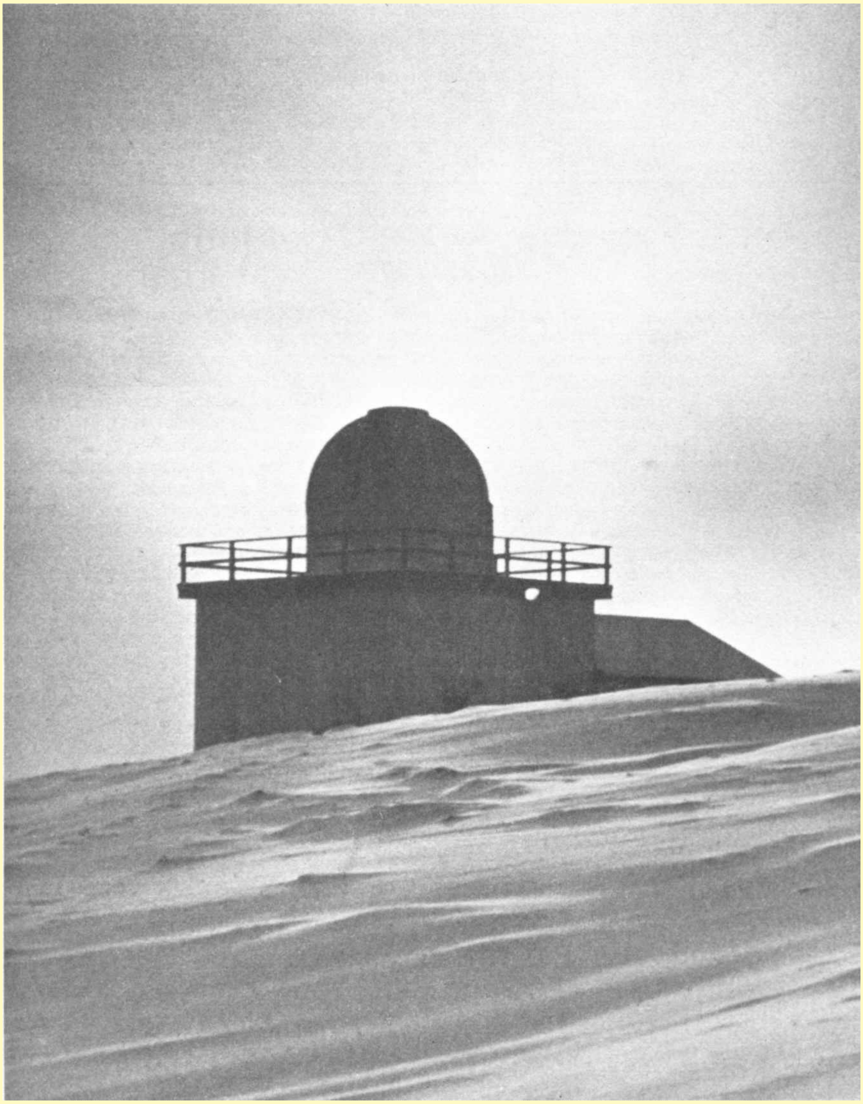
NATIONAL NEWSLETTER

February 1976



The Arctic Sun silhouettes the Radiosonde buildings at Mould Bay, N.W.T. The domed structure houses equipment for tracking upper air balloons. Photo by Ken Pilon.

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February 1976

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Please submit all material and communications to:
The *National Newsletter*
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Deadline is two months prior to the month of issue.

Nominations for RASC Executive, 1976-1977

The By-Laws of the Society provide for a Nominating Committee composed of the three surviving immediate Past Presidents, whose duty it is to prepare a slate of candidates for the offices of the Society.

Next May, we must elect the following officers: President, 1st Vice-President, 2nd Vice-President, Treasurer, Recorder, and Librarian. If any member wishes to make suggestions in this regard, he should contact the Committee Chairman, Dr. J. D. Fernie, c/o The National Office, 252 College Street, Toronto, Ontario, M5T 1R7.

As well, the By-Laws provide that "any five members of the Society, in good standing, may nominate additional candidates for any office, provided that such nomination, accompanied by a letter of acceptance from the nominee shall be received by the Secretary of the Society, not less than sixty days before the date of the annual meeting."

It would be appreciated if any such nominations were submitted no later than March 1, 1976, in order to allow for the printing and mailing of ballots.

Full details pertaining to nominations are outlined in By-Law 1, Article 11(a), as published in the June, 1969 *JOURNAL*, pages 155–168.

The Adams-Leverrier Affair

By Dr. J. D. Fernie, National President

When I first started writing these columns I said they would contain well-known as well as little-known stories, but in retrospect I see I have tended to avoid the more renowned tales. So perhaps it is time to look at one of the most famous incidents in the history of modern astronomy, a *cause célèbre* that not only produced an international uproar, but one that is extraordinarily illuminating in terms of human character. This was the discovery of the planet Neptune in the 1840's, and the roles played in that event by two young men: John Adams and Urbain Leverrier.

The story really goes back to the night of March 13, 1781, when a local organist and minor composer in the English city of Bath, indulging in his hobby of amateur astronomy, happened to turn his six-inch reflector on a 'star' that appeared to show a distinct disk. This, of course, was William Herschel discovering the planet Uranus, the occasion that started his conversion from minor musician to the greatest observational astronomer of his day. Things got off to a slow start, however, because Herschel thought he had discovered just another comet, and threw everyone off the track by announcing that it had a diurnal parallax of 10 to 20 seconds of arc. It was not until that summer that it was realized from continuing observations of the object that it was really a new planet, the first ever to be actually discovered.

The immediate challenge was to calculate the orbit of the new planet, but here something of a problem arose. Since Uranus is so far out in the solar system it moves very slowly, and the few months of observation were not sufficient to calculate an accurate orbit because so little of the orbit had been traversed in that time. Before long, however, several astronomers, notably Johann Bode, realized that because Uranus appears as only a very small disk, previous generations of astronomers might well have mistakenly recorded its position as a star. Using the available observations to calculate roughly where the planet would have been in the past, they began a search of old catalogues to find any records of a 'star' in positions where, in fact, it was now known that no stars existed. Sure enough, human frailty did not fail them, and Bode soon found several such earlier observations. One, by John Flamsteed, went back almost a hundred years (if you ever wonder why there is no 34 Tauri, it is because that 'star' was Uranus).

With these more distant observations to hand, astronomers attempted to calculate a precise orbit for Uranus. Curiously though, it proved impossible to represent both old and new observations with a single set of elements. Those that satisfied the new observations gave errors of position for the old observations of sometimes as much as 45 seconds of arc. Yet the earlier observers were known to have been generally accurate to within a few seconds. The best that the orbital experts could come up with was to blandly shrug away the few early observations as being unaccountably inaccurate. Clearly more such early observations would be very useful.

The early years of the nineteenth century saw European astronomy somewhat in decline, what with Napoleon and Wellington rampaging around the Continent. It was a good time to hole up in one's library and dig into old records and catalogues. In this way a good many early observations of Uranus came to light. Flamsteed had actually observed the planet six times without realizing it, while Pierre Lemmonnier took the record at eleven observations, six of them made in nine days without noting anything amiss. The search seems to have been exacting; one of Lemmonnier's observations was turned up scribbled on a brown paper bag previously used for hair powder. Evidently both observing records and library standards were a little different then.

But things only went from bad to worse. Despite the mathematical abilities of such astronomers as Bode and Bessel, the early observations could not be reconciled with the later ones. Alexis Bouvard worked the hardest at these orbital calculations, and it was he who found that by 1820 the current observations could not even be reconciled with those made at the time of discovery. As usual there was no dearth of imaginative explanations. Perhaps Descartes had been right and there was a 'cosmic fluid' dragging on Uranus; perhaps Uranus had a massive satellite swinging it out of position; perhaps it was being buffeted by a barrage of comets; perhaps Newton's law of gravity required modification at such large distances (a view favoured by Airy, the Astronomer Royal). None of these proved viable. The problem became the hottest topic in theoretical astronomy, academies offered prizes for its solution, but no acceptable solutions were forthcoming.

And there the matter stood in 1841 when a 22 year-old second-year undergraduate at Cambridge University, John Couch Adams, wrote a memorandum announcing his intention, once he had his degree, of seeing whether the motions of Uranus could be explained by the presence of a yet more distant planet, and if so to calculate its position so that it might be discovered.

This idea for explaining Uranus' behaviour was nothing new; in fact, by 1840 it was the most popular explanation going. But the mathematical difficulties of the undertaking were so horrendous that none of the established celestial mechanicians had even approached the details. One had to be either a genius or an undergraduate to even think of tackling it. But then, John Couch Adams was an unusual undergraduate.

No, John Couch Adams was not an average undergraduate, anymore than he had been an average child. Born in 1819, the eldest son of a poor but genteel tenant farmer in Cornwall, he had, like Newton before him, seemed destined to become a farmer too. At age eight he attended a country school conducted by a gentleman appropriately named Sleep, who inappropriately billed himself as "Professor of Caligraphy, Stenography, French, Hebrew, etc. ... Mr. Sleep Challenges any man in England for Caligraphy, Stenography, or the Mathematics." Fortunately the challenge did not extend to boys, for it soon turned out that 8-year-old John was much the better of the two at mathematics. After further occasions, when John administered a severe mathematical thrashing to his 11-year-old cousin, and then outperformed a much better schoolmaster of mathematics than Mr. Sleep (and this was real mathematics, not mental arithmetic), his parents rescued him from the care of Mr. Sleep and sent him to a bigger school.

But with their strained finances they had not been able to choose the most appropriate school, and the new one turned out to offer training almost exclusively in the classics, so again John was left to teach himself mathematics after school hours in the local library. Here he first came to astronomy via a copy of John Herschel's *Outlines of Astronomy* given him in 1834, followed by the excitement of systematically observing Halley's comet in 1835.

Eventually, thanks to very great financial efforts on the part of his parents, John found himself at St. John's College, Cambridge in the autumn of 1839. As might be expected, the flower had at last found the soil in which to flourish, and his student career was one of ever-increasing brilliance. The man who was to be his closest friend at Cambridge, A. S. Campbell, very nearly left the first day, when he got into a casual conversation with Adams on mathematics and was so aghast at what he took to be the average Cantabrian undergraduate's abilities he felt there could be no place there for him. But Adams, unlike many people of great intellectual ability, was renowned for his easy-going friendliness and generosity (traits that would be his undoing over Neptune), and soon he and Campbell and others were launched together on their studies.

Always there was the pull of astronomy, and in 1841 we find Adams rebuking himself in his diary: "I have badly broken my plan today, chiefly wasting my time with Astronomy. I resolve not to let my astronomical amusements interfere with my regular work." But he reached a watershed on June 26 of that year, when, browsing in a Cambridge bookstore, he came on a report by the Astronomer Royal outlining the great puzzling problem of the motion of Uranus. A week later he entered in his diary the memorandum mentioned earlier: when once he had his degree he would tackle the problem of Uranus.

But to get his degree he must finally face that horrendous hurdle, the Cambridge Mathematical Tripos. Eighteen three-hour papers, stunning not only in their difficulty but also in their originality. (It was once estimated that if one were to do only the bookwork in the Tripos, albeit perfectly, one would place 23rd in a class of 30.) Campbell noted that during the exams Adams would sit for an hour or more just staring at the paper, and then finally lifting his pen, rapidly write out the answers. The result, of course, was foregone: Adams came out on top, a position known as Senior Wrangler. What was unique, though, was that he had scored over 4000 marks, while the Second Wrangler had scored only 1800. There was thus a greater gap between first and second place than between second and last place.

And so at last to Uranus. But Adams saw as his first duty the repayment of his parents for their sacrifice, and so, now a Fellow of his college, he gave over all his available time to tutoring, sending back the money so earned to Cornwall. Uranus would have to await vacations.

Finally, back in Cornwall in the summer of 1843, "cheerful and happy and thoroughly enjoying the country life", Adams began his work. He had enormous powers of concentration, and soon was the despair of his brother George, who acted as assistant in checking John's arithmetic. They sat up till all hours of the night:

> "Often I have been tired [writes George] and said to him 'It's time to go to bed, John'. His reply would be 'In a minute', and he would go on unconscious of anything but his calculations. In his walks on Laneast Downs his mind would be fully occupied with his work. I might call his attention to some object and get a reply, but he would again relapse into his calculations."

And so, off and on, it went for two years. He needed more data, and through James Challis, Plumian Professor of Astronomy at Cambridge, obtained the necessary Greenwich records from the Astronomer Royal. At last, in September of 1845 he had a solution, which included a prediction of where the unknown planet beyond Uranus should be in the sky on October 1. This he communicated to Challis.

No doubt we of a modern freewheeling society do not easily see the intricate formalities of the Victorian mind, yet the course of events at this stage seems little more than incomprehensible. Here was Challis, presented with a definite position and date by a man of undoubted competence, having available a suitable telescope for making the necessary simple observations (which could have been made by an assistant – perhaps even Adams – if Challis couldn't be bothered), with the prize at stake nothing less than one of the greatest triumphs in the history of astronomy. And what did he do? He sat down and wrote Adams a letter of introduction to Airy, the Astronomer Royal, and then went back to his own routine work on cometary orbits. And Adams, cheerful easy-going Adams, apparently accepted the situation without a murmur. After two years in the calculations (and his predicted position was, in fact, good to within two degrees), they threw away the prize for the want of a few hours of observing. But that was only the first time they threw it away.

Off went Adams with his letter to Greenwich. Airy was in France, but hearing of the visit later, wrote a pleasant letter to Challis saying he hoped to hear again from young Mr. Adams. Adams reappeared at Greenwich a couple of weeks later, but Airy was on his way back from London. Adams left his card and said he would call again in a few hours. This time he was met at the door by the butler, who regretted the Astronomer Royal was at dinner (Airy dined each day at precisely 3:30 p.m.) and could not be disturbed. Adams left a manuscript version of his calculations and set off home. I can imagine his thoughts while slogging up and down Greenwich hill, cheerfulness finally wearing thin.

But Airy was quite impressed by the young man's work. He wrote a long and technical letter, generally approving, and including a question about the new planet's radius vector. And now Adams slipped up badly. He apparently did not know that Airy attached an importance to exactitude and promptitude that bordered on the psychotic. Easy-going Adams treated the question as rhetorical and failed to reply. It was his undoing. Even after Adams had realized his mistake and had written an abject letter of apology, including a completely satisfactory reply to the question, Airy wrote to Challis:

> Adams's silence ... was so far unfortunate that it interposed an effectual barrier to all further communication. It was clearly impossible for me to write to him again.

And there, until the next summer, Airy and Challis and Adams let the matter rest. Meanwhile they sat back and watched with interest as Urbain Jean Joseph Leverrier rapidly overtook them in exactly the same problem.

(Continued in the next issue)

Ed. Note: Reprinted from the *David Dunlap Doings* with kind permission of the Editor, Dr. J. F. Heard, and the author.

A Most Forgotten Land

By Ken Pilon

The searchlight sweeps through the darkness and red flares cast their glow over the scene as the government research ship "Arctic Explorer" arrives at Mould Bay, the first ship to call at this lonely Arctic weather station.

Mould Bay (76°N, 119°W), is one of nine "Upper Air" Stations located in the Canadian Arctic islands that comprise a 35-station network. Established in 1948 as a joint Canadian-American weather station, it is located on Prince Patrick Island, 700 miles north of the Arctic Circle in the western Arctic Archipelago. American participation was withdrawn in 1971. Mould Bay has a permanent population of eleven people (six scientific, one electronics expert, four support staff) and three dogs. During the summer the population may approach 40. I am employed as a Meteorological Technician by the Department of the Environment.

Our main work is in the field of meteorology and earth-related sciences. The work consists of twice-daily balloon soundings of the atmosphere (hence the term "Upper Air") to heights of between 80,000 and 100,000 feet. The data from these flights are exchanged internationally for use in weather forecasting, aviation, climatology and research. Surface weather is also recorded and the data exchanged. We are equipped with seismographic equipment, and a magnetic and auroral observatory. Other data collected include solar and terrestrial radiation, ice and snow surveys, soil temperatures, atmospheric contaminents, etc. All data are transmitted via radio-teletype to Resolute Bay (the communications centre for high-arctic traffic), 500 miles east of here. From Resolute it is re-transmitted via Anik satellite to computers in Winnipeg, Toronto and Montreal and then forwarded internationally. We also provide ground-to-air support in support of civil aviation.

"What's your temperature down there?" a Korean Air DC-8 radios.

"Thirty below. What's yours up there?" I ask back.

"Oh, it's very warm here, but it's 60 below outside", was his reply.

A week later he wanted to know the length of our airstrip, so that the pilot could drop in for hot coffee! (Our airstrip also acts as an emergency airfield in the event that an aircraft has to make a forced landing. If need be, we can handle almost any of the polar flying aircraft up to and including the Boeing 747. Whether it could get back into the air again is an entirely different matter.)

The radios also pick up other aircraft: a 737 with an ill passenger asking for an ambulance, or an Armed Forces Hercules which has discovered the remains of a downed aircraft.

I remember trying to radio one of our vehicles, which are radio equipped, only to be interrupted by, "Car 14...., car 14...., go pick up Sally at the A & W." It was the taxi-company in Inuvik, 600 miles to the south.

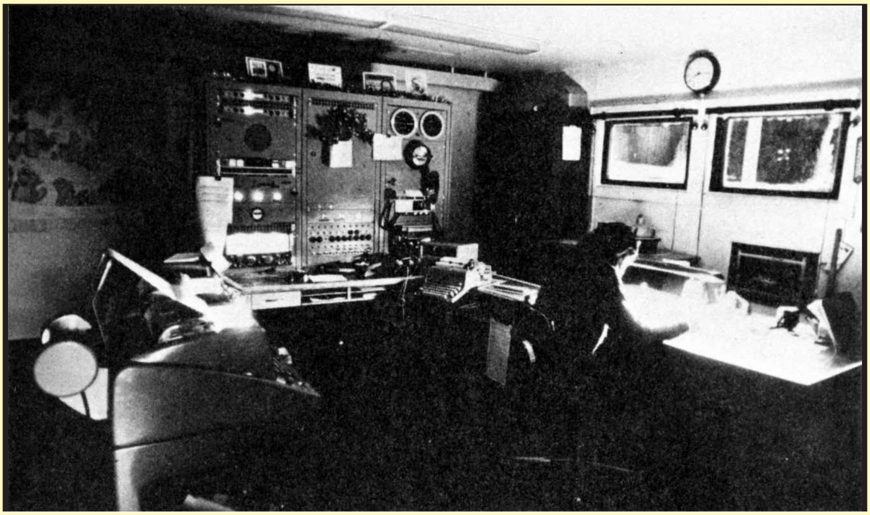
The balloon soundings can be interesting. Once I released the balloon and watched it sail off into the distance without its instruments. I had forgotten to tie them on. Occasionally high winds will crash the instruments package into the side of a building, and sometimes ground turbulence will cause the balloon and instruments crash onto the ground just after they have been released. I remember a chap who somehow managed to get his glove stuck in the instruments at release. His glove made 90,000 feet. Another chap thought he had successfully released his balloon but then found that he still had the transmitter in his hand. Occasionally a not so humorous situation occurs when someone is dragged along the ground during a release in a blizzard.

Mould Bay is situated on a bay of the same name. This site is at the mouth of a 200-foot wide river bed that is filled with water only during the "spring run-off", (i.e. in July!). The surrounding tundra is broken by 800-foot cliffs on the east and west, intersected by hills on the camp's edge. During the summer the terrain of red soil takes on the likeness of some distant planet. Plants and flowers, though numerous, are sparse by southern standards. Summer brings birds, mostly gulls and jaegers, although snowy owls and ravens are common. Insects are most uncommon. Little is known about life in the waters of the bay. Land animals include rabbits, foxes, wolves, polar bears, muskox, caribou and lemmings. The first three abound year round; the latter three make their appearances during the summer. Polar bears are infrequent visitors. Foxes enter the camp in pairs, one to allow itself to be chased by the station's dogs and the other to make off with the then undefended food supply. The wolves patrol the island from north to south in packs of three to twenty-five. They make frequent intrusions into camp and with patience can be hand-fed. Almost all of the animals do not demonstrate any real fear of man.

Mould Bay is one of the coldest and driest places on the continent. Summer brings over three months of 24-hour daylight, seven weeks without snow-cover and temperatures into the 40's. Winter brings more than three months of darkness and five months of below zero temperatures. Last January the average temperature was close to –40°F with the high and low for the month respectively, –20° and –61°. Windchill will reach –130°F. The monthly precipitation was a trace. The all-time recorded high (set last year) is 61°F. Annual precipitation is but 3 inches.

The station contains two libraries: the second, which was set up due to the lack of interest in the first, contains books and magazines of particular interest to men. There is ham-radio (for those who are too impatient to wait out the next month's mail plane), billiards, ping-pong, movies, a dark-room, a music library with complete stereo facilities, weight-lifting room, sports equipment, and countless decks of cards. "Bull-sessions" cover such varied topics as the effects of earthworms on the earth's interior or defense tactics in the event of a Soviet tank attack across the polar ice-cap. Partying (men only), is also big. We have a fully-equipped Post Office, complete with lists of serial numbers of counterfeit bills, Canada Manpower openings, etc. We receive Loblaw's circulars advertising "this week's special ...", letters from other countries wanting an official Mould Bay post-mark (I don't think they believe it's here), and letters from people who want to know, "What is it like to live near the North Pole?" or, "How cold is it?" A.M. radio reception can be quite good in the "dark season", covering most of North America and sometimes Europe and Asia.

Currently we have an oil exploration program under way with five sites on the island, one of which is based here. During the fall and spring our airstrip is busy with giant cargo aircraft flying in support of the winter exploration program. I remember one tractor-train that set off on a 40-mile trip to one of the other sites. They spent well over a month carving endless circles before they stumbled upon their destination with



The radio room in the operations building at Mould Bay. Photo by Ken Pilon.

the aid of aircraft. They could not find the other site in the dark.

To date no woman has ever worked at Mould Bay, and only recently have they been allowed. But Mould will set no precedent. We have no second washroom!

Such is Mould Bay: ample parking space, miles of uncrowded beaches, no air pollution or traffic congestion. Where else would you rather be? Bring a sweater!

We sound the air, take its temperature, measure its velocity and calculate its effects. Barren thoughts in a desolate 'scape. We make our moves and wait our time. The forgotten ones, in a most forgotten land.

(Mr. Pilon is a former editor of 'SCOPE, the Toronto Centre's newsletter. He is presently employed by the Atmospheric Environment Service as a Meteorological Technician and stationed at Alert, N.W.T. – Ed.)

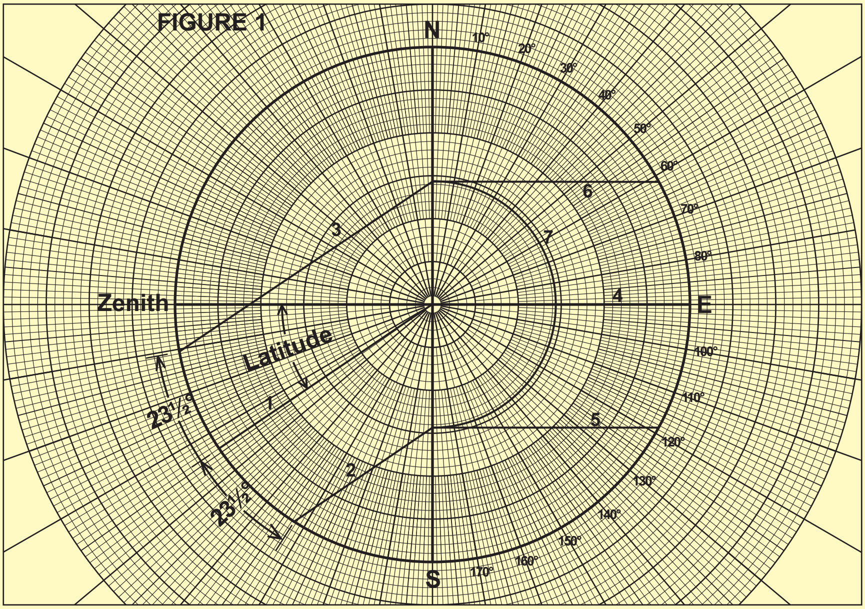
Graphical Method of Finding the Azimuth of Sunrise and Sunset

By LeRoy A. Woodward

The author, after noticing a number of spectacular sunrises, decided to make a series of photographs to record the beauty. Selecting a convenient location, the top of the Physics Building, a number of colourful views were obtained as the eastern sky changed from dark to dawn. However, the series was somewhat spoiled by the sun's coming up behind a building some distance away. Hence, it seemed better to be able to select a location during daylight hours and know that, weather permitting, it would be suitable. A graphical approach to getting the necessary information was the result. After it was developed, it was found to be instructive in demonstrating the changes of the apparent path of the sun with season and location of the observer. These changes, brought about by the tilt of the earth's axis of rotation relative to the earth-sun plane, are much more dramatic than is usually realized by individuals who spend most of their time at one relatively small latitude region. A series of graphs for different latitudes in both hemispheres can be quickly made and provides a means of increased understanding and appreciation.

Azimuth, one of the coordinates of the horizon system of celestial coordinates, measures the angle clockwise from the north point of the horizon to the vertical circle on which the body is located. The other coordinate in this system is altitude which is the angle measured up from the horizon to the location of the body on its vertical circle. Values for these two parameters are what an observer needs in order to locate a particular celestial body relative to his position. At sunrise and sunset the altitude of the sun is, of course, zero, so the azimuth is the only parameter of significance. In more every-day terms, knowing the azimuth of sunrise or sunset enables the observer to predict how far north of south of the east or west point the sun will rise or set on that particular day. These locations vary with the season and the latitude of the observer, and the angles range between 23½° for observers on the equator to 90° for observers at the Arctic or Antarctic Circles. Above these latitudes, the sun either does not rise or set during some parts of the year.

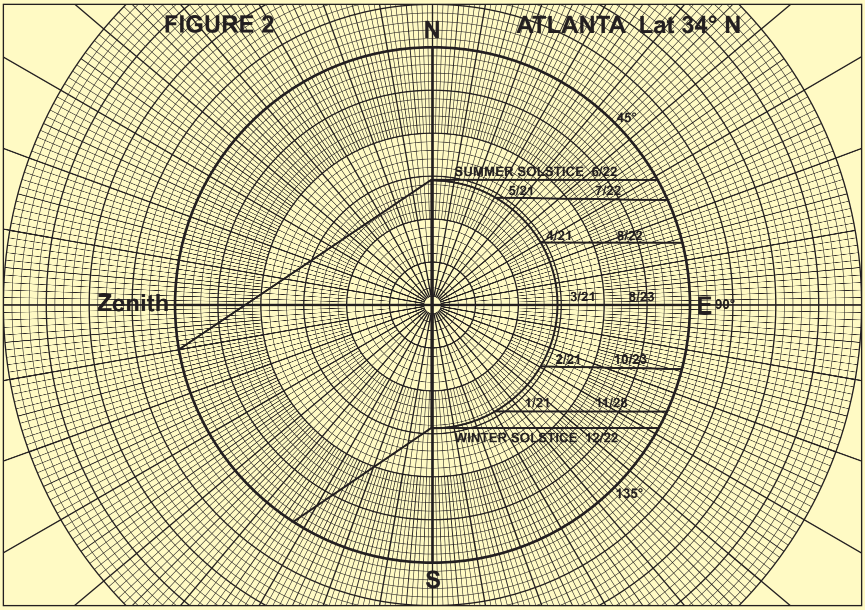
This paper describes a graphical approach to obtaining the necessary information. Depending on care and equipment used, the method can provide any desired degree of accuracy; but practical information, within a degree of angle, can be obtained with fairly simple equipment and moderate care. To use this system, one requires the following: knowledge of the observer's latitude to the nearest degree, polar coordinate paper, a ruling compass, and some means of drawing parallel lines such as a drafting machine or parallel rulers.



The steps of the method are as follows. (See Figure 1) Rule in the largest complete circle that is available on the paper. Half of this circle will be used as a vertical circle and the other half will be used as a horizontal circle. Rule in the N-S line with north at the top of the paper. Label the directions around the circle as indicated in Figure 1. Measure an angle south (northern hemisphere) from the zenith equal to the observer's latitude to the closest degree. Draw line (1) from the centre to this point. Mark off arcs on the circle equal to 23½° on either side of this line. Draw lines (2) and (3) parallel to line (1) to these points on the circle. Where these lines intersect the vertical line, draw lines (5) and (6) parallel to the east line, (4). Draw a smaller half circle, (7), of radius equal to the distance shown. This completes the basic construction. Line

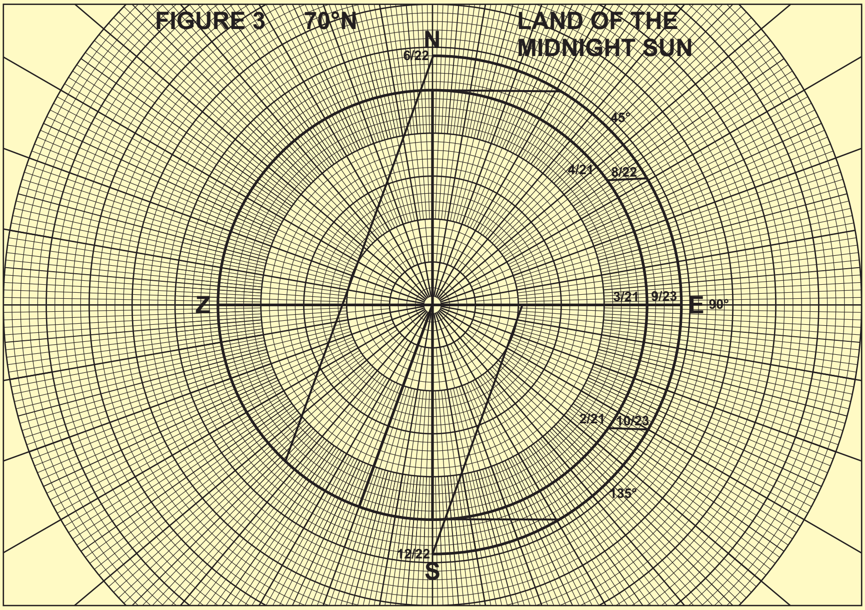
(1) is the line of the sun's path in the vertical circle at the equinoxes, approximately March 21 and September 23 and its projection in the horizontal circle, line (4) is the location of sunrise on these dates. Line (2) is the sun line for the winter solstice, approximately December 22; and its projection, line (5), shows the angle of sunrise on this date. Line (3) is the sun-line for the summer solstice, approximately June 22; and its projection, line (6), shows the angle of sunrise on this date. Half circle (7) provides the means of dividing this arc into days on the basis that the sun's apparent motion is approximately one degree per day back and forth along this half circle. This approximation is based on the fact that 365 days can be considered as 360 days when days are added or subtracted from the fixed points on the circle.

Figure 2 illustrates a completed graph for the latitude of Atlanta, Georgia, (34°N), with some additional monthly lines drawn in to facilitate the use of a ruler which can be held roughly parallel to one of the lines to estimate the angle for days between these dates. Sunsets are, of course, directly opposite in the west. Subtracting the azimuth of sunrise from 360° will give the azimuth of sunset.



An additional utility of this approach is that it provides a means of graphically illustrating the effects of the tilt of the earth's axis of rotation to the earth-sun plane. Most people have heard of the effects but really do not comprehend their magnitude. By drawing a series of graphs for different latitudes, a quite dramatic presentation is possible. Figure 3 illustrates an extreme case by going above the Arctic Circle to the land of the midnight sun, 70°N. Here the smaller half circle has become larger than the main circle and the projections show that between April 17 and July 26 approximately, the sun never gets below the horizon.

There are some practical considerations that limit the accuracy obtainable from even a carefully constructed graph. Due to the refraction effect, the sun actually appears on the horizon shortly before it would be geometrically visible. In the northern hemisphere this means it appears slightly north of the predicted position. The angles found really apply only to an ocean-type horizon. Any elevation of the horizon means that the sun would appear to the south of the predicted point. There is also a change



due to elevation of the observer. The results of all these changes limits the need for more accurate construction than is indicated in the figures, but still the method provides a practical means for locating a camera or getting a feel for the effect of the tilt of the earth's axis. Observers in the southern hemisphere would, of course, have to invert the construction around the zenith-east line. If polar coordinate paper is not available, plain paper and the use of a protractor can be substituted but probably with somewhat reduced accuracy.
(Dr. Woodward is Associate Professor of Physics at the Georgia Institute of Technology, Atlanta, Georgia.)

Astronomy Update

By Dr. D. P. Hube

W. D. Heintz, Swarthmore College, who is a well-known observer of visual binaries, took advantage of the recent favourable apparition of Eros to measure its apparent angular size (specifically, the elongation of extreme diameter) through visual observations with a micrometer. The diameter varies by a factor of approximately 2. On January 15, 1975, the asteroid appeared to *brighten* as the apparent angular diameter *decreased*, indicating a wide variation in reflectivity on different parts of the surface Inhomogeneity in surface structure/composition is not unknown among minor planets and planetary satellites.

(*Astrophysical Journal*, 200, 787, 1975)

"Early-type stars blow bubbles ..." The hot, early-type (0 to B2 spectral type) stars are expected from theory and known from stellar winds which sweep the interstellar gas away from the star out to a typical radius of 30 parsecs. An example may be the well-known Rosette Nebula which, on direct photographs, is seen to have a central cavity.

(*Astrophysical Journal*, 200, L107, 1975)

Few subjects in Astronomy have been so controversial or been so readily dismissed as nonsense by the experts as the subject of “stellar rings”. If you look at almost any photograph of a rich star field containing thousands of stellar images, after a while your eye will probably begin to see various patterns in the distribution of the stars: straight lines, circles, etc. The German astronomers J. Isserstedt and T. Schmidt-Kaler and their co-workers first presented evidence in 1967 that many of the oval or circular ring patterns are physically real and not just chance configurations of stars at different distances along the line-of-sight. For some of the nearer stellar rings they were able to derive distances and, hence, dimensions. Surprisingly, the *minor diameters* of the rings almost all turned out to be near 7 parsecs, with *very* little spread. The explanation offered is that each ring is a projection on the celestial sphere of a prolate ellipsoidal grouping (cluster) of physically related stars. The arbitrary orientation of the prolate ellipsoid in space leaves only one parameter unchanged, namely the length of the apparent minor axis. Assuming, then, that the 1000, or so, recognized stellar rings are, for the most part, real and that all have a minor axis of length 7 parsecs, the distance to each ring can be calculated independently of any other observations, and then the distribution of all the rings in space can be determined. When he did this, Isserstedt found that the stellar rings are distributed around the galactic centre in an incredibly well-defined spiral pattern.

In recent years, a few researchers have lent support to the work of Isserstedt, but most others have been lead to support the view that the stellar rings are just chance configurations. In most cases, standard interpretations of photometric, satrometric, and spectroscopic observations of the stars in a given ring have lead to the conclusion that the stars are *not* all at a common distance and, therefore, are not physically related to one-another.

Isserstedt has summarized the older evidence for stellar rings; attempted to counter the arguments of his critics by, for example, arguing that insufficient attention has been paid to the ages (very young) and chemical compositions of stellar ring members in interpreting the photometry; and he has presented new evidence to support the reality of the configurations. Far more unusual stars (Wolf-Rayet, long-period Mira variables, supergiants, etc.) are found in or near stellar rings than one would expect by chance. Also, several rings are found to be straddled by pairs of pulsars.

If stellar rings do, in the final analysis, prove to be real they will be invaluable in delineating the large-scale structure of our galaxy. The origin of such unusual structures will also prove to be a difficult problem for astrophysicists to solve.

(*Vistas in Astronomy*, 19, 123, 1975)

(Reprinted from the Edmonton Centre’s newsletter *Stardust*)

Sol III

By Anthony Whyte

Some flowers exhibit heliotropism; that is, they track or follow the sun across the sky by twisting about on their stems. A familiar example of this is the sunflower. Now a Canadian botanist has discovered two species of plants growing on Ellesmere Island, N.W.T. that, as well as being heliotropic, also exhibit an even more interesting feature. Peter Kevan has found that the flowers of *Papaver* sp. and *Dryas* sp. are open bowls that serve as spherical reflectors to focus heat from the sun! In a spherical reflector there is a plane of foci which is parallel to the plane of the tangent at the origin. Calculations from measurements of flowers of *Papaver* indicate that as long as the flowers track the sun with no greater error than 22.7°, the limits of the plane of foci will remain within the gynoecium (i.e. the female reproductive organs). *Dryas*, however, must track more accurately if the focus is to fall on the tip of the gynoecium. *Papaver* flowers were found to attain a temperature excess (above the temperature of the air) of up to 10°C. In *Dryas* the increase was about 4°C. Under cloudy conditions, heliotropism and the temperature excesses were abolished. Flower power, generated by the combined effects of heliotropism and radiant hear focusing, is important to reproduction of the plants in the high Arctic.

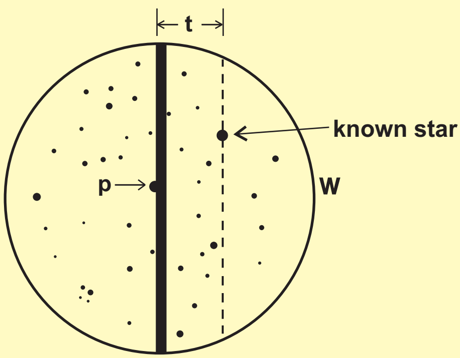
(Reprinted from the Edmonton Centre’s newsletter *Stardust*)

Minor Planet Observing

By Doug Welsh

People often ask me why I observe minor planets. They will say, “It looks just like a star, so why bother?” My friends, it is not that simple! Think of the ancients looking up at the Andromeda galaxy and saying, “It looks just like a little cloud, so why bother?” You know how far that kind of attitude will get you. Observing asteroids is not only pleasureable, but can also be taken seriously, and useful contributions to the knowledge of the solar system can be supplied by the average amateur. This field is one of the only areas concerning our solar system in which NASA hasn’t outmoded earth-based research (yet).

There are quite a few members of the Ottawa group who are supplied with Dr. J. U. Gunter’s wonderful charts and a few have even found several minor planets. The operation used to find one is simple. The field on the charts is fairly large and always contains a star of at least fourth magnitude. It is, then, fairly routine to star hop to the field. The asteroid is found near the line on the chart and is where no star is marked on the chart. Once located, it can usually be tracked night after night and from field to field. Most minor planets move quite slowly and show, on the average, a 5 minute of arc to 10 minute of arc displacement from one night to the next. At a stationary point the planet is, of course, STATIONARY! In the other extreme, earth-grazers like Eros cover a few degrees in one day. With binoculars one can see 10th magnitude and brighter minor planets. In 1975 there were about 15 visible with binoculars.



The most obviously useful work that an amateur equipped with a 60 mm, or larger, telescope can do is position measurements. This may be done by just marking the position on the chart with an “X” by comparing its position with other stars in the field. By the way, it is wise to use low or medium power, as high power won’t show any detail and will restrict the field considerably. The time and date should be noted, and the observation will be forwarded to the ALPO Minor Planet recorder, if sent to me.

The second way is more elegant and considerably more accurate.

Take a low or medium power eyepiece and insert one straight crosshair in focus across the field. After locating the asteroid, insert the eyepiece and align the crosshair so that it is north-south in orientation. Find a 7th, 8th, or 9th magnitude star to the west in the field. You may go a field or two west if necessary. You will also need a stopwatch or CHU. If you have a clock drive, now is the time to turn it off. When the bright star reaches the crosshair and disappears, start the stopwatch. Record the time until the asteroid reaches the crosshair. Repeat the measurement 3 to 5 times and calculate the average interval. Be sure to record the date, time, average interval and which star was the bright one by drawing a line from it to a visual naked eye star or by marking it on a chart. Send this information to me and I will reduce it and send it in. Try to estimate its declination by plotting it the easy way aforementioned. Obviously, the procedure is backwards positionwise for a star east of the planet.

Happy Asteroiding!

(Ed note: An object moves across the sky, and hence through the 'scope field at a rate of about 1 second of RA in 1 second of time. On celestial equator, this is about 15 seconds of arc. Rolf Meier, Editor, *Astronotes*).

From "Astronotes", Ottawa Centre

41st Stellafane Meeting

By Rolf Meier

The number of Ottawans attending last year's Stellafane convention could be counted more easily this time than in the past. They were Gordie Grant, Art Fraser, Pierre Lemay, Fred Lossing, Barry Matthews, and Rolf Meier. But of course it was the quality of those that went rather than the number which is important. We managed to bring two awards back to Ottawa. Pierre Lemay won first prize in the junior division with his 10-inch f/7 reflector and Rolf Meier won third prize for mechanical excellence with his 6-inch f/5 instant reflector.

The drive down with Fred Lossing was highlighted by stops in antique stores. Fred picked up an antique telescope with telescoping sections.

Camping on Breezy Hill was limited this time to 100 sites, and made for better use of facilities. Together with those people who camped on other grounds, attendance was probably around 600 persons.

The meeting date was Saturday, August 9. In the morning there was a tour of the Hartness-Porter Museum of Amateur Telescope Making in Springfield. The local amateurs have done much to restore the Hartness turret telescope and to collect historical telescope-making items.

Judging of the telescopes took place starting at noon. First prize for mechanical excellence went to a man from the Montreal French Centre for his massive aluminum telescope. At 450 pounds and solidly-bolted RA axis, it was very steady. It will be a very good telescope once he gets the mirror aluminized, RA drive figured out, and a way of moving the hour circle. A spectrohelioscope won first prize for the special type of instruments. The famous Carlsberg beer can telescope featured in "Smog and Telescope" was on display but did not win an award.

Saturday afternoon talks featured "The Optics of Galileo and Newton" and "An Electronic Guider for Astrophotography" among other interesting topics.

Bar-B-Q chicken was provided as the evening meal.

Sunny Saturday became a clear night while the twilight talks proceeded. Gov. Joseph Johnson gave his words of welcome, Walter Scott Houston gave his usual entertaining address, and Kenneth J. Brown told us why not to be an armchair astronomer.

From "Astronotes", Ottawa Centre

Contests for Amateur Astronomers

A nation-wide contest for amateur astrophotographers and an amateur telescope makers' competition have been announced by the Astronomical League (A.L.), according to League president Rollin P. Van Zandt, Peoria, Illinois.

Approved at the A.L.'s August convention in Atlanta, the programs are open to any amateur, including non-League members, and can be conducted locally by astronomical societies, school astronomy and camera clubs and regional organizations. National judging will be conducted August 16–22, 1976 at the League national convention at Kutztown, Pa.

The photography contest, limited to amateurs, includes black and white and color photographs, with both groups sub-divided into "Deep-Sky Objects" (requiring relatively long-time exposures and special equipment) and "General" categories. Each of the four categories will receive awards and will be judged for astronomical interest and artistic merit.

Deadline for submission of photos to the chairman, Marion Robson, P.O. Box 105, Parker Ford, Pa., is July 30, 1976. All entries must be mounted for hanging and may be from 5″ × 7″ to 4′ × 8′. Return cover and postage must be provided.

Judges for the photo contest are: Robert Richardson, New Hope, Pa., employed by Questar Corp.; George Keene, Rochester, N.Y. of Eastman Kodak Co.; and Evans Kern, Ph.D., Dean of Art, Kutztown State College, Kutztown, Pa.

All entries will be mounted and displayed at a special show open to the public August 4–22 at the Kutztown State College Gallery. All winners of local and regional competitions will be identified in the display during the convention.

The telescope competition, open for amateur equipment only, is chaired by Ellsworth Machin III, Bethlehem, Pa. Amateur instruments using commercial parts may be displayed, but only home-built components will be judged. Entrants for the national telescope competition must be registered at the convention where all entries will be publicly displayed.

Kits to conduct local astrophotography and telescope competitions are available. Included are award certificates, guidelines for conducting your own contest, suggested activities and publicity material useful to local astronomical societies or school astronomy and photography clubs. These are available for $1 each, as are entry forms and information on the national judging, conducted separately from local events, from: George Maurer, R.D. 3, Box 140, Coopersburg, Pa. 18036.

The Astronomical League is a national federation of amateur astronomical organizations. Further information on the League and its programs is available from: Wilma A. Cherup, Executive Secretary, 4 Klopfer St., Pittsburgh, Pa.

Messier 51 is an eighth magnitude spiral galaxy in the constellation of Canex Venatice. Toronto Centre president Jack Newton took this photo on TRI-X film with his 12 inch f 4.6 trailer mounted Newtonian Telescope.

(In reviewing 1975 issues of the *National Newsletter* we, its editors, have noted that practically all of the astrophotos have come from the Toronto Centre. This isn't surprising since the Toronto Centre is large, very active, and close at hand. However, we want the *Newsletter* to be a truly national publication. **We need your help.** If you have taken some good astrophotos (or made some interesting drawings) recently, or know someone who has, please send them in. In 1976 we hope to display more of Jack Newton's fine pictures and those of other Toronto Centre photographers, but we also hope that someone in every centre will take the time to insure that his or her centre is represented pictorially in these pages. W. T. P.)

1976 General Assembly
May 21-22-23-24

The Calgary Centre extends a real friendly Western welcome to all R.A.S.C. members and their friends to head west to Canada's fastest growing city, name o' Calgary, once known as "l'il olde cowtown" but now the bustling home of almost half a million people.

Plans are well along with plenty of entertainment scheduled starting with a banquet on the Friday evening followed by the retiring Presidential Address by Dr. D.J. Fernie. An "Olde Tyme Nite" with a lighthearted barn dance atmosphere at the old Wainwright Hotel in Calgary's Heritage Park will complete the evening. This hotel in its heyday had the longest bar in the West ... it is still available if you wish to rest an elbow. It also boasts some of the finest outdoor plumbing – on two levels! – used now strictly for shutterbugs.

Plan to arrive early on Friday. A registration form will be included in the next issue of the JOURNAL Newsletter but can be obtained NOW from:

Mr. Cam Fahrner,
115 Coleridge Road N.W.,
Calgary, Alberta.
T2K 1X5

Saturday will start with the Papers Session. Papers on all aspects of observational, theoretical or instrumental astronomy are requested for inclusion in the program. Abstracts of about 150 words in length must be sent before April 1st to:

Dr. T. Alan Clark,
Department of Physics,
University of Calgary,
Calgary, Alberta.
T2N 1N4

Presentation should not take longer than 10 minutes to allow time for a discussion period.

Members are reminded of the Observing Competition outlined in the June '75 issue of the R.A.S.C. JOURNAL. It is hoped all Centres will participate and this should form the basis of the exhibits. Other exhibitors should contact Mr. Ulrich Haasdyk stating how much space would be required for the entry.

The evening will start with a banquet sponsored by the Government of Alberta followed by an address by Dr. Jack Locke, Past President of the Society.

Sunday – Banff Tour and Bar B Q. The Committee took special note of comments made at the 1968 General Assembly in Calgary and has planned a very exciting day. A visit to the Cosmic Ray Observatory on top of 8000-foot Sulphur Mountain will afford delegates a view of the Rocky Mountains in all their splendour from virtually the "roof of the world". Don't forget your camera! A laze in the famous "hot springs" pool is available, if desired, followed by an open air Bar B Q and then back to the Calgary Centennial Planetarium to wind up a memorable day.

For guests staying over Monday (Victoria Day) a visit to the University of Calgary's Rothney Astrophysical Observatory is planned. Undergraduate astronomical students have use of a versatile 16" reflector telescope with a photometer and other instrumental accessories at the Cassegrain focus. A large concrete pad has pedestals for many more smaller telescopes.

We need YOU to ensure the success of the 1976 General Assembly. Write now for your registration form!

F. JOHN HOWELL
Chairman
General Assembly Committee

L'Envoi

The Stars are Free
By Dora Russell

Astronomy is not just for the astute mathematical and scientific minds of the world. Astronomy is for everybody, and the stars, like other good things in life, are free.

You don't have to master the mathematics of harmony in order to appreciate good music. The same holds true of astronomy, and it is a science that has thrown its arms wide, as it beckons to lovers of the beautiful, lovers of research, lovers of education, lovers of culture, lovers of recreation, lovers of romance, lovers of the unknown.

A perfectly horrible array of calculations and statistics can terrify people into thinking that astonomy is for the learned only.

Yet even a hobo can be a cultured star-gazer. Perhaps, if the truth were known, it may be among the ranks of the hoboes of this world that our most fervent searchers of the sky may be found.

Such a character is outlined in George Orwell's *A London Pavement Artist*. Here is an excerpt:

> "Bozo limped slowly, with a queer, crab-like gait, half sideways, dragging his box of colours over his shoulder. As we were crossing the bridge, he stopped in one of the alcoves to rest. He fell silent for a minute or two, and to my surprise I saw that he was looking at the stars. He touched my hand and pointed to the sky with his stick.
>
> "Say, will you look at Aldebaran! Look at the colour. Like a great blood orange!"
>
> From the way he spoke he might have been an art critic in a picture gallery. I was astonished. I confessed I did not know which Aldebaran was – indeed, I had never even noticed that the stars were of different colours! Bozo began to give me some elementary hints on astronomy, pointing out the chief constellations. He seemed concerned at my ignorance. I said to him, surprised:
>
> "You seem to know a lot about the stars."
>
> "Not a great lot. I know a bit though. I got two letters from the Astronomer Royal thanking me for writing about meteors. The stars are a free show; it don't cost anything to use your eyes."
>
> "It don't follow that because a man's on the road he can't think of anything but tea-and-two-slices."

St. John's, Newfoundland Centre