NATIONAL NEWSLETTER

June, 1981

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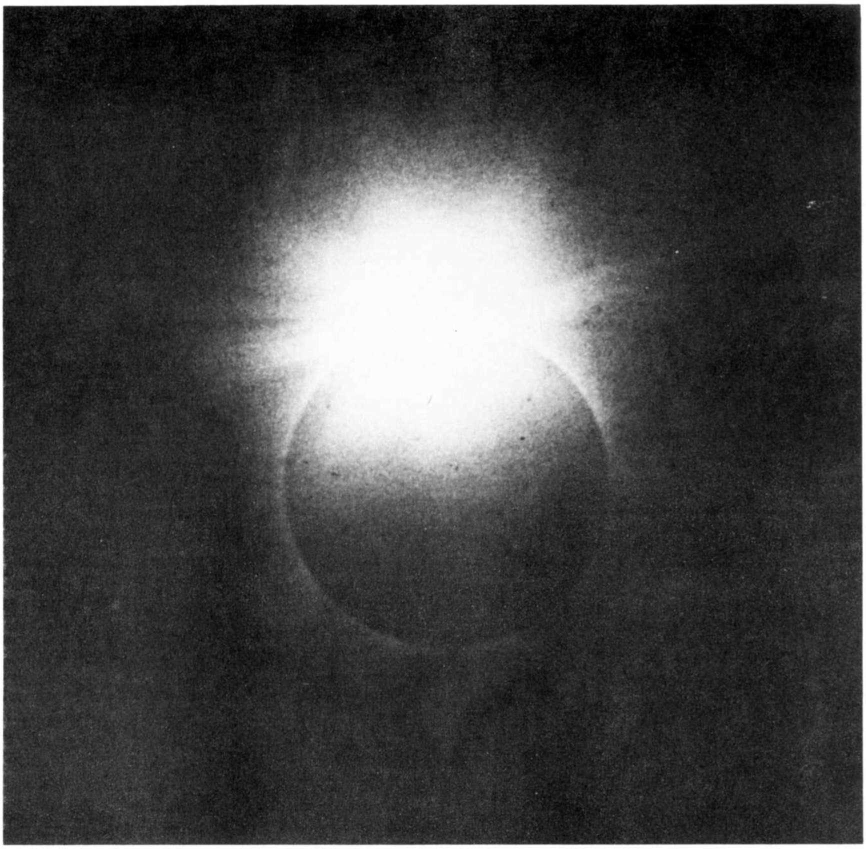

This diamond ring signalled the beginning of totality at the 1973 June 30 solar eclipse, viewed from *S. S. Canberra* off the west African coast. This July many amateur astronomers will travel to Siberia to witness another total solar eclipse. In this issue we look ahead to the prospects for an even more exciting one on 1983 June 11. (*Photo by B. R. Chou*)

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Chasing the Monsoon Eclipse

by Jay Anderson
Environment Canada

On June 11, 1983, the Earth, Sun and Moon will once again reach a position in their celestial dance which will permit the Moon's shadow to fall on the Earth. The amphitheatre for this solar eclipse will be located in Southeast Asia: through the Indonesian archipelago and across New Guinea.

This part of the world has a climate typical of the inner tropics, substantially modified by a number of unique local features. Temperatures are high, but not excessive, with an annual range so small that it does not distinguish the seasons. The region is the largest area of the globe with an annual rainfall of 2500 millimetres (100 inches) or more. The air is humid year round, yet, strangely, sunshine is abundant.

Indonesia is affected by three large scale seasonal weather patterns. From November to March the northwest monsoon brings air from Asia across these waters. The east monsoon, from May to September, carries air from Australia. Between the two is a transitional period, familiar in literature as the doldrums.

The east monsoon season (known elsewhere as the southwest monsoon) will be well-established at eclipse time. It can be equated with the northern hemisphere's summer, and in the region of the eclipse, brings a distinct dry season which is not found in most other parts of the archipelago.

While North Americans are inclined to think of a monsoon season as a wet one, the time is better described by a direct translation of this Arabic word – "seasonal wind." During June, winds blow outward from a winter high pressure cell which builds over Australia (it's winter in the southern hemisphere), crossing the Timor Sea to reach the islands which make up

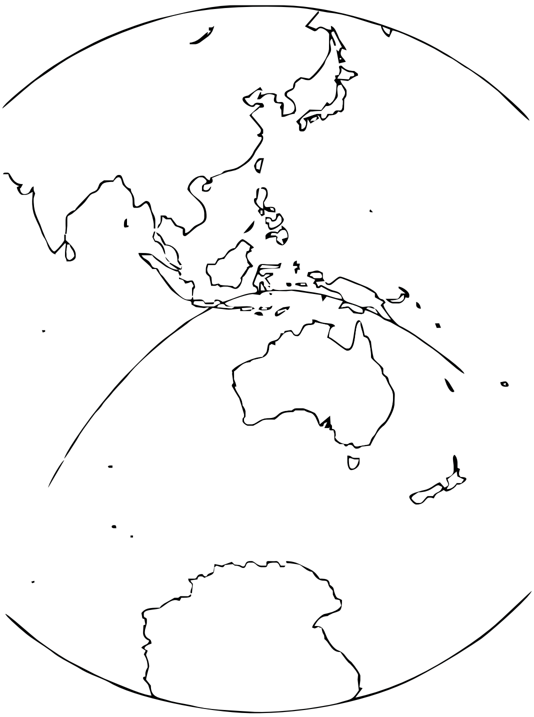

FIG. 1—A computer-drawn plot of the 1983 eclipse path, from a programme written by Andrew Lowe.

Indonesia. At its Australian source the air mass is typical of a desert – dry and warm. The same type of air can be found over the deserts of the American southwest, bringing skies that astronomers brag about.

As the monsoon winds carry this air away from the Australian coast, it is rapidly humidified by the warm waters of the Timor Sea, changing, in the lower levels at least, to the warm and sultry maritime air familiar to those living along the Gulf Coast. The atmosphere becomes very unstable, capable of forming immense thunderstorms which can drop prodigious amounts of rain.

Nevertheless, in the relatively short distance from Australia to the eclipse site, the atmosphere remains dry above the lowest 6 to 8 thousand feet and rainfall is much less intense than at locations farther to the north and west.

During June, Kupang, on the island of Timor, and closest to Australia, has an average monthly rainfall of only 10 millimetres (0.4 inches). But Kupang is a prominent exception in this equatorial region, and those islands closer to the eclipse track are much wetter. Surabaya, in the eclipse zone on the north side of Java, averages 86 millimetres of rain in June, while Makassar, on Sulawesi (Celebes), averages 74. These amounts are a little less than those which typically fall on the northern plains states and Canadian prairies during the same month.

SUNSHINE

To the eclipse chaser, cloud cover is more important than rainfall, though there is more than a casual relationship between the two. Indonesia, despite the rainfall statistics, is a very sunny land. Because almost all precipitation comes from thunderstorms, monthly amounts accumulate rapidly from only a modest amount of cloud.

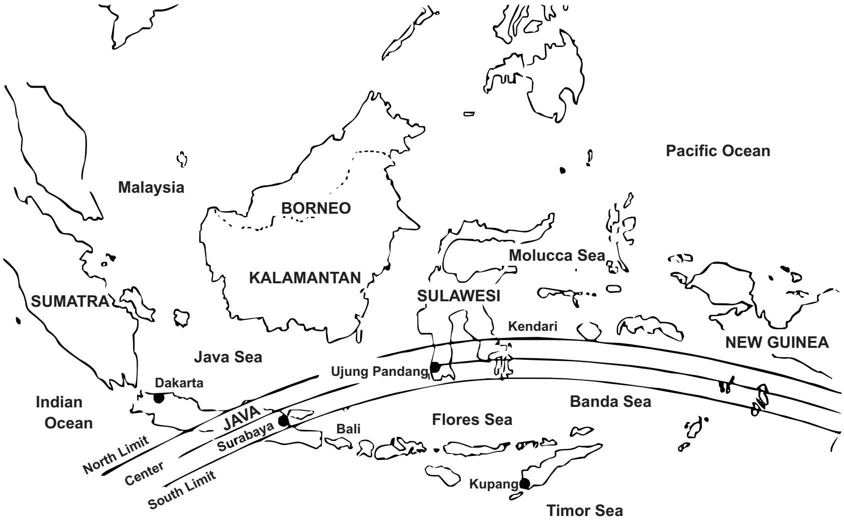

FIG. 2—A map of the Indonesian area, showing the eclipse path through Java and Sulawesi.

Because of the rapid modification of the Australian air mass as it passes over water, cloud cover increases quickly from east to west. But even more significant are the effects of the local terrain on the steady monsoon winds.

As inhabitants of the Appalachians and Rockies are well aware, air which is forced to rise can very quickly turn to cloud, especially if it was humid to begin with. Across southeast Asia this effect is very common; smaller islands may have a wet and dry season determined almost exclusively by the wind direction. Windward sides, with an upslope wind, are wet; the leeward side with its descending and drying winds, will have a much smaller amount of precipitation. In the area of the eclipse sunny weather will favour the north side of Java and the west side of Sulawesi.

At Surabaya only one third of the east monsoon days have more than half the sky covered by cloud. At Bandung, in western Java on the island's mountainous spine, the number of cloudy days nearly doubles. This is not entirely due to the higher altitude of Bandung, since the longer over-water trajectory makes western Java cloudier than the east. Both Semarang and Djakarta, on the northwest coast, show a significant amount more cloud than Surabaya.

On Sulawesi, Ujung Pandang (Makassar) is sheltered from the east winds and is nearly as sunny as Surabaya. However Kendari, on the same island, but east of Ujung Pandang, lies fully in the path of the monsoon and midday hardly ever sees a sunny sky.

Since daytime heating has a strong effect on the formation of convective clouds such as thunderstorms, skies tend to be cloudier in the afternoon. There are many variations on this theme in the complicated weather patterns of the archipelago, but by-and-large a morning eclipse is more likely to be favoured by sunshine than an afternoon one. The moon's shadow reaches Java about 11:30 AM local time and Sulawesi a half hour later. Since Sulawesi lies some 9 degrees east of Java on the eclipse track, the sun has had an additional half hour to form cloud because of its earlier rising. The combined effect, which brings an hour more sunshine, could be critical if the day is inclined to be cloudy.

Satellite photographs taken in June of 1977 and 1979 offer considerable encouragement to eclipse chasers, reflecting the promising statistics shown on p. L33. Three sites, Surabaya, Ujung Pandang, and the south coast of Java were examined for cloud on the photographs; the statistics that resulted do little more than give a rough indication of the frequency of cloud

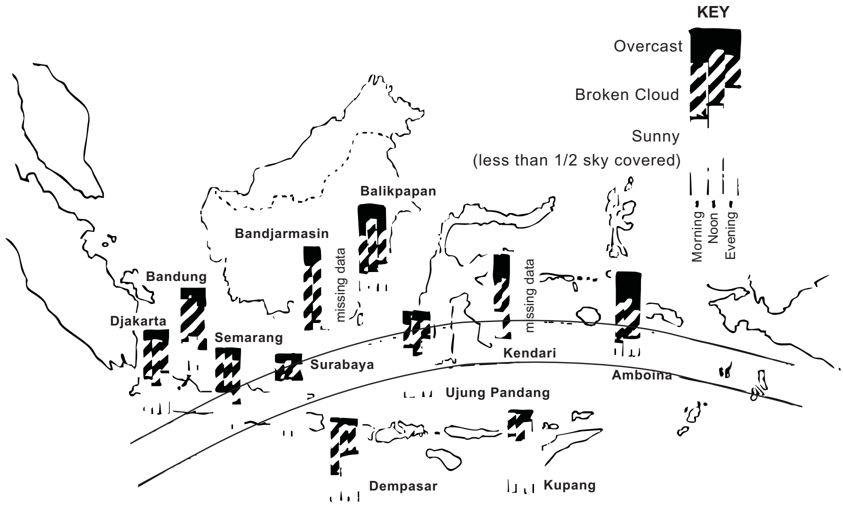

FIG. 3—A chart of key sites around the eclipse path showing cloud cover statistics. Surabaya and Ujung Pandang appear to offer the best chances.

cover, but they are not widely different than the much more extensive data that was used to compile the diagram on the next page.

In 1977, pictures were taken by NOAA-5 at approximately 9 AM and 9 PM local time. In 1979, TIROS-N passed overhead at 3 AM and 3 PM. The analysis of their photos showed the number of cloudy and clear passes at the three sites along the eclipse track.

The conclusion confirmed that cloud is less likely in the morning than in the afternoon and evening. However considerable cloud can be found overnight as well, some because of coastal fog, and more to thunderstorms formed when cooling air flowing off the land triggers the instability.

Though the satellite photographs are promising, the statistics shown above should be used for planning.

VISIBILITY

The onset of the east monsoon is marked by a decrease in visibility as a dry haze changes the sky to a blue-grey colour. The haze is composed of salt particles evaporated from the sea surface, with additional material added from grass and forest fires. Drought conditions in Australia aggravate the problem, and it tends to worsen as the east monsoon progresses. The lack of extensive cleansing rainfalls is a contributing factor.

The haze is confined to the lower atmosphere, along with most of the humidity. At altitudes above the haze layer, between 6 and 10 thousand feet above sea level, the air takes on a refreshing dryness and the sky returns to its familiar blue tint. Adventuresome eclipse chasers may want to take their chances at higher locations where photographs will be of a higher quality.

WINDS

The east monsoon becomes established in May and blows for several months, increasing in steadiness and strength until August. This is an average condition, for every year has its variations in monsoonal development. To those used to the ever-varying winds of the temperate zones, the monsoon winds of Indonesia will blow with an ongoing monotony.

The mountainous islands and sea channels have a strong directive influence, turning the winds to blow parallel to the coasts. Land and sea breezes alternate during the night and day as the warming effect of the sun sets up the characteristic off- and on-shore winds. Sea breezes, which bring onshore winds, are very efficient at preventing the formation of convective cloud for several miles inland from the coast.

This breeze begins toward mid-morning along the coast and gradually presses inland as the afternoon progresses. The cloud edge, if there is one, retreats from the coast, provided the interior terrain is relatively flat and close to sea level. Bays are particularly suitable locations to benefit from this effect, while peninsulas offer the poorest prospects. The sea breeze is a low level circulation, so that eclipse sites may take advantage of the protection of higher terrain, while still enjoying a wind which blows off the sea at the surface.

Mountainous terrain also channels the winds, and the disturbed monsoons tend to develop high velocities as they turn or converge through the passes.

SELECTING THE ECLIPSE SITE

The most likely weather pattern should follow this scenario:

1. The probability of sunny weather is high (approximately 65%), especially on the northeast coast of Java. Clouds may be building for the afternoon. Higher elevations will have the greatest tendency to cloud over, though this is not a pronounced factor in east Java. Locations in the lee of higher ground (northeast Java, southwest Sulawesi) are best. Coastal sites with an onshore sea breeze give additional assurances.
2. Haze will bring some reduction to visibility, though probably not less than 10 miles. Higher locations will have a bluer sky.
3. Moderate east to east-southeast winds are most likely on the south coast. Winds will follow the terrain in inland areas. By late morning north coastal areas will have the beginnings of a sea breeze which may strengthen or weaken the monsoon winds, depending on the coast's exposure.
4. Temperatures and humidities will be high, with the mercury reaching close to 30° Celsius. High mountain passes or saddles will be drier.

With these characteristics in mind, an eclipse site can be selected to maximize the probability of a good view. Here are some techniques which may help:

1. Watch the weather for as many days as possible before the eclipse in the general area of where you wish to be. Note the time that the first puffy convective clouds appear, and their extent at eclipse time. Since the cloud tends to appear earlier on days in which it is heavy, the pattern on eclipse day may give a few hours warning that a particular site may not have

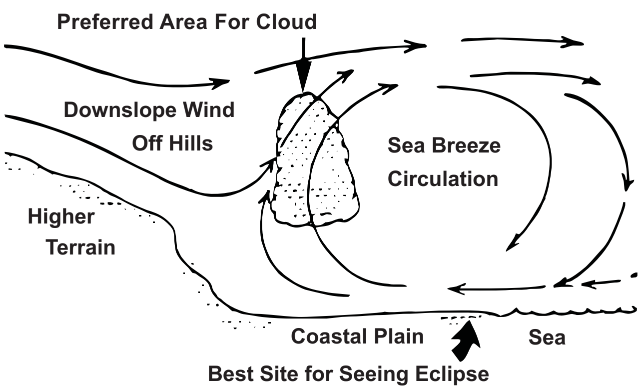

FIG. 4—Cloud cover is less likely over coastal plains near the shore but may build up inland.

a particularly good view of the show. Be careful, since the cloud will probably be a little heavier right after it first pops up, than a short while later. If you choose a coastal site, look for one with an onshore breeze at eclipse time, and confirm that the cloud has been pushed inland.

2. For the highest quality photography, choose a high inland site. The colour of the sky and the drier feeling will serve as good indicators of the state of the atmosphere.
3. Choose the most easterly location possible.
4. Stay mobile. If your skies cloud over, head upwind or across the wind, especially if it's to a lower elevation. Convective cloud almost always has sunnier skies nearby.

Of all the locations available, the climatological evidence suggests that the north coast of Java, near Surabaya, may offer the best chances. The island of Sulawesi, near Ujung Pandang, is also a good site. Both depend on finding the right local conditions to maximize the probabilities, but even in poor locations the frequency of cloud shown by past records suggest that the chances of a successful eclipse are high.

MASCON 1981

MASCON 1981, the first ever Manitoba Astronomical Convention, will be held in Manitoba's Riding Mountain National Park on August 1 to 3, 1981. The park is situated 95 km north of Brandon, Manitoba. The event is being organised by the Society's Winnipeg Centre, and is intended to be a gathering of the continent's amateur and professional astronomers.

The programme will include invited talks by David Levy, Damien LeMay, Dr. Martin Clutton-Brock and Dr. Ian Halliday. There will also be sky viewing sessions and a telescope competition.

Further information regarding registration can be obtained by writing to:

MASCON 1981
P.O. Box 174
St. James Post Office
Winnipeg, Manitoba
R3J 3R4

or by telephoning collect Guy Westcott, President of Winnipeg Centre, at (204)-269-1499.

Personal Opinions on the Survey of (Canadian) Unattached Members

by Raymond Auclair
Unattached Member

(In the December 1980 *Newsletter*, we saw the actual results of the survey. Let us now look at what Mr. Auclair, who conducted this survey in the summer of 1979, has extracted from these results. We also hope that those of you who have different views on this subject will make these views known to us – *The Editor*.)

Fifty-eight unattached members have answered the twenty question survey. Many answers simply confirmed what I thought all along, but some answers may force me, and others, to take a new and deeper look at some of our goals and the means that we have to achieve these goals.

First, the obvious stuff: Membership in the R.A.S.C., even as an unattached member, does fulfill some needs since the average respondant had been with us for close to seven years. He is aware that he may be getting less than a member who is attached to a centre, but he is satisfied, on the whole, with his membership in our society. Nevertheless, he would join a centre if it was possible. He would like to find out more about other members and about their field(s) of interest in astronomy; he therefore favors an association among unattached members and would like to see such an association prepare this list. The average respondant never went to a General Assembly nor does he feel properly represented there; nevertheless he believes that the decisions taken at G.A.'s are beneficial to him.

Now, the less obvious! A majority of respondants think that there should be some sort of journal or newsletter for unattached members of the R.A.S.C. and the information most in demand is "What projects are the centres working on?" This, to me, was a surprise since I have always looked at the *National Newsletter* (*NNL*) as the perfect tool to inform members on any centre's activities. Of the respondants 66% indicated their willingness to pay an extra fee for such information. In these days of inflation and rising costs of operation, some of us were ready to suggest a reduction in services in order to keep membership fees to a minimum. The way I read the results, members will pay the fees IF the society gives them their money's worth. And if one is to offer a service in return for a fee, let's make it the kind of service wanted by the customer. The customer wants to know what projects are going on in the centres, the *NNL* is a forum through which the centres can inform us of their achievements; why not, then, ask each centre to provide the *NNL* with TIMELY information about their activities and plans.

Why should we go through this effort and all this work? Well, many people join a society such as ours to have, among other things, a sense of belonging and a feeling of being accepted by other people sharing a common interest. Participation will help the member feel he truly belongs to a national society rather than being a subscriber to a journal that comes out six times a year. Unfortunately, many members are informed too late (if at all) of projects to which they could have contributed in a constructive manner (and through which they could have made new friends sharing the same interest in astronomy). Unattached members suffer most from this communication gap, but they are not the only ones.

I am not saying that everyone should participate. I am saying that everyone should have at least an opportunity to participate. By not informing (in time) the other members of what is going on in your own world, you are closing the door to nation-wide communication and exchanges. By opening that door, you show other members that we all belong to the same society, that you welcome their help (and their encouragement).

In conclusion, I must inform you that this survey was to determine if an association among unattached members was wanted and feasible. The low return (30%) and the nature of the answers seem to indicate that such an association is not really needed at this time. Most of the unfulfilled needs of the unattached members can be best fulfilled by tools that already exist within our society and it seems, to me, that the *NNL* may very well be the most important tool at our disposal. It will require everyone's cooperation, but it should prove more efficient than forming a formal association.

Another need is one of direct communciations, and the survey shows that a list of members, showing each member's particular field(s) of interest in astronomy, would be very helpful. Any idea on how such a list could be prepared, compiled, distributed? Please tell me (and don't forget that what seems obvious to you may have never crossed my mind, so don't hesitate to write).

1527 Champagne,
Cornwall, Ont.
K6J 4W7

Moving Into Space?

by John Greer
Saskatoon Centre

A number of recent magazine articles and news items have mentioned the rising interest in Space and Astronomy among the general public. This is, of course, because of the fantastic results of the Voyager missions and the upcoming Space Shuttle mission. All this pays dividends in increased support for astronomical research both on Earth and in space. The

Large Space Telescope (or whatever it is being called now) is slated to go into operation in the mid-1980's, and will enormously expand our horizons. Add to this the existing orbital observatories and the future space astronomy programs now in the planning stages and the future of astronomy looks very promising.

However, all this leads us to another point – telescopes are not the only things about to go into orbit. The Solar Power Satellite (SPS for short) is being hailed as the ultimate solution to the energy crisis. What is an SPS? It is a sheet of solar cells several kilometres on a side, located in a 24-hour orbit about 35,000 km out. Its function is to convert sunlight into microwaves which are then beamed back to earth and converted to electricity.

That's the good part, what follows are the parts that hurt. An SPS will be BRIGHT. Very bright – so much so that it may even be visible in the daytime. Remember Echo I, Skylab and all the other large artificial objects in space? SPS will approach the brightness of the moon in crescent phase. What's more, if things go as planned, there won't be just one or two sitting up there being bright all over the place, there may be ten or dozens, or many more. In fact, a recent article in a certain popular science magazine enthusiastically predicted a veritable belt of the things encircling the earth busily beaming power to an enthusiastic world. What they didn't mention were the amateur astronomers foaming at the mouth because they can no longer see the sky – only a line of painfully bright solar power satellites hanging over the equator, washing out the stars.

These predictions may be in the same class as the "airplane in every garage" type that appeared regularly in the pulp magazines in the 1940's or they may be as inevitable as cloud on Saturday night, but it is alarming to consider our activities coming to a final, abrupt end.

Move into space? We may have to.

The Failure of Scottish Astronomy in the Eighteenth Century – Part II

by Ian W. Stuart
Hamilton Centre

In the last issue I explained why Scotland failed to develop a strong astronomical tradition in the 18th century due to unfavorable economic and geographical conditions. These encumberances made Scottish astronomy peculiar in comparison to its English and French counterparts and endowed it with two unusual characteristics.

Most of Scottish astronomy was based on naked eye or lower power optical observations. This was because of the Scots' inability to acquire large telescopes, and the poor seeing conditions which would have prevented the effective use of high power telescopes even if they had been available. As a result, whereas England and France became deeply involved with stellar and planetary astronomy, Scotland turned to solar and lunar astronomy. With the help of James Short's telescopic accessories, the Scots became some of the most accurate observers of eclipses, both lunar and solar. The Philosophical Society of Edinburgh was started in 1737 due to the co-ordinated efforts of Scottish scientists to view the rare annular solar eclipse in that year. The Scots also became specialists at measuring lunar occultations. These data formed the basis for Tobias Mayer's solution of the problem of the moon's apparent motions. Scottish astronomers made accurate star maps, but they did not bother to include nebulae unless these were visible to the naked eye. For lack of a better term then, Scottish observational astronomy was confined to nuts and bolts observing, whereas the French and English were engaged in the more glamorous planetary and deep-sky observing. French and English astronomers were discovering new objects in the sky while the Scots were refining measurements of the well-known celestial objects.

The second pecularity of Scottish astronomy was its deeply rooted geometrical tradition. Whereas most European astronomers eagerly adopted Newton's mathematical treatment to describe the motion of heavenly bodies, the Scots clung to the cumbersome outmoded geometrical method. One of Scotland's greatest astronomers of the 18th century, Colin

Maclaurin (1698–1746), a staunch supporter of Newton, proved all of Newton's gravitational theory geometrically. It was only after publication of Maclaurin's work that Scottish astronomers began to accept the Universal Theory of Gravitation. He was also the prime instigator and co-ordinator for the observation of the annular solar eclipse of 1737. Subsequently he helped to found the Philosophical Society of Edinburgh. Scottish astronomy was truly hindered by the geometrical tradition – Newton's formulas and new mathematics (the calculus) were not accepted and the geometrical method abandoned until the end of the 18th century.

While none of the Scottish astronomers rose to the stature of Gahileo, Kepler, or Herschel, several did make important contributions to the science.

Although he is outside the timespan of this article, James Gregory (1638–75) must be considered for his suggestion of a practical method of determining the distance of the Earth from the sun by parallactic observation of a transit of Venus. This set in motion one of the main achievements of astronomical study of the 18th century. Gregory's method made possible a more precise determination of the size of the astronomical unit, and hence that of the solar system.

Born in Rothesay and educated at Glasgow and Edinburgh, Mathew Stewart (1717–85) was one of the great geometrical astronomers. His greatest achievement was a geometrical proof of Kepher's second law of planetary motions. He also deduced the motions of the lunar apsides using the geometrical approach, more accurately than had Newton. In "The Distance of the Sun from the Earth Determined by the Theory of Gravity", he concluded by means of geometrical constructions that the earth was 119 million miles away – by far the most precise value obtained to that time, and the value used until more exact figures were elucidated from the transit of Venus in 1769.

Alexander Wilson (1714–86) broke the mathematical tradition somewhat with his observations of the sun. In a paper which he presented to the Royal Society of London, he speculated that sunspots were depressions of the sun's surface through which the dark body of the sun could be seen. While this has since been proved false, at the time his ideas were given serious thought and were even expanded and developed by William Herschel in his Solar Theory. Another question that perplexed Wilson was why the stars did not fall into each other. He eventually concluded that the stars must be revolving about some central point or mass. It was from this idea that Herschel began to think of the Galaxy as a flattened lenticular disc.

On the periphery of the Scottish astronomical scene was James Short (1710–68). Short was not an astronomer, but an optician. He is known for his finely constructed astronomical equipment. Short was the first to construct a sturdy yet adjustable spider for Newtonian reflectors. His greatest contribution to the development of astronomical instruments, and one for which he gets very little credit, was the adaptation of the telescope for use upon an equatorial mount. This was a marvelous device for astronomers, who formerly had to continuously adjust the telescope in both right ascension and declination to follow an object across the sky. James Short was by far the most prolific writer among the Scottish correspondents to the Royal Society of London. In all, he wrote thirty-one astronomically related articles on topics ranging from comets, eclipses and auroras, to improvements in telescopic instruments and accessories.

Eighteenth century Scotland had two good popularizers of astronomy. The first of these was David Gregory (1661–1708). The brother of James Gregory is best remembered for his popular text, The Elements of Physical and Geometrical Astronomy. After giving the obligatory geometrical proofs of Kepler's laws of motion, and demonstrating the various uses of geometry in astronomy, he gives the reader an imaginary tour of the solar system. Gregory begins with the view from the sun, and then goes on to Mercury, where the inhabitants, for lack of being able to see phases of an inferior planet, would most likely believe in the Ptolemaic System with Mercury at its centre. From Mercury Gregory gives the reader a description of the solar system as viewed from Venus, Mars, and Jupiter, as well as the beautiful bizarre sights on Saturn.

In the latter half of the 18th century James Ferguson filled the role of popularizer of astronomy. The format of Ferguson's book was similar to that of Gregory, but it contained much less mathematics and geometry. Ferguson actively tried to sell astronomy to the public.

To this end he demonstrated how it was now possible to determine the exact dates of great events in the past by applying the knowledge of astronomy to biblical and historical records. Ferguson, with the help of a biblical scholar, constructed the entire history of the world in a table. According to Ferguson, the world began in the year 4007 B.C.; Noah's flood occurred 2300 years later. Ferguson also shows that on the day of the Crucifixion the darkness was not caused by an eclipse of the sun but was altogether supernatural, for the moon was then on the side of the heavens opposite the sun. This assertion of the presence of God by means of a direct application of astronomical knowledge must have been greatly reassuring to the minds of a still deeply religious public.

Ferguson constructed an orrery, a mechanical model which exactly reproduced the motion of the planets in the solar system. He built other devices to demonstrate astronomical principles, such as the Calculator, which shows the sun's declination, maximum angle to the horizon, rising and setting times and place along the ecliptic for any given day. With a few adjustments, the same could be done for the moon. Ferguson also made an improved Planetary Globe which showed the order and rising and setting times of the planets on any given day. These external visualizations of the confusing sights men saw in the night sky helped to take the mystery out of astronomy. The mechanics of the heavens and the peculiar visual effects on an earthbound astronomer were demonstrated in terms that the average man could readily understand.

It is ironic that both Gregory and Ferguson published their works and lived most of their lives in England. Perhaps this is another reason for the lack of a strong astronomical tradition in Scotland: most of her leading astronomers and popularizers lived outside Scotland. The drain of astronomical talent was a great hindrance.

And so an unusual and unfortunate set of economic, geographical and to a certain extent, social factors prevented the development of a strong astronomical tradition within Scotland of the 1700s. Confined to lunar and solar astronomy for the most part because they could not use large telescopes, the Scottish astronomers fell behind their French and English colleagues in stellar astronomy. The scientific talent of Scotland soon turned away from the heavens and brought its resources to bear upon the problems of biology, engineering and medicine.

NASA Publications Available

The U.S. Government Printing Office has recently announced that NASA publications on the Space Shuttle are now available. A list of the selections and their prices may be obtained by writing to

The Superintendent of Documents
U.S. Government Printing Office
Department 50
Washington, D.C. 20402

Why would David call me late at night?

by Peter Jedicke
London Centre

One of the truly wonderful achievements of the R.A.S.C. is the wide respect which has been won by the annual *Observer's Handbook*. It is no great exaggeration to say that amateur astronomers in North America generally find out about celestial events by one of two means: either they read about them in the *Observer's Handbook*, or they are told about them by someone who read the *Observer's Handbook*.

Thus it came to pass that on the 21st of January I was nestled in my bed, having blithely ignored the clearly printed warning of an impending penumbral eclipse of the moon. The telephone rang. It was 0230h.

Five minutes later I was seated on a cold bench out on the balcony of our apartment, dressed only in a bathrobe, staring in rapt attention at the disk of the full moon, high overhead. Just as promised by David Levy, 3000 km away in Tucson, Arizona, the face of the silvery celestial orb was dusted with the shadow of our earth. By stretching the phone cord beyond its natural limits, I was able to continue my transcontinental conversation. According to David, this was the darkest penumbral eclipse in many decades. The Handbook informs us (after the fact) that the moon was perfectly embedded in the penumbra; none of its disk was shadowed in the umbra, and none of its disk extended beyond the penumbra.

From my vantage point, the northern limb of the moon seemed darker than the southern; David concurred. Perhaps the umbra extended just a bit beyond the calculated limits? But even more striking was the shadowy blackness of the sight. Previous lunar eclipses in my experience had indicated the penumbra to be much more reddish in colour – what has been described by many observers as a burnt orange.

Most striking of all was the sharing of a thrilling sight with a good friend almost a tenth of the way around the earth. The moon, I soberly reminded myself, was 150 times more distant than David, but it felt very, very close.

In Praise of the Hooker

by Roy L. Bishop
Halifax Centre

The history of science has been, in part, the history of man's attempt to strengthen and quantify his feeble senses with precision instruments. The prototype of scientific instruments is the telescope. The telescope appeared early in the scientific revolution and today still has a major role in the advance of knowledge.

Of all the telescopes that have been raised to the heavens, two can be singled out for their pivotal contributions to astronomy. The first is the crude refractor that Galileo turned on the Moon in the autumn of 1609. Within a few months Aristotle's concept of the unblemished perfection of the heavens, together with the Ptolemaic universe, lay in ruins. Earth had been wrenched from the center of creation and the plurality of worlds was more than forbidden speculation.

The other telescope deserving of special praise is the 100 inch reflector on Mt. Wilson above Los Angeles. John D. Hooker, a business man of that city, provided the funds for its mirror in 1906. By the end of the First World War it was complete, a precise symphony of girders, and rivets, and glass. Here, for the first time, a professional telescope exceeded the aperture of that of an amateur. It was larger than that giant of the Irish mists, the 72 inch Leviathan of the Earl of Rosse.

Within a decade a new universe was revealed in the mirror of the Hooker reflector. Through cepheids in M31, M33, and NGC6822, the telescope enabled Edwin Hubble to confirm that the Milky Way was not the universe, but only one of countless galaxies. After a few more orbits of the Sun, the instrument provided Hubble with unequivocal evidence for the expansion of the universe, a prediction made earlier by Albert Einstein with his general theory of relativity, but a prediction so staggering that even Einstein could not accept it prior to Hubble's data. In the Hooker mirror man had seen himself in an obscure corner of an immense universe, a dynamic universe with a finite, violent past and an uncertain future.

Today the glow of man's energy waste has degraded the skies over Mt. Wilson, but no newer instruments have yet equalled the accomplishments of the Hooker. Larger telescopes, and telescopes probing other regions of the spectrum have brought confirmation and extension, but no comparable revolution.