomy if their first looks were through a modest, large aperture, low power telescope, instead of through one of the standard, small aperture, high power, wobbly, $99. wonders from the local department store.

The range of useful magnification for an astronomical telescope extends from about 0.2x to 2x per millimeter of objective diameter (or 5x to 50x per inch of objective for those who also still think in Fahrenheit). As an example, for a 60 mm telescope the useful magnification extends from about 12x to 120x (and not to 450x as the mail order catalogues would have us believe). Beyond 2x/mm all that is revealed is the fuzziness inherent in the wave nature of light.

The reciprocals of 0.2x/mm and 2x/mm give the range of diameter (5 mm to 0.5 mm) of the exit pupil, the small round bundle of light located at the observer's eye. "Modest magnification" might be defined as from about 0.2x/mm to 0.5x/mm (exit pupil diameter 5 mm to 2 mm). The first figure is approximately where richest field telescopes (RFT's) operate.

I first came across the RFT concept back in 1960 while browsing through a large paperback entitled Amateur Astronomy Handbook, A

Fawcett How-To Book, # 454. It contained fascinating statements such as: "It can visually define the galactic reaches of space more brilliantly than any other small instrument. In fact, it outperforms the giant telescopes in the definition of the richness of star fields." These thoughts struck deep and helped to fire an interest in the wonders of optics.

According to volume 2 of the classic Amateur Telescope Making books (Scientific American), the RFT concept was first emphasized by S. L. Walkden of London, England around 1916. On page 638 Walkden himself states:

"It has long appeared to me that amateur astronomy is too much obsessed with the idea that a telescope is to be valued as a powerful magnifying instrument, with light-grasp as a secondary necessity. But for the chief pleasures in the contemplation of the sidereal heavens the telescope needs considering primarily as a light-gathering instrument, with magnifying power as the secondary necessity only so far as without some the light grasp cannot be made available. If we knew a way of increasing light-grasp without any magnification at all we should obtain most magnificent impressions of the night sky — such as possibly the owls tend to have — but, unfortunately, present optics can tell of no way of having that. Photography, with its cumulative effect, is some solution to the problem, but, except in its wealth of detail, a photograph is a poor substitute for the life and sparkle of the visual impression. (The RFT) is the next best thing. (An RFT will show objects such as the Andromeda galaxy and the America Nebula) not dead, though, but come to life, so that, indeed, the solemn thinking and realizing observer can sometimes almost want to be left alone with what he sees."

Walkden's comments serve to illuminate an interesting fact. Namely, nearly all of the Universe is best seen at low magnifications. It is only in our immediate backyard, for the Moon and the planets, that high magnifications are really desirable (with modest apologies to double star and planetary nebulae fans). Low powers (near 0.2x/mm) with their large, eye-filling exit pupils (about 5 mm), yield optimum illuminance of the retinal images of extended (non-star like) objects. With such powers the delicate, gossamer nebulosity of gas clouds and galaxies can best be seen. (The brilliance of stars is independent of magnification, except below 0.2x/mm where all the light is unable to enter the eye since the exit pupil is larger than the eye pupil, and above 2x/mm where diffraction noticeably broadens their images.)

I suspect that some readers probably think that the lower limit of 0.2x/mm is not quite right. Would not a better figure be 0.14x/mm corresponding to a 7 mm exit pupil? After all, what about 7x50 binoculars? Let me make four comments on this: Firstly, 0.2x/mm is only an approximation. It is not a fixed, magic number. Secondly, as one grows older the eye pupil cannot open quite as wide as it used to. Thirdly, aberrations associated with the peripheral portions of the cornea and lens of the eye tend to offset the advantage of a 7 mm exit pupil. And finally, a 5 mm exit pupil lowers the background sky-light a bit to produce views that are, to me at least, aesthetically more pleasing.

In addition to giving the best views of

gas clouds and galaxies, modest magnifications have many other merits (and here we have one of those rare instances where several good features are not mutually exclusive!). For completeness I shall begin the list with the merit that lies behind the RFT concept:

1. The brightness of extended objects is near its optimum value. Reflection nebulae, gas clouds, and galaxies are thus best seen near 0.2x/mm.

2. Field of view. For a given telescope, the lowest magnifications (~ 0.2x/mm) yield the largest field of view, particularly if the low power eyepiece is of the "erfle" type. A wide field has several advantages:
   - (a) A bigger segment of the Universe is in view at any one instant.
   - (b) The locating of celestial objects is easier.
   - (c) The need for a motor drive is minimized. In fact, an equatorial mount is not even essential. The neglected altazimuth mount can be very serviceable and convenient for a visual RFT.
   - (d) There is a greater chance of seeing meteors and other unexpected sights (small star clusters, comets, RCMP,..)

3. Atmospheric turbulence is seldom a problem at low magnifications. On dark, sparkly nights when higher magnifications are often useless, the RFT is ideal.

4. Steadiness of the mount is less critical. This is especially appreciated when touching the telescope to focus or aim it. Other sources of vibration such as wind and "friends" are less annoying also.

5. Focusing is less critical with a low power eyepiece.
6. Eye relief (the distance between the eyepiece and the eye) is greater and thus more comfortable.
7. Imperfections in the optics, including diffraction effects, are less noticeable at low magnifications.
8. Motes (small, strange spots and hair-like things) in the observer's eye are often bothersome at high magnifications; however, with an exit pupil as wide as 5 mm, the retinal shadows of this flotsam in the vitreous humor of the eye are much less noticeable.

By using binoculars, one can add to all of these merits both the light gain and the sense of depth and reality that attends the simultaneous use of both eyes. Some of the most heavenly views I have experienced have tumbled through the limpid lenses of 15x60 binoculars.

Roy L. Bishop
Maktomkus Observatory

COMET WEST OBSERVED

The first rep ort of an observation of Comet West was received as I was putting the last touches to MM's. It was first seen by James Taylor at 6:10 pm, 25 Feb. and was visible through Binoculars dispite some thin clouds on the horizon. The tail, he said, was about 3 times the length (ie. diameter) of the coma. He could not see it with out optical aid and he did not hazard a guess at the magnitude. Recent reports from the IAU have showen it to be one to two mags. brighter than predicted in the circular reproduced in last months issue. I hope you get a good view of it as well.

BK

VANCOUVER CENTRE COORDINATES ECLIPSE TRIP

Ed. note: This was mailed Oct 23, 1975 received about Jan 5 ie. too late for inclusion in NN's for Jan/Feb. Since the eclipse isn't until Oct 23 1976 you probably still have lots of time to finalize your reservations!

This article isn't going to sell one trip to Australia. But that's okay; it isn't supposed to. What it might do is convincethose of you who are confirmed eclipse chasers, that you should band together and go as a group. If you just ignore the cameraderie, exchange of ideas and projects, and general travelling companionship, there is still one very good reason to go together; IT'S CHEAPER!

The Vancouver Centre is working on plans to organize every eclipse chaser from Halifax to Victoria into a comprehensive tour group. Using the resources of the MacMillan Planetarium, and some essential cooperation from Australian amateur astronomers, Canadian Pacific Airlines and officials of Australian and Hawaiian observatories, we hope to put together an eclipse package that will make everyone happy. Here's what we've done so far....and here's what you have to do.

To begin with, it's a break even venture. It is not some travel agent's idea of what amateur astronomers need. The tour will be about three weeks duration. It will get the amateur from any location in Caada to Vancouver. From there it is off to Nandi, Fiji (it is a fuel stop and doesn't cost extra so we might as well see it), and then to Sydney. Arrangements there will be made for accomodation, trips to the observing site, trips to Australia's famous radio telescope installations, and the usual tourist tours (pub hopping). We hope to get our Australian counterparts (the R.A.A.S.) to do a lot of the leg work on this.

On the return leg of the trip, there will be a stop in Hawaii (because again it doesn't cost extra). Though we can't guarantee anything, we're working on getting access to the observatories on Mauno Kea. If you have not heard Canada, France and Hawaii are building a 141" telescope atop Mauno Kea. Finally, its back home to rain and cold.

Well there's the outline. At this stage, nothing is set. We can't even tell you what it will cost except that it is bound to be astronomically expensive (I wish I hadn't said that). We can tell you what you'll save going as a group.

To begin with, we hope to get access to all the sites that would interest an amateur astronomer. We also hope to have the Royal Australian Amateur Astronomical Society make many of the arrangements for us (they charge less than travel agents). Travelling as a group (20 or up) we save $400.00 or more per person on the airfare. We've made special arrangements with the airlines involved so that telescopes and other equipment will get special handling and will not be subject to excess baggage charge (this amounts to about $50.00 for a telescope).

The Vancouver Centre doesn't get anything out of this; other than the fact that a handful of our members will be going. We have the contacts in the right places, and by doing a lot of the organization, we can get a break on many of the charges.

What we need most, is some indication of how many people across the country might be interested in going. We know of a few from Vancouver, the usual handful of diehards from Ottawa, Ken Chilton from Hamilton (if the station pays), but what about the rest of you?

If you are even vaguely interested, could you drop us a note as soon as possible. By that time, we should have a more definite idea of what we might do, and how much it might cost. Incidentally, the eclipse is 3:50 in duration and takes place after lunch but before cocktails.

Lets hear from you. Thanks.

Vancouver Centre, RASC
1100 Chestnut St.
Vancouver, B.C.
V6J 3J9

BINOCULARS FOR CELESTIAL VIEWING

There is no monocular telescope which can produce the same magnitude of beauty on a clear star filled night, like a good pair of binoculars. Combining extreme portability with unsurpassed advantage of simultaneously seeing spectacular fields of view with both eyes, binoculars are excellent for learning your way about the sky as well as for more serious observing programs like hunting comets and studying variable stars. Whether beginner or amateur, many hours of pleasurable stargazing can be derived, with virtually carefree maintenance and preparation.

Binoculars are basically a matched set of reduced size refractor telescopes connected in precise alignment enabling both eyes to see the same object at the same time. Both objective and ocular lenses are achromatic and between each optical path are matched prisms that serve a two fold purpose. First, they erect the otherwise upside down image produced by an astronomical telescope. Secondly, instead of just giving a right side up view like the right angle star diagonal prisms supplied on small refractor telescopes, binocular prisms flip the mirrorlike image of a scene so that'right' and 'left' in the binocular eyepiece corresponds to right and left in the scene you are viewing.

True prismatic binoculars should be distinguished from less costly and often optically inferior opera or field glasses. These consist of two simple telescopes mounted side by side and are often referred to as imitation binoculars. While both types give erect images for terrestrial use, opera glasses use negative eyepiece lenses to magnify the image produced by the objectives and give a very restricted field of view. Usually you can buy high quality prismatic binoculars for less than the cost of the smallest refractor telescope-- making them an ideal first sky watching instrument for the raw, beginning astronomy enthusiast. Their value does not stop there, however, because they are an indispensable accessory for the seasoned observer as well as maintaining their observational value even after the beginner graduates to his first telescope.

Specifications for binoculars are written as a sequence of numbers like 7x35. The first number and 'x' is magnification, while the second number gives the clear aperture in millimeters of the objective lense. Specifications of 6x30 7x35,7x50 and 10x50 are generally useful for stargazing, however most serious observers find 7x50s and 10x50s a good compromise between size, power and field of view. The larger aperture works best for low levels encountered in sky observing.

Virtually every celestial object can be enjoyably viewed with binoculars. Lunar surface features provide fine sights with higher power models, while eclipses of both sun and moon are best observed with such instruments. At 7 or 10 power, you can see the thin crescents of Venus and watch the satellites of Jupiter (though here, higher magnification is recommended). Also, you can track from night to night, against the sky background, the slow daily movement of all the planets (except Pluto) and brighter asteroids. Frequent and beautiful twilight conjunctions of the moon and bright planets are often superb binocular sights. Rounding out the solar system are comets—some of which have been discovered with 10x50 binoculars.

When it comes to the realm of the stars, an almost limitless number of objects lie within the realm of binoculars, including bright variables and highly coloured variables and highly coloured stars, wide double and multiple stars, open and globular clusters, bright and dark nebulae, and even galaxies. Perhaps the grandest sight of all is our own Milky Way galaxy—an incredible profusion of suns seen in binoculars as in no other type of optical instrument. All of this and more awaits the binocular user!

Even though all celestial objects are technically at 'infinity' and therefore too distant to show depth perspective, one of the surprises and delights of binocular viewing you will encounter is the breath-taking view of the moon seemingly suspended three dimensionly against the star background. Although only illusionary, the effect is never-the-less real and dramatic.

Larry Coldwell

THE PERSONAL EQUATION IN ASTRONOMY AND THE RISE OF EXPERIMENTAL PSYCHOLOGY

Part 1: The Discovery of the 'Personal Equation'

Psychology and astronomy are not sciences that one ordinarily thinks of as having much connection with one another, yet a series of events which began at the Greenwich Observatory toward the end of the eighteenth century played a significant role in the development of scientific psychology. The story began when Maskelyne, the British Astronomer Royal, noticed a difference between his own measurements and those of an assistant in the timing of a transit of a star across the meridian of the observatory. The taking of such 'stellar transits' was one of the most important tasks of every observatory of the period, for upon them depended the determination of the true time, the positions and movements of the various 'heavenly bodies' and the calibration of the clock. As the calculation of the longitude requires precise knowledge of time, ships' chronometers were checked by the observatory, and the importance of their accuracy to a sea-faring nation such as Britain can be readily imagined.

The method then in use for the taking of transits was the 'eye and ear' method of Bradley. Most simply, the instrument used in taking the measurements was a telescope mounted in an east-west axis, and turning in the plane of the meridian. Parallel wires were set in the focus of the eye piece, and the middle of these was the meridian. The task for the astronomer was to determine the exact moment at which a star crossed this meridian. Sophisticated measuring devices were not, of course, then available. In Bradley's method, when a star is about to make its transit, the observer reads off the time from a clock and continues to count the second beats while he watches the star in the telescope. As the moving image approaches the central wire, he fixes firmly in mind its place at the last beat before it crosses the wire and its place at the first beat after; from the distances of these two points from the meridian, the astronomer estimates by eye the time of the crossing in tenths of seconds. The problem, therefore, is to determine the correct tenth of the relevant second.

It can be seen that in the absence of an automated means of measuring stellar transits, the task was largely a mental one. The psychological phenomena involved are complex; Bradley's method involves visually fixing the exact place of the star at the first beat, remembering this point, the fixing of the place at the second beat, the comparison of the two positions, and the expression of their relation in tenths. Despite the recognized complexities of the psychological processes which are involved, it was generally assumed that this method was accurate to one-tenth, or at most, two-tenths of a second.

Maskelyne, however, noticed in 1795 that one of his assistants, Kinnebrook, differed from his supervisor by more than this accepted error. In the third volume of the Greenwich Observations, Maskelyne (1795) reported on this difference and its eventual outcome:

> I think it necessary to mention that my assistant, Mr. David Kinnebrook, who had observed the transits of stars and planetsvery well in agreement with all the year 1794, and for a great part of the present year, began from the beginning of August last to see them down a half second of time later than he should do according to my observations; and in January of the succeeding year, 1796, he increased his error to eight tenths of a second. As he had unfortunately continued a considerable time in this error before I noticed it, and did not seem to me likely ever to get over it and return to a right method of observing, therefore, though with great reluctance, as he was a diligent and useful assistant to me in other respects, I parted with him...
>
> I cannot persuade myself that my late assistant continued in the use of this method (Bradley's) of observing, but rather suppose he fell into some irregular and confused method of his own, as I do not see how he could have otherwise committed such gross errors.

The incident was forgotten by everyone (with the exception, presumably, of the unfortunate Kinnebrook) until it was mentioned in 1816 by von Lindenau in a history of the observatory at Greenwich. At Königsberg, where a new observatory had been built in 1813 under his direction, the Belgian Astronomer Royal, F.W. Bessel, was intrigued by the report. Why should a well trained and apparently conscientious observer using good equipment and a method that was supposed to be accurate to one- or two-tenths of a second, persist in giving measurements so at variance with those of his superior? Bessel assumed that since the discrepancy continued despite the obvious wish of Kinnebrook to be accurate, it must be involuntary. As such, if it was to occur in other than this isolated case, it would be of major significance for astronomers.

Bessel was a pioneer in the more exact measurements of modern astronomy and had a particular interest in instrumental errors of measurement. Errors of observation, while not widely studied, were not unknown, and the mathemation, Johann Karl Gauss, had discussed the theory of them at the Gottingen observatory in 1809; he had gone so far as to devise a mathematical formula expressing 'the rate of normal range of error with which to correct his calculations' (Capretta, 1967, p.66). With Bessel's particular interests, and aware as he apparently was of the relevant work of Gauss, it is not surprising that the story of Maskelyne and his assistant should have caught his attention. Was it possible that the accepted method of Bradley was not as accurate as it had been assumed? might the method be subject to relatively serious personal errors of observation? Bessel sent to Greenwich for a copy of Maskelyne's complete observations and'after studying them, determined to see whether this personal difference, which seemed incredibly large in view of the supposed accuracy of the method, could be found amoung observers more experienced than Kinnebrook' (Boring, 1957, p. 135).

Bessel's first attempt to compare his own observations with those of other astronomers was made in 1819 when he visited Enecke and von Lindenau; this attempt failed, however, when there was only one clear night during the period they had together! The next year, at Königsberg, he had an opportunity to compare himself withWalbeck. Selecting ten stars, they alternately observed transits of five one night and five the next, for five nights. They discovered that Bessel always estimated the time as earlier than Walbeck; the average difference was 1.041 seconds, with little variation. Such a difference was incredible, in view of the supposed degree of accuracy of Bradley's 'eye and ear' method. How could two observers differ more than a second in using a method that involved estimating fractional intervals between beats of a clock only one second apart? Yet Bessel reported: "We ended the observations with the conviction that it would be impossible for either to observe differently, even by only a single tenth of a second" (quoted in Sanford, 1888, p.10). While these results have been questioned, and it has been suggested that they were due to an artifact of some observing procedure, from one point of view it is irrelevant whether the result is in fact a true difference or an artifact; the findings served to further increase Bessel's interest, and led him to continue his investigation of the phenomenon.

In 1823, Bessel had an opportunity to make further comparisons, this time with Argelander. Departing from the more usual method, Bessel made the clock corrections while Argelander made the observations. The results were compared with those made on the same stars in 1821, when Bessel had done both the observing and the clock corrections. The difference between the two observations presented in the standard form, is A - B = 1.223 seconds. Again the difference was greater than should have been possible! As a result of Bessel's presentation in this form of the various comparisons he made, the phenomenon came to be called the "personal equation".

Bessel was particularly anxious to compare his own observations with those of Struve of Dorpat who was more experienced in making stellar transits than Walbeck and Argelander. As no direct opportunity presented itself to make comparisions, Bessel thought of the idea of determining a personal equation by means of a third observer. Since both Walbeck and Argelander had compared themselves with Struve on visits to Dorpat, and these results were available, Bessel made the following Calculations:

By direct comparison:

W - B = 1.041 s. (1820) A - B = 1.223 s. (1823)
W - S = 0.242 s. (1821) A - S = 0.202 s. (1823)

Hence, by subtraction:

$$S - B = 0.799 \text{ s.} \qquad S - B = 1.021 \text{s.}$$

Eventually Bessel had data to permit him to make three such indirect comparisons and two direct ones. The various values for the personal equation varied from 0.044 sec. to 1.021 sec. It had originally been Bessel's hope that he could use the personal equation as a means of correcting the observer error of any particular astronomer. His eventual conclusion, however, was that not only were there individual differences in observations but that these differences were variable, so that one could not reliably "calibrate the observer" in order to correct for them.

Other astronomers were less pessimistic, however, and they argued that the variability of the personalequation was not so large that correction was entirely useless. While the comparisons of Bessel's observations with those of Struve had varied widely, the four comparisons made after the discovery of such differences (covering the period 1821 to 1834) all showed that Bessel observed earlier in amounts varying from 0.770 to 1.021 seconds. While one could not expect, in using the personal equation, to arrive at a completely accurate measurement, it could be used to reduce the error.

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Have you Read ? (Don't you always?)

Two articles struck me and I can't get them out of my mind so I'll pass them on to you. They both concern themselves with that marvelous thermodynamic word ENTROPY.

The first is in SCIENCE Oct 31st and is by an Economist from Roumania by the name of Georgescou-Roegen (or something- I've lost my copy but not my image of this article). The Socioeconomic entropy is increasing at an alarming rate and perhaps the hippies are right. Bring back the horse.

The second is in SCIENTIFIC AMERICAN Dec. 75 p56. If you accept that our planet does not occupy a privileged position in the universe then "microscopic information" is as unknowable as Heisenberg'suncertainty principle. The universe is not running down. There is more information to be found- the present moment always contains an element of genuine novelty and the future is never wholly predictable. Not even the ultimate computor- the universe itself-ever contains enough information to completely specify its own future states. Oh yes, I promised ENTROPY- $H+I=H_{max}=I_{max}$ where H is thermodynamic entropy and I is macroscopic information.

Murray Cunningham

← so there!

SOLUTION TO----THE LUNIBIN - 76

1 C	2 L	U	S	T	E	3 R		4 M	A	S	5 E	R	6 S		7 U	R	A	8 N	U	9 S
	O					10 A	R	A			R		U					E		C
	11 N	O	D	12 E		Y		G				13 S	P	I	C	14 A		T		I
	G			O		E		15 N	U		16 C		E			G				N
17 T	I	T	A	N		T		E			18 L	Y	R	A	E		19 L	Y	O	T
	T				20 C		21 P	T		22 F			G			23 N	I			I
24 H	U	B	B	L	E			25 O	O	R	T		I		26 P			27 R		L
	D				L			S		A		28 S	A	G	I	29 T	T	A		L
30 P	E	R	31 I	G	E	E		P		U			N			A				A
			O		S			H		32 N	O	C	T	33 I	L	U	34 C	E	N	T
35 M	A	36 G	N	I	T	U	37 D	E		H				O			M			I
K		R			I		38 O	R	I	O	N	I	39 S			40 R	A	D	I	O
	41 V	A	R	I	A	B	L	E		F			Y		42 O					N
43 S		V			L		L		44 H	E	45 R	T	Z	S	P	R	46 U	N	G	
47 P	R	I	S	48 M			49 F	L	A	R	E		Y		E		G			50 S
E		T		G		51 M	U		L		S		G		N		E			T
52 C	R	A	B		53 C	O	S	54 M	O	L	O	G	Y			55 I	M	56 A	G	E
T		T		57 G		N		V			L			58 A		O		C		A
R		I		R		T			59 R	E	V	E	R	S	I	N	G			D
60 O	Z	O	N	E		61 H	62 E		N		I			C		O		63 M	A	Y
G		N		64 G	D		Q			65 U	N	I	V	E	R	S	E			S
R				O			U		66 M		G			N		P		67 E		T
68 A	B	69 E	R	R	A	T	I	O	N			70 A	P	S		H		P		A
P		R		I			N		71 R	E	D			I		E		O		T
H		O		72 A	U	R	O	R	A			73 C		O		74 R	O	C	H	E
		75 S	U	N			X		76 S	E	A	S	O	N		E		H		

D. Brooks

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Total membership, including life members which are designated by an '*', was 47 as of 20 Feb. This is up roughly a third from this time last year. If your name is not on this list then don't delay renewing your membership as the Journal will be delayed even more than usual.

Equipment that is known to exist is listed following the address of the owner. The code is as follows:
Rl--reflector, Rr--refractor, Cel--Celestron, Q--Questar
B--Bionoculars.
Additional equipment owned by the universities include:
SMU-- 2.5" & 4" Rr, 3.5" Q, 3"Maksutov, 6" & 16" Rl.
Dal-- 3.5" Q
Acadia-- 6 3" Rl, 2.5" Rr(?)
St. F.X-- 5" &10" Cel
Mt. A.-- 8"Rl, 2.5"Rr
Tantalon Jr High-- 10 2.5" Rr

OBSERVING REMINDERS

Mar 10-12 —Zeta Bootids meteors. Radiant position is RA 14^h 32^m and Dec +12°. Not one of your major showers by any means. Moon is new on 8th

Sat 20 Mar—spring equinox at 7:50 AST. Sun is 92,579,482 miles from Earth, and at RA 0^h and Dec 0°.

Sun 21 Mar—Occultation of Neptune at 06^h AST. Neptune at mag 7.7 will reappear from the dark side (W) with the moon at 3rd quarter.

Wed 7 Ap —20 56 AST occultation of ϵ Gem by mars. Star is mag 3.2, Mars is mag 1.3 and the event will occur when they are well to west of meridian. Great chance to measure diffraction patterns with a'simple' photometer with a chart recorder on the output, Chris.

Ap 19-23 —Lyrids. Radiant position is RA 18^h 04^m, Dec +33. Max is on 22nd at 22^hAST when about 15 meteors/hr will be recorded. Velocity is moderate at 48km s^{-1}. Moon—LQ

Tues 27 Ap—Mercury at greatest eastern elongation ie. it is to be seen in the west after sunset. This is one of the most favourable of the year, the planet being 19° above horizon at sunset and being 79,512,942 mi. from Earth. Will be visible for the following couple of weeks.

Thur 29 Ap—Partial solar eclipse. We see the event begin as the sun rises (5:10 for Hfx). Mid eclipse is 5:30AST and will last roughly 40 min. Will be annular in NW Africa if you happen along.

Thur 5 May— η Aquarids. Radiant point RA 22^h16^m Dec -2°. Duration is 3 or 4 days to ¼ max. rate. You can expect to see 20/hr of these speed demons (64 $kmsec^{-1}$). Max is at 0^h on the 5th and the first quarter moon won't affect your observations after mid-night. Fast motion of these meteors makes them more difficult to capture on film than the Lyrids. If you have a 28mm f/2.8 lense or better you might be able to get a faint streak or two. Aim your tri-pod mounted camera to one side of the radiant point (few meteors appear at the radiant point) and leave the shutter open 15 min. or longer. Make sure no lights are nearby.

all 1976——Take another gander at NGC 1976 or perhaps more familiar as M42 or even more familiar-Orion Neb.

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