HERMES

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HERMES

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Comment

THOSE of you who read *Nature* or *The Observer* will know that one of the most exciting discoveries of all time has recently been made. Dr. GEORGE CLAUS of New York University and Professor BARTHOLOMEW NAGY of Fordham University believe they have found fossil evidence of 'organised elements' in fragments of the Orgeuil meteorite which fell in France almost a hundred years ago and the Ivuna meteorite which fell in Africa in 1938. The two American scientists describe five types of what they call 'organised elements'—four of them apparently similar to microscopic terrestrial algae—and one unlike any known Earthly organism. It seems fairly certain that these fossils are actually part of the meteorites and have not been picked up during their stay on Earth because fragments of each contained similar evidence. This announcement has already awakened fierce controversy—controversy which may continue for many years. One thing is certain—research into meteorite fragments will be intensified until some clear-cut conclusion can be reached.

In my last Comment I promised you a full report on Operation Airglow. I am disappointed to have to tell you that the weather was poor and that the astronomical projects suffered badly. Both teams had set themselves very wide programmes of social, geological, biological, botanical, ornithological, and other surveys and a wealth of information has been gathered. Many hundreds of photographs were taken and many feet of 8 mm ciné film exposed. One thing was made very apparent by GEORGE TIEDEMAN and his colleagues when they described their adventures on Skye at the Caxton Hall after the Annual General Meeting on October 21—they certainly have initiative! Much work still remains to be done on analysis and collation of records so it is still possible that I may be able to publish some astronomical notes which will be of interest and value.

Almost half the questionnaires sent out with *Hermes* October 1961 were completed and returned and the Council thank all of you who co-operated so willingly. The task of organising the results is far larger than any of us had expected and will take some time to complete. Many of you had been thinking about *Hermes* and sent additional suggestions. I have been quite unable to write to you all individually but assure you that I have taken very careful note of what you said.

The Council, of course, had a rough idea how many JAS members were actively associated with Groups but a preliminary check through the pile of completed questionnaires indicates that the numbers are lower than had been thought. I was not surprised at this for, with a few notable exceptions, a high proportion of the material contributed to *Hermes* comes from independent members. This frankly puzzles me for I read in Group journals of ambitious plans, of numerous instruments and observing programmes, of practical projects

and interesting ideas. Yet these activities seem shrouded in secrecy. Do they never mature or are they saved only for exclusive publication in what are, I admit, a remarkably good collection of local journals? Elsewhere in this issue is an illustrated description of a camera built in Croydon. Will the next issue carry an article on some other Group's achievement?

GEOFFREY LINDOP of Crewe has sent me a full report of the Auroral observation he made on October 28 last year. The display started at 18h 45m and continued until 20h 5m and covered a wide area of sky. At one stage he says it was light enough to read by and rays were clearly seen. His report has been confirmed from a number of sources.

Clear skies and good seeing right through 1962! John Lytheer.

Jupiter and Radio Astronomy

Paul Oliver

IT WAS really by a fortunate accident that astronomers came to know about Jupiter's radio flashes. They have not been completely explained, and were certainly not a feature of the radio sky to be expected and sought out deliberately. The accidental discovery came about because of the work of B. BURKE and K. L. FRANKLIN of the Carnegie Institution in Washington.

These two observers were experimenting with a new kind of receiving aerial of a type similar to the *Mills Cross*, which had just been built in Australia. The *Mills Cross* instrument was designed and constructed by B. MILLS in Sydney. It is an interferometer, but the spacing between the two aerials has been reduced to zero, and the two arms have been superimposed to form a cross. The instrument used by Burke and Franklin was of a quite simple structure designed for the rather low frequency of 20Mc/s as an exploration of radio astronomy techniques at the long wavelength end of the spectrum. The aerial was difficult to align, and it was thus decided to set it so that it would receive signals from the same part of the sky, day after day. It was set at a declination of 23° where there are two bright radio sources (the Crab nebula and the nebula IC443).

All sorts of signals were picked up, but one mysterious signal resembling electric drill interference, appeared for a few minutes each day. The signal came at a time when it could not have been caused by any known source of interference. Secondly, it could not possibly have come from any fixed point in the sky. However, as it happened, the two astronomers noticed that at that time the declination of Jupiter was 23°, and on comparing the movements of the radio source and of the planet, they found an **exact** agreement.

During a terrestrial thunderstorm sharp crackles may be heard in radio receivers. At first, the Jupiter signals seemed to be very like these, with sharp fluctuations from pulses of about one second in duration. These can be observed for one hour or more at a time, followed by several quiet hours; just as would be expected from a thunderstorm. However, the energy in the storm would have to be of gigantic proportions to be felt here, on Earth. This suggestion has to be dropped because it has been shown that the signals are in many respects quite unlike lightning signals.

It has also been proved that the actual radio source must lie somewhere in the band of markings containing the Great Red Spot. It would have been gratifying indeed to find that the Red Spot itself was the source, but in fact the source coincides with much more minor markings, which may have nothing at all to do with the actual source.

However, Jupiter has four large satellites or moons which are easily visible with a small telescope. These satellites as they circle around the planet, appear to cross the visible disc. Thus, there is a distinct possibility that one of them may occult the radio spot, thus giving astronomers a very valuable method of determining the exact position of the source and also, possibly, its diameter.

Miscellanea

Henry Welsh FRAS

Formerly Curator of the Port Elizabeth Observatory

A Scale Model of the Solar System.

Everybody knows that with the exception of the Moon, the nearest heavenly body is many millions of miles away from the Earth. But as few can visualise the immensity of even one million miles, let us construct a scale model which will help us to understand the size of the Solar System, as the Sun and its attendant family of planets and satellites are known.

If we represent the Sun by a globe two feet in diameter, then Mercury, the planet nearest to the Sun, would be represented by a pin's head and it would revolve around the Sun in a more or less circular orbit the radius of which would be about 28 yards. The rest of the Sun's family would then be represented as follows:

Planet	*Object*	*Radius of orbit*
Venus	A pea	52 yards
Earth	A pea	72 yards
Mars	A large pin's head	110 yards
Minor Planets	Grains of sand and specks of dust	120 to 390 yards
Jupiter	A medium-sized orange	390 yards
Saturn	A small orange	690 yards
Uranus	A small plum	4/5ths of a mile
Neptune	A large plum	1 and 1/5th of a mile

(A lawn tennis court is 26 yards, and a Rugby football ground is 110 yards, in length.)

Pluto, the outermost planet, whose discovery was announced in 1930, is so remote, small, faint and difficult to see, even with the largest telescopes, that its size has not yet been accurately determined. Suffice it to say that Pluto's average distance from the Sun is 3,666 million miles, and that it takes more than 248 years to complete a single circuit round the Sun.

Another way to help us visualize the distances of these objects, which are very much nearer than the stars, is to remember that a train travelling at 50 mph would take eight hours to complete a journey of 400 miles, 20 days to go round the equator, six months to travel to the Moon, and 220 years to the Sun.

Put in yet another way, a space-ship, which would have to have a velocity of 25,000 mph in order to overcome the Earth's gravitational pull, would require 3½ years to reach the famous ringed planet Saturn, whose average distance from the Sun is 886,100,000 miles. And for a journey to Pluto and back the traveller would have to provide his space-ship with enough food, water, oxygen and fuel for 33 years.

Some facts about the Sun

The Sun's diameter (864,000 miles) is about 109 times that of the Earth, and 400 times that of the Moon. About 720 Suns could be placed next to each other so as to stretch right round the horizon.

The Earth's distance from the Sun varies between 91½ and 94½ million miles. A radar beam, travelling with the speed of light (186,271 mps) would take about 16½ minutes to travel to the Sun and back, but only a little over 2½ seconds to go to the Moon and back.

Matter ejected from the Sun, would have to travel at speeds in excess of 384 mps in order to overcome the Sun's huge gravitational force. The Sun's

weight is 333,434 times greater than the Earth's, the latter's mass being approximately 6,600 million, million, million tons.

The Sun's surface temperature is about 6,000°C, but at the centre the temperature runs into millions of degrees. Sir James Jeans once calculated that if a shilling could be heated up to the temperature of the Sun's centre, its heat would shrivel up every living thing within thousands of miles of it. The Sun's light is nearly half-a-million times greater than the Moon's, and each square centimetre of the Sun's surface shines with a light equal to about 50,000 candle power. Nevertheless, if the Sun could somehow be removed to a distance of 200 light years (a light year is equal to 5,870 million million miles)—no very great distance as stars go—its brightness would be so reduced that it would become invisible to the naked eye, and a pair of binoculars would be required to see it.

A scale model of our galaxy

What is generally known as "our galaxy" is that gigantic conglomeration of matter which includes the Solar System, with its Sun, planets, satellites, comets and meteors; all the stars that are visible to the naked eye, and many millions more that are revealed in telescopes; star clusters; a certain amount of gaseous, nebular matter and dust; and indeed the Milky Way itself. The whole thing is more or less lens-shaped in cross-section and has spiral arms rather like a Catherine Wheel. And just like a true Catherine Wheel this galaxy of ours, as well as all the others, is rotating around its own centre of gravity. Ours takes about 200—250 million years to rotate once.

So vast is the galaxy that astronomers do not express its dimensions in millions of miles, but rather in light years. It has been found that the length of the major axis is about 90,000 light years, and that of the minor axis about 20,000. The Sun, however, is not at the centre, but some 30,000 light years away from it, or about 15,000 light years from the periphery. Nor is the Sun in any way a remarkable star: it is just one of a large number of stars comprising what is called the Local System, that is to say, a group of stars that are associated in several ways with one another. The diameter of this Local System is about 20,000 light years, and its thickness about 4,000.

Now in order to reduce these figures to comprehensible quantities, let us mentally make a scale model on a scale of 1:1,000,000,000,000,000 (one to a thousand billion).

OUR GALAXY

	miles approximately
Overall diameter	560
Greatest thickness	125
Sun's distance from centre	186
Sun's distance from periphery	93
Diameter of Local System	125
Thickness of Local System	25

On the same scale the diameter of the orbit of Neptune (almost the furthest planet from the Sun) would be four-tenths of an inch. One light year would be eleven yards, and 100 light years would be 1,100 yards.

How many stars are there in the universe?

The answer is that nobody knows with any degree of certainty how many stars there are *in the universe*. But we have a pretty good idea how many there are in our galaxy.

The world's biggest telescope, the 200-inch reflector at Mount Palomar, reveals not far short of 2,000 million over the whole sky, though astronomers estimate that the total number in our galaxy alone is probably fifty times this number, most of them being too distant and faint to be recorded even on the most sensitive photographic plates which have been exposed for several hours.

This lens-shaped galaxy, therefore, may number something like 100,000 million stars, and the world's greatest telescopes have revealed some hundreds of millions of similar galaxies in outer space. They are generally referred to as island universes or extra-galactic nebulae, and each one consists of many millions of stars just like our own. These stars are all suns very much like ours, and some of them may very well have planets circling them just like ours.

Most of these island universes are too faint to be seen except in a telescope, though there are three famous ones that can be seen with the unaided eye. One is the Great Andromeda Nebula, which is about a million and a half light years away, and the others are the two Magellanic Clouds, which are visible in south latitudes and look rather like detached portions of the Milky Way. Nubecula Major, as the larger one is called, is about 112,300 light years distant, and has a diameter of some 14,000 light years.

What is known about the number of stars in these incredibly distant island universes is based largely on analogy and by comparison with our own galaxy, so that the answer to our original question must remain for the present, and perhaps for all time, somewhat conjectural.

More New Worlds

Stewart Robertson

A NUMBER of planets have had extra satellites discovered going round them, satellites that upon subsequent investigation have eluded their discoverers. Saturn, for instance, is surrounded by nine satellites: Mimas, Enceladus, Tethys, Dione, Rhea, Iapitus, Phobe, Titan and Hyperion. PICKERING in 1905 thought he had observed a tenth satellite. It was even given a name, Themis, and its orbital period calculated at 20d 20.4h. Since then, however, it has never been seen again.

A Venusian moon has often been seen: in 1822 on October 23, WEBB saw a bright shining thing near Venus. Previously, in 1645, a similar body was seen, and later, too, in 1867. Despite these sightings the existence of a Venusian moon is doubted.

In 1779, HARDING and SCHROTER saw a bright spot cross the planet Mercury. This possible Mercurian moon was never seen again.

At White Sands in New Mexico, under CLYDE TOMBAUGH (the discoverer of Pluto), the United States Army is endeavouring to find a second moon of the Earth. If it exists it will be very small like the Martian moons, Phobos and Deimos. Its discovery would remove the necessity of building a large artificial satellite close to Earth.

It is a possibility that Uranus or Neptune have undiscovered satellites. Some astronomers think that Pluto was once a satellite of Neptune, before it broke away from Neptune's gravitational pull.

The larger satellites of Jupiter and Saturn, Io, Europa, Callisto, Ganymede, Titan and Triton may possess tiny moons of their own. They would be worldlets only a mile or so across.

Out beyond Pluto it is not impossible that several as yet undiscovered planets may exist, among them Pickering's Planet P. It is known that unless Pluto's composition is of very heavy materials completely out of keeping with the rest of the Solar System, it cannot possibly be responsible for the perturbations of Neptune and Uranus in their orbits. This seems to lead to the conclusion that there is a large planet wandering on the fringes of the Solar System. There may even be planets wandering *between the stellar systems*, cold and barren, devoid of life until drawn within the glow of some sun.

Around the Groups

Peter S. Litton

CHESHIRE. Cheadle, This newly-established group is planning regular meetings and already some members are taking part in JAS projects.

CROYDON. Indoor meetings continue at regular fortnightly intervals, under the Chairmanship of Miss Rossie Atwell. Attendance is never less than 20, and often in excess of 30. Recent events of importance include a talk by Paul Murdin on Globular Clusters and some experiences of Mr. J. V. Thomson when he took part in the construction of the 200-in telescope on Mount Palomar. Mr. Thomson's talk was followed by an excellent 16 mm colour film. A visit was made by 35 members and friends to Mr. Hyde's Observatory at Clacton on October 15. Having been shown round the now-famous Martello tower and having had the various pen recorders and other instruments explained to them, the party inspected various types of aerial arrays and antennae set up in a number of places. Mr. Hyde also demonstrated his coudé clock-driven telescope used for observing the Sun by projection with various powers. A "Bring and Buy" Sale held on December 2 at Mr. and Mrs. Best's house, helped to raise funds towards the ultimate erection of a 16-in reflector and ancillary equipment.

EASTBOURNE. The Eastbourne local authority have now approved the plans for the proposed observatory on the South Downs, mentioned in the last *Hermes* Funds are being accumulated to enable construction work on the buildings to start. The group has received illustrated reports of the expedition to the Isle of Skye from George Teideman of Croydon and from Roger Seymour.

GLOUCESTERSHIRE. I have received confirmation from Miss Alison P. Brown that regular monthly meetings have now started. It is hoped to start a programme of auroral observations and to exchange notes with the neighbouring South Wales Group.

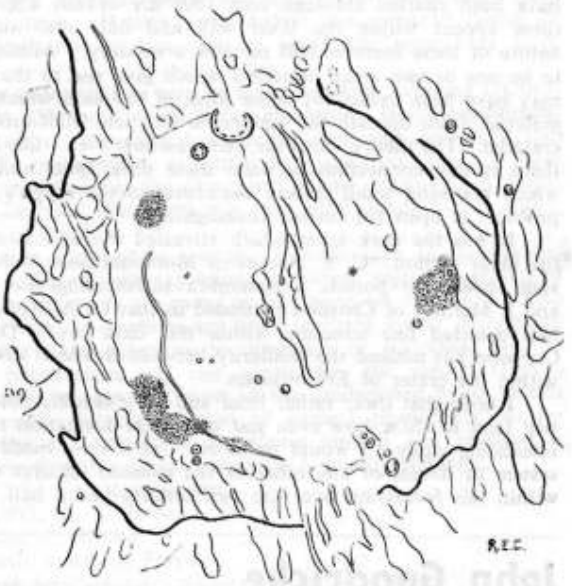
LONDON, NE & E. By the time this appears, Leslie Green's group will have produced their booklet for beginners *Introducing Astronomy*. The price is 9d, plus postage. A group library has been set up at which copies of JAS and group publications are available to group members on loan. Copies of BAA and BIS literature are also held and I have no doubt that the idea will be carefully considered by other groups.

LONDON, GOLDERS GREEN. Lily Morrison and Anthony Goudie have both written to tell me of the progress made by the group. About 20 to 25 members attend the monthly meetings. They are fortunate in being able to meet in the home of one of their members and are most grateful for the hospitality extended to them. Practical observation is carried out at the Hampstead Observatory where the 6-in refractor is operated by Julia Wilcox.

SOUTH WALES. Colin Reeves has sent me copies of the latest literature issued by this go-ahead group. Auroral observations continue and a group lunar project is being planned in close association with Mr. R. E. Ellis, Director of the JAS Lunar Section. The programme outlined in the November Bulletin of the group is most attractive and includes a trip to Mr. T. Moore's observatory at Tredegar where an 8½-in reflector is installed.

I am very grateful for the reports received from these groups. This feature depends entirely on the information I receive from group secretaries or correspondents. The JAS Council know that there is a widespread demand for closer links between groups and more information about the things they do. *Hermes* is the appropriate medium of communication but I have to rely on regular reporting if *Hermes* is to fulfil this function.

Chart of Alphonsus based on Plate D5-a in Kuiper's Photographic Lunar Atlas.



Lunar Section Notes

R. E. Ellis

THE FOURTH issue of Selen, bulletin of the JAS Lunar Section, contains the first preliminary report on the section's observations of the lunar crater Alphonsus. Situated near the apparent centre of the moon's disk this formation presents an easy and interesting object for the small telescope. An easy object because of its large size, the diameter being 70 miles and its surrounding ring reaching heights of about 7000 feet. An interesting object because of the unusual amount of attention this crater has been given in recent years by professional astronomers.

Most recent interest was aroused at the announcement of the suspected volcanic outbreak just East of the central peak. This occurrence was observed by the Russian astronomer, N. A. Kozyrev, on November 3, 1958 whilst taking a spectrogram of this crater. The idea of a volcanic erruption put forward by Kozyrev is not generally accepted by all astronomers but there does seem to be a clear indication that something happened within this region of Alphonsus.

The search for a tenuous lunar atmosphere has occupied the attention of many astronomers and notably Dr. Dinsmore Alter, an American, who using the 60-in. reflector at Mount Wilson on October 26, 1956 took photographs of Alphonsus in infra-red and ultra-violet light and found that in the red certain features were clearly defined which were not visible on the plate exposed to the violet whereas similar features in an adjacent formation were clear in both colours. This suggested that a local obscuration, caused by some form of gas, took place within a limited region of the crater. Dr. Alter is quick to point out, however, that the same effect may be caused by some other phenomena and the photographs cannot be taken as conclusive evidence of the existence of a lunar atmosphere.

No mention of Alphonsus would be complete without reference to the conspicuous dark spots which are visible within its walls. The fact that they are most noticeable at Full Moon has led many to believe that the spots darken as the Moon approaches full phase. It would appear, however, that this illusion is purely an effect of contrast and it has been shown that the spots are in fact lighter at full moon than under low illumination. Some 27 dark spots

have been charted although only four are of any appreciable size. Of these, three appear within the West wall and only one within the Eastern. The nature of these features still remains a mystery. Within each spot there appear to be one or two small craterlets which give rise to the idea that the darkening may have been caused by some form of eruption which caused a layer of dark material, from beneath the surface, to dissipate itself around the opening of each craterlet. The theory, however, remains unproven. Dr. Fielder wonders whether there is any connection between these dark spots and the many bright spots which surround small craters elsewhere on the moon's surface. Obviously the problem is open for further investigation.

It was the dark spots which attracted the attention of several members of the lunar section. C. V. Reeves of Monmouthshire notes that the large Eastern spot appears to possess a penumbra surrounding the dark crater of the spot and J. Mathers of Croydon reminded us that G. A. Hole using his 24-in reflector had detected fine structure within this dark area. D. B. P. Beglan also of Croydon has noticed the similarity between this spot and another which appears within the crater of Eratosthenes.

I hope that these rather brief and very sketchy notes concerning Alphonsus will tend to show how even just one lunar formation can offer several lines of interesting study. I would point out that I have made no mention of the rille system or domes or any other of the isolated features which have been charted within this formation over the past century and a half.

John Goodricke

B. R. H. Tombleson

THE NAME of JOHN GOODRICKE does not figure in the Encyclopedia Britannica or Chambers Encyclopedia, and is scarcely noticed in the Astronomical Encyclopedia. Yet because of his physical disabilities, his short life and the importance of his discoveries (though they would have inevitably been discovered later) I have always had a soft spot for him. Although very little is known about him, W. M. Smart in "Some Famous Stars" and also The Dictionary of National Biography both record some details and I have drawn on these sources.

John Goodricke was born at Groningen in Holland on September 17, 1764. He was deaf and dumb from birth and it was due, no doubt, to his physical disabilities that he had leisure and opportunity to become absorbed in observational astronomy. On the death of his father in 1784 he became heir to his grandfather Sir John Goodricke, of Ribstone Hall in Yorkshire, who, however survived him.

On November 12, 1782 at York he was observing the star *Algol* when he noticed that it was becoming gradually fainter. Continuing his observations he found that the star was again becoming brighter. He maintained observation of *Algol* throughout the winter of 1782/3 and was able to deduce the period of the light-changes, which he gave as 2d 20h 49m 8s , an amazingly accurate result even when judged by modern standards. He communicated his discovery to the Royal Society in May 1873 in a paper entitled "A series of observations on, and a discovery of, the period of the variation of the light of the bright star in the Head of Medusa, called *Algol*". He suggested that the cause of the phenomenon was the periodical eclipse of *Algol* by a large and dark body—essentially of stellar dimensions and possibly only faintly luminous—revolving around *Algol* in the same period as that of the light-changes. This explanation did not commend itself to Sir WILLIAM HERSCHEL, then at the height of his fame, for, he said, he had repeatedly observed *Algol* with his 7-ft. telescope and found it "distinctly single". It was later Herschel's good fortune to discover the

existence of binary stars and he was then disposed to accept Goodricke's theory, although he was still unable to detect the hypothetical companion in his telescope. Indeed as the separation of the components is of the order of six million miles, even the largest telescope so far constructed is unable to detect the companion star.

In 1784 Goodricke discovered the variability of *Beta Lyrae*, and suggested that the variable was actually a single bright star, rotating about an axis considerably inclined to the plane of the Earth's orbit around the Sun, its surface being mottled with several permanent dark blotches resembling in this respect, except in the matter of scale and permanence, the solar disk with its short-lived sun-spots. The modern interpretation of the light-curve of *Beta Lyrae* is of two elipsoid stars almost in contact, revolving about their common centre of mass with the greater axis of one component pointing towards the centre of the other.

Also in 1784, shortly after his discovery of the variability of *Algol*, Goodricke discovered the variability of *Delta Cephei*. He found that the star's brightness changed in cycles of 5d 8h 37.5 m. This is about 10m on the short side, but is yet amazingly accurate considering the somewhat crude observational methods at his disposal.

In one of his papers to the Royal Society he wrote, referring to the three variable stars he had discovered, "Such enquiries may probably lead to some better knowledge of the fixed stars especially of their constitution and the cause of their remarkable changes". Modern research has fully justified the instinctive faith of this young astronomer that his discoveries were only a prelude to a clearer knowledge and understanding of the heavenly bodies.

Goodricke died at the age of twenty-one and a half years, an incalculable loss to the science of Astronomy, but an object lesson to all young astronomers of the triumph of an active mind over severe physical disability. He was unmarried. For his discovery of the variability of *Algol* he was awarded in 1783 the Copley medal. Fourteen days before his death he was elected a Fellow of the Royal Society. He was buried at Hunsingore in Yorkshire. A portrait of him hangs in Gilling Castle, Yorkshire.

The Changing Face of Jupiter

Patrick Moore

IN SOME ways the scope of the amateur astronomer is less wide than it used to be half a century ago. Startling discoveries are not often to be made; few people are lucky enough to detect a nova, for instance and even comets are often trapped first by professional observers. But in a way, this restricted field makes the role of the amateur even more valuable, provided that he is ready to put in plenty of routine work.

One of the most promising fields is Jupiter, whose face is always changing, and which is not closely studied by professional workers insofar as its surface features are concerned. Much of our knowledge of Jupiter is in fact due to amateurs; men such as the Rev. T. E. R. Phillips, who unfortunately died some time ago, and F. J. Hargreaves and B. M. Peek, who are happily still very much alive. And though Jupiter has been low in British skies this year, it has been extremely active, so that this may be a good moment to say something about recent events there.

The main interest during 1961 was in the behaviour of the north and south equatorial belts, and the whole of the equatorial zone itself. My observations during the previous year, 1960, had shown that (as usual) the north equatorial belt was the most prominent feature on the disk, while the south equatorial and

south temperate belts were comparable in intensity, and sometimes clearly double. When the planet emerged from the dawn in the spring of 1961 there had been a startling change. For the first time since 1956 the south equatorial belt was almost as prominent as the north equatorial, and the south temperate belt had faded, while the whole of the south temperate zone was light and featureless. In fact, my observations from May to December 1961 showed that almost nothing was happening anywhere except in the equatorial regions.

The extraordinary thing was that the south equatorial and north equatorial belts were exceptionally close together. When I first noted this I thought I must be mistaken, but the appearance has since been confirmed, and it is undoubtedly real. Measuring belt latitudes is a tricky problem, but in this case the shift was too great to be overlooked.

Moreover, the equatorial zone darkened during June, and at times it seemed as though the two belts were merging together into one very broad band, though closer study revealed that this was not actually so. Large rather diffuse white patches also appeared, particularly between June 29 and July 6, and the whole region was in a state of unusual activity which contrasted sharply with the quietness of the rest of the disk. Later, from October, things became rather more normal, but all observers will be anxious to see what has happened by the time Jupiter becomes available once more in 1962.

It is also worth noting that our old friend the Great Red Spot, obscure in 1959 and 1960, had become prominent again in 1961—and it really was pinkish. On the other hand there was an almost complete fading-out of the south temperate belt during the late summer and early autumn, and the Red Spot gave the unusual appearance of being isolated. The belt reappeared before the end of the apparition.

There are all sorts of problems to be faced here. What causes these changes on Jupiter? For that matter, what is the "surface" of the planet like, if, below its outer clouds, it has a true surface at all? Why do various features such as the Red Spot have their own particular drifts and rotation periods? And, last but by no means least, is there any link between observed surface features and the radio emission from Jupiter?

Until we know just how the planet behaves, these problems are difficult to solve, and long-continued observation work is the only way to find out the answers. If we amateurs can provide the raw material, then the theorists can use it to work out more satisfactory models for the planet.

Luckily the observations can be made with small telescopes; even a 6-in reflector is fairly adequate, and with an 8-in there is no trouble at all. The essential thing is to time the moments when the various features "transit"—that is to say, cross the central meridian of the planet. Jupiter spins so rapidly that a marked drift can be noted in even a minute or two, and with a little practice, aided by a reliable watch, it is possible to time surface transits to within an accuracy of one minute or so, which is quite good enough. Moreover, the central meridian is easy to locate, since Jupiter is so obviously flattened at the poles.

When doing serious work on Jupiter, it is wise to remember a couple of good transit timings are worth more than a dozen pretty drawings; in fact drawings are most valuable when they are confined to "strips" across the disk, made to tie in with the transit observations. Working out the longtitudes of the features from transit-timings involves nothing more frightening than simple addition, and all the tables are given in the BAA Handbook.

So it is greatly to be hoped that telescope-users will spend at least some time studying Jupiter, because this is a field in which they can be particularly useful. During 1962 the planet will be higher up, in Britain, than was the case in 1961, so that there is every hope of making some valuable observations.

● trend

A review of new ideas in astronomy

A NEW STEADY-STATE MODEL OF THE UNIVERSE

IN A previous *trend*, in fact in the very first appearance of this department of *Hermes* in July, 1961, we reported MARTIN RYLE'S radio observations of the discrete sources, which in Ryle's view "provided conclusive evidence against the steady-state model of the Universe". We also reported that Professor HOYLE, whose particular version is the most widely known, although not the only, steady-state theory in Cosmology, had already begun to adapt his model to conform with Ryle's observations. An account of Hoyle's paper has now been published as the proceedings at the Meeting of the Royal Astronomical Society on Friday, April 14 1961; this is not Hoyle's formal presentation of the paper which will undoubtedly appear in due course in the *Monthly Notices*.

The main weakness of a theoretical study of any subject, but especially an astronomical one, lies in the complex of assumptions made, often unconsciously. There is no hard and fast rule that one can apply to the assumptions in a theory (except, of course, that they must be self-consistent), and the only guides are oft-meagre knowledge and experience. Where alternatives appear, then one must choose the simplest, in accordance with the rule laid down by William of Occam in the early 14th century: "entities should not be multiplied beyond necessity". (Actually, this principle, known as Occam's razor, was not stated by Occam in these words. He expressed it less obscurely as "it is vain to do with more what can be done with less".) If, of course, the simple case proves on closer inspection to be wrong then it must be abandoned.

This is precisely what Professor Hoyle has done. The original steady-state theory had assumed that the probability that a radio galaxy was a radio emitter is independent of its age, this being the simpler alternative in the absence of evidence to the contrary. Since the first formulation of the steady-state theory some evidence has come to light that this is not the case: the majority of identifications of radio sources with optical ones is with massive E and SO galaxies with very old stellar populations. In other words it appears that the probability that a galaxy will be a radio emitter gets larger as the galaxy gets older.

Now, condensations of galaxies which will be close together when they are formed (Hoyle conceives the steady state to be obtained with clusters of galaxies, rather than with individual galaxies) become separated by the expansion of the Universe and a new generation of galaxies will be formed in the space which they leave behind. Thus, he says, an observer situated in a typical position in space has young objects near him rather than old ones. Hence it will be more likely that the galaxies further out from the observer will be emitting radio waves than the ones close in. It will appear therefore that there are more galaxies at distances further away from us. Such are the observations by Ryle. But on the new theory this is only because (in radio light) we cannot observe the galaxies near to us. A similar effect will be observed in the evolutionary theory.

At first glance it will appear that there is no way of telling the steady-state theory with the new probability distribution from the evolutionary theory with the old one. There are in fact differences in detail. In particular, in order to fit the observations by Ryle the galaxies on the evolutionary model will have to be more likely to emit radio waves early on in their lives. The (very tentative) evidence is against this.

All in all, then, it seems that the steady-state theory is far from dead yet—or if is, it will not lie down.

"Proceedings at a meeting of the Royal Astronomical Society, 1961 April 14", *The Observatory*, 81, 86 (1961)

The Astro-Photographer

Croydon Meteor Camera

K. S. G. Stocker

Greatly enlarged part of test plate.

NAKED-EYE meteor observing can be a tedious and tiring business requiring a good deal of patience—more than I possess! I have nothing but admiration for people willing to stay out in the open under the stars, usually well after midnight, looking, with craned neck towards a meteor radiant and noting down details of time, brighness, direction and duration of track of any meteors seen. Such information is of very great value and such observers, even today, are relatively few and far between. Many more are badly needed. There is, however, a more convenient way of recording meteors—simply by photographing them. Before this can be done, though, the camera may well have to be built!

One such instrument has just been constructed by members of the Croydon Group using an F2.9 Pentac lens of 8-in focal length generously placed at their disposal by MR. H. B. RIDLEY, Director of the Meteor Section of the BAA.

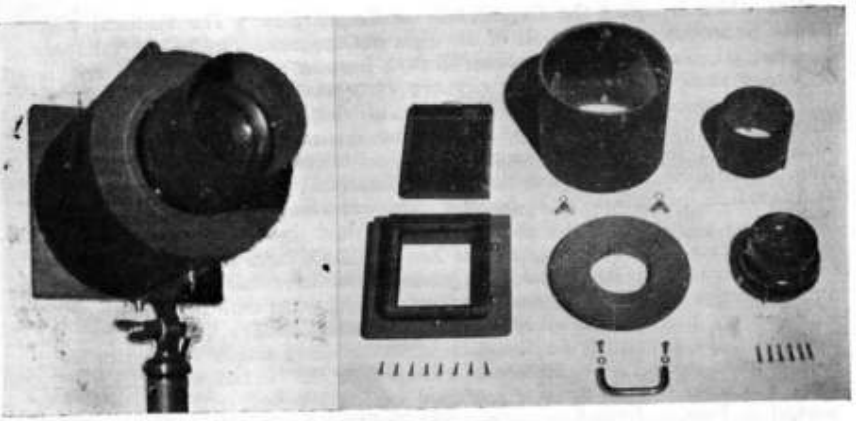
JOHN MARSH, after much careful thought, produced preliminary designs of a simple, sturdy and effective camera. In addition to the lens only three main components were needed—a lens mount, a plate-holder assembly and a body capable of holding these two accurately and rigidly. A double-sided plate-holder, taking 5-in x 4-in plates was obtained for 25/-. A box of one dozen HP3 plates was also bought because they are quite fast but not too grainy.

Construction of the camera body, end-pieces for the lens mount and plate-holder carrier was done mainly by K. AUSTEN and R. WEBSTER, two members with considerable engineering experience and the necessary equipment.

The body itself was made from "Paxolin" tubing, 7-in diameter and ¼-in thick walls. This was turned on a lathe to the required length and then fitted with the two-end pieces of seasoned mahogany. They were again turned to a precise fitting. Both end-pieces are held in position by chromium-plated countersunk wood screws. The plate-holder carrier was constructed from brass curtain rail and soldered together. Sponge rubber packing, incorporated in the original design, was found to be unnecessary.

The final components were a dewcap—made of "Paxolin" resin-bonded paper and held in position over the lens mount with 3 spring clips—2 special bolts in the bottom of the body for attachment to a tripod and a chromium-plated carrier handle on the top. The exterior of the camera body was finished in black "crackle" and the inside with matt black paint. The mahogany end-pieces were treated with a coat of shellac.

The optical tests were carried out by J. W. KENT late August 1961, and here it was a case of "third time lucky". The first two plates to be exposed were unfortunately out of focus but after suitable adjustment, the third test plate



The completed instrument mounted ready for use. The components are shown on the right. An ordinary enamelled drinking mug serves as a dust-cover and shutter.

proved satisfactory. I have examined this plate carefully and am interested to note the ease with which this lens system splits *Epsilon Lyrae*. The field of view is a little smaller than expected, being some 33 x 25 degrees, but the star trails recorded are good right to the edge. Exposure time in this case was 5m and the faintest magnitude recorded was fainter than 6. Exposures of the order of 15m should reveal objects down to magnitude 8 or 9. Jimmy Kent developed the plate in "Pentalex", an X-ray developer by May and Baker which gives high contrast and low fogging characteristics. In his opinion exposures of 20m or so may be possible using HP3 plates, somewhat less if HPS plates are used.

I wish all aspiring meteor photographers good luck in 1962. Please send me copies of your successful pictures!

By the way, would a JAS Photographic Section be feasible? If you have any ideas, why not write to me?

Mr. K. S. G. Stocker, 12, Oxford Road, Wallington, Surrey.

The Zodiacal Light

John K. Sabbagh

THE Zodiacal Light is to many amateur astronomers no more than an item to which two or three lines in books on general astronomy are devoted and to which not much importance is attached. However, it has been used in recent years to tell astronomers a little about the composition of interplanetary space and has been elevated from the position of a little-known astronomical phenomenon.

What, in fact, is the Zodiacal Light, and how does it show itself? It is a faint band of light, about the magnitude of the Milky Way, stretching from the horizon, where it is widest, and lying approximately along the ecliptic. It is called the Zodiacal Light because it lies along the constellations of the zodiac. Its shape can only roughly be discerned and it is very difficult to see if there is any haze in the sky; thus to make observations from northern latitudes is very difficult. The band itself appears to get fainter as the distance from the horizon increases, and it fades out after twenty or thirty degrees. Observations from tropical locations with perfect conditions have shown that the band continues right across the sky through the zodiacal constellations and widens and brightens at a point in the sky directly opposite the Sun. It is this faint patch where the band

widens which is called the *Gegenschein* or Counterglow. The Zodiacal Light cannot be seen during the whole of the night but appears about an hour after the Sun has set, disappearing below the western horizon towards midnight and re-appearing above the eastern horizon in the early morning.

If any serious observations are to be made they must of necessity be made from regions where the sky is clear and the Zodiacal Light well-placed. This would suggest somewhere in the tropics. If an attempt is to be made to see it from the British Isles, the best time to try is in the spring when the ecliptic is at its greatest inclination to the horizon; there must be no trace of moonlight in the sky.

Theories attempting to explain the Zodiacal Light have been put forward by several astronomers, both past and present, and have been based on either atmospheric or interplanetary scattering by particles. Up until the middle of the 17th century it had been accepted, by those who thought about it, that the Zodiacal Light was merely an atmospheric phenomenon, similar to solar or lunar haloes, or to the aurorae. However, at that time the famous astronomer J. D. CASSINI, known for the division he found in Saturn's rings and who lived and worked in France, decided to observe the Zodiacal Light over a long period in an attempt to account for its origin. He made several observations which helped him in this. He saw that the light appeared at a point on the horizon near where the Sun had set, at about an hour afterwards, and that the band as a whole went lower and lower as the night wore on, as if attached to the Sun and pulled by it. He also noticed that its morning appearance followed the same procedure in reverse, and that when it was blotted out by the approaching dawn, it was near the point on the horizon where the Sun was due to rise. This suggested a possible explanation of the light as being due to some sort of light around the Sun which is so faint that it may only be seen when the Sun's light is blotted out completely. Cassini also measured the exact position of the light among the stars and decided that it lay in a line with the Sun's equator. This convinced him that the Zodiacal Light was entirely an interplanetary phenomenon. He suggested, as an explanation, that the light was due to a reflection of the Sun's rays from a dusty nebula that lay around the Sun. This hypothesis, although not accepted by all, was held for two hundred years as being the most likely explanation.

The first doubts that were raised were concerned with the nature of the particles scattering and reflecting the Sun's light. Towards the beginning of this century interest was being aroused in the nature of the Sun's corona, its fiery gaseous halo, that could only be seen at the time of a total solar eclipse, and then only for a few seconds. The corona could not be due to reflection from dust because dust particles could not exist in such temperatures but would be vaporised, and it was suggested that the cause was the scattering of sunlight by electrons and other sub-atomic particles. A major step forward in such research came with the invention of the coronagraph by LYOT in 1930. This instrument, a glorified telescope with a series of baffles and screens to isolate the coronal light, enabled astronomers to observe the corona at any time the Sun was visible. With the help of the coronagraph and the spectroscope the electron theory of the corona was substantiated and it was suggested that the Zodiacal Light was merely an extension of the solar corona to distances as great as one astronomical unit, and that the scattering particles were electrons whose density decreased with distance from the Sun. Recently three scientists have independently come forward with theories that the electron density in the region of the Earth is about one thousand per c.c. and this would tend to confirm the 'extension of the corona' theory.

A scientist who has done much work on night sky illumination and the Zodiacal Light is Professor BLACKWELL, who has made most of his observations from the Bolivian Andes. Using photography and spectroscopy, he discovered

that the light lies along the plane of Jupiter's orbit and not along the ecliptic. This would confirm the interplanetary theory, if any confirmation were needed, as it would be caused by interplanetary particles affected by Jupiter, the most massive planet. Blackwell also decided to confirm or deny the interplanetary electron density and estimate its contribution to the Zodiacal Light. He reasoned in the following manner. If the sunlight was reflected mainly by dust particles the spectrum of the Zodiacal Light would show traces of Fraunhofer lines as the particles would have no appreciable motion. However, the rapid motion of any electons scattering sunlight would produce a Doppler effect which would spread the Fraunhofer lines to either side. Because the mean velocity of the electrons would be so high this effect would produce such a spread of the line that effectively a continuous spectrum would be observed. Although his results have not yet been completely analysed, the first findings suggest that, in fact, the proportion of light due to electron scattering is much lower than had been thought.

Thus it seems that there is a lot to be said for Cassini's theory and that a major part of the Zodiacal Light comes from light scattered by dust particles in the space between the Earth and the Sun.

Fireballs

S. R. Stebbing

"A fiery ball swept low over New Haven, U.S.A. on August 20th, 1953, shaking the foundation of several large buildings. It seemed like a long-awaited signal that the world was coming to an end, a witness said.

The trembling foundations, the dimming lights, and the screams of frightened motorists coincided with the grim prediction of doomsday forewarned by ancient Egyptian prophets . . .

The New Haven incident occurred just after dark. A great swoosh broke through the silence of the hot August evening. Immediately, buildings began to tremble, lights dimmed suddenly and panic followed in its wake.

It was reported that only one resident actually saw a red ball of fire about 6 to 8 inches in diameter smash through a sign board, change its course, tear through the top of a large tree, just miss telephone and power lines, and disappear over a hill about a half-mile away. The New Haven Fire Dept. rushed to investigate the smoking, half-demolished sign. They couldn't explain what ripped the hole more than a foot wide, through 20 gauge steel. Whatever it was had struck with a terrific impact."

THE above report is an extract of a news item published in the *Bridgeport Herald*, August 1958, and is typical of a number of observations of natural phenomena, the origin and behaviour of which cannot be fully explained. This type of *fireball* is sporadic, and unlike the well-known showers of true (intrinsic) meteors, observed and studied by trained observers in astronomical observing sections, the nature of the fireballs, or strangely behaved meteorites, cannot easily be accounted for with any satisfaction.

There are numerous theories regarding fireballs, and the most feasible explanation comes from DONALD H. ROBEY of the Convair Astronautics Division of the General Dynamics Corporation at California, who suggested that slow moving fireballs of a greenish colour can be accounted for by the hypothesis that they are objects referred to as *cometoids* (to distinguish them from meteorites) and are composed of substances frozen at very low temperatures.

The characteristics of cometoids predicted qualitatively from the theory are fuzziness in outline at low altitudes, shiny "metallic" appearances at high altitudes, wobbling in flight, spherical in shape, light emission, short lifetime and no impact debris.

Robey theorized that cometoids are composed of frozen gases, carbon, oxygen, nitrogen and hydrogen, in an excited state after being exposed to cosmic radiation—and when the cometoids enter the Earth's atmosphere a green glow results from solid nitrogen, which is, evidently, the most brilliant of the thermo-luminescent ices. Robey also holds to the opinion that the fragments of cometoids will slow down to as little as 500 mph and that they are able to follow an erratic path as a result of the release of bubbles of gas within the fragments as they travel through the air. The light emission is accredited to gases within the cometoid body rather than frictional encounter within the Earth's atmosphere which is negligible at the speeds which normally occur.

To illustrate the application of the above theory, I will cite a typical case from the LUFORO[5] *Bulletin* dated January, 1961.

"The Kansas State Highway Patrol today said 'a ball of fire travelling at a high rate of speed had been picked up on the radar at the Hutchinson (Kansas) Naval Air Station.'

City Editor, Brian Coyne, of the Arkansas City *Daily Traveller* said 'a brightly-lighted tear-shaped object with prongs or streams of light spraying downward was sighted shortly after midnight. A second object was sighted around 1 a.m. The prongs or streams of bright light also were observed first as directed towards the Earth and then extending from the sides of the object.' He also described the head of the object as being green in colour or 'bluish green'."

In spite of the wide application of the Cosmic Ice theory, a quick perusal of fireball reports show quite distinctly that this will adequately account for only a small proportion of reports. Consider, for example, the reports listed below—can they be considered as harmless as the cometoid?

1874, July 28[1]. A disastrous flood befell the community of Saw Mill Run, Nr. Pittsburg, Pennsylvania. Local villagers beheld a strange sight prior to the disaster. Over on the Northeastern horizon sailed a black cloud ringed with a scarlet belt; and over on the Southwestern horizon, slowly sailed another black cloud—with a scarlet belt. They approached each other, and at the same time, charged flashes of lightning which grew in intensity and violence. They collided with a great flash and rain fell in torrents. The result, about 150 persons drowned.

1883, February 27. Many reports of luminous objects in the sky and an earthquake at Connecticut, U.S.A.

1892, January 7. A fiery blast shot across the State of Georgia on the previous June 5, described as a "black tornado filled with fire". This coincided with earthquake shocks in Italy, approximately the same geographical latitude; people in New York State were watching a glare in the sky and shocks were felt.

1908, June 30[2]. A blue disk shaped object about 15 minutes in diameter appeared in the sky together with a loud noise resembling a cannonade. This was followed by a loud explosion audible for miles around. Trees were blown flat and their bark and branches were scorched by the impact.

1957, November 6[7]. A large red-hot egg-shaped object appeared near Alamogordo, N. Mexico and stopped the engines of 11 cars as it passed within about 40 feet. Intense heat was felt.

1957, November 14. A large orange-red moon was seen by three witnesses between Mitcham, Effingham and Epsom in Surrey. The object moved rapidly out of sight.

1958, January 18[3]. Central Asia. A large bright object passed over a forest and vanished on reaching the horizon. Over a city, an object the size and brightness of the moon was sighted, and, over another city, an object described as being similar to an electric bulb appeared from behind a cloud. In all cases the objects were accounted for as "electrical phenomena".

1958, June 3-4[7]. A large dull red object was seen over Nottingham. It moved

with a skipping motion and at great height and speed. Mystery bangs were heard in the area at the time. Houses were shaken and windows rattled in West Bridgeford. A similar object was seen at about the same time from Finchley, London.

1961, March 4th. A large meteorite was seen in seven counties including Oxfordshire, Wiltshire, Somerset, Gloucestershire, Buckinghamshire, Northamptonshire. and Hertfordshire. The object, travelling towards the west and, leaving a trail of sparks was described by one observer as similar to a rocket in shape. A loud rumbling was heard five minutes after the object had passed overhead. A Royal Observatory spokesman declared that there was very little doubt that it was a meteorite in the process of breaking up.

It is interesting to note that certain sporadic fireballs such as those listed above are connected to a degree with explosions, radiation, meteorological and seismic activity, while the cometoids are more or less harmless in nature. Also notice that some of the above observations are listed in flying saucer chronology despite the fact that there is no reference to doorways or portholes, and no suggestion of artificial construction. If one approaches the subject from a scientific angle, it can easily be seen that most of the unidentified flying objects (UFO's) sighted come under the classification of natural phenomena. so far unexplained. Nevertheless the subject is of intense interest and research is being carried out on these lines for which assistance is greatly welcome.

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Limits of Resolution

Ian Redpath

WHATEVER aperture telescope you have, it is important to know the faintest magnitude and the closest stars that it will see in order to determine its limits.

The magnitude limit is determined by the following formula:

$$m = 9 + 5 \log A$$

where m is the limiting magnitude and A is the aperture in inches. The formula gives only "ideal" results, and applies to excellent seeing conditions and normal vision.

As an example, imagine a telescope of six inches aperture. Substituting $A = 6$, the formula becomes $m = 9 + 5 \log 6$.

The logarithm of 6 is 0.7782, which we can find from four-figure tables. Five times this is 3.8910, and nine added to the answer gives 12.8910. The faintest magnitude resolved by a six-inch glass (or mirror) is then roughly 12.9. When the working is set out correctly, the calculation becomes.

no.	log.	
6.0	0.7782	
	5	×
	3.8910	
	9	+
	12.8910	

To discover the resolving power in seconds of arc of a telescope of aperture A inches, the following formula is used:

$$\text{resolving power} = \frac{5''.0}{A}$$

For the six-inch telescope which we used before, the resolving power becomes 5".0/6, that is 0.8333". This telescope will thus resolve two stars 0.38 seconds of arc apart. This formula, however, only applies to pairs of stars which are roughly equal in brightness and of the sixth magnitude. When the pairs are of unequal magnitude and/or of lower mean magnitude, then the numerator in the formula must be considerably increased.

Here is a table of the faintest magnitude visible and the resolving power in seconds of arc for different aperture telescopes.

Aperture mm.	Aperture in.	Faintest magnitude	Resolving Power (secs. of arc)
50	2	10.5	2.5
75	3	11.4	1.7
100	4	12	1.25
150	6	12.9	0.83
220	8½	13.6	0.59
250	10	14.0	0.50
300	12	14.4	0.42
313	12½	14.5	0.40
380	15	14.9	0.33

It should be noted that the above figures are only approximations and that under exceptional conditions these limits may be exceded; but in general, especially for those living in cities, the limits will not be attained.

After the aperture has increased above fifteen inches, the faintest magnitude increases very slowly, and it would take a six foot reflector to bring an 18th magnitude objects into view. In general, doubling the aperture adds another 1.5 magnitudes to the faintest magnitude. The 200-in. Mt. Palomar telescope can only bring objects brighter than a magnitude of 20.5 to the naked eye.

Recommended Books

ASTRONOMY, by PATRICK MOORE, Oldbourne, London, 1961. 253 pages. Price 35s.

THIS must surely be the greatest book which Patrick Moore has ever written. It combines the knowledge of years of patient research and observation into one large encyclopedia. On every page there are photographs, drawings and paintings some in colour and amounting to more than 400 in number. Having such a great quantity of plates, the book could easily have turned into a mere picture-book, but the author has made a skilful compromise between this and a text-book. Among the plates are some wonderful reproductions of the latest colour photographs of nebulæ from the Palomar Observatory. The colour paintings, some of which are so extremely exact that they could be photographs, are by the well known David Hardy, the astronomer who can translate his thoughts into pictures. In my opinion, however, some space is wasted,—the large representations of Uranus and Neptune for instance—could have been covered by drawings a quarter the size. Again, the lunar photographs are not adequate, being except for two, on a small scale. The one of Tycho, in particular, is not too good. The text, of twenty-three chapters, is written in the usual style which the

author uses and forms a competent history of astronomy. Also included is a list of important dates in astronomical development.

At the relatively low cost of 35s. the book would make a suitable gift to buy yourself. J.H.M.

ASTRONOMICAL SPECTROSCOPY by A. D. THACKERAY. Volume 2 of The *Survey of Astronomy* edited by COLIN A. RONAN. Eyre and Spottiswoode, London, 1961. 256 pages, price 18s.

IN PRINCIPLE, the aim of *The Survey of Astronomy* is very laudable: in the words of the blurb, it aims "to fill the gap in the literature between the very elementary volumes on astronomy and works of a high standard technically". There has long been a demand for this sort of book at the sort of price that these are published at (no mean feat to produce such a volume at under a pound these days!).

One must judge the books as they are produced, however not as they are meant to be in theory. And this book whilst the best in its class (it is the only one) fails. The underlying theme is the astronomical spectrograph; but the overlying impression is that of a hash up of the more elementary parts of stellar physics. The only feature which might have saved the book is the initial part on the spectroscope and the foundations of spectral theory. This is too rushed to be of value to the person who knows only a little about the subject (it leaves him with too many unanswered questions) and too skimpy to be of use to the University student (one of the class of people at which the book is aimed). Don't buy it if you have anything else on stellar physics in the *Introduction to Astronomy* (Payne-Gaposchkin), *Astronomy* (Russell, Dugan, Stewart) or *Elementary Astronomy* (Struve) class. But OK if you don't have anything else, and need to recommend a present to an uncle.—P.G.M.

COSMOLOGY by H. BONDI. Second edition, published by Cambridge University Press, London, 1961. Paperback, 182 pages, price 15s.

THIS book was first published in 1952, and the second edition was revised up to 1959. It is now available as an inexpensive paperback.

The book is valuable, not only as a statement of the technical details of the various cosmological theories, but also as a statement of the point of view of a physicist.

Professor Bondi regards Cosmology as a branch of physics in its own right, not as a mere adjuct to relativity or a branch of philosophy, and this attitude, which is not shared by all cosmologists by any means, pervades and colours the entire book. The result? One of the most stimulating accounts of one of the most stimulating fields of thought that there is.

Highly recommended to all budding physicists and mathematicians.—P.G.M.

YEARBOOK OF ASTRONOMY 1962 Editor: J. G. PORTER. Associate Editor: PATRICK MOORE. Eyre and Spottiswoode, London, 1961. 216 pages. Price 15s.

THIS very welcome book is unique in attempting to appeal to both the active observer and the "arm-chair astronomer", as outlined in the preface. This it certainly does in readability, but as the price compares unfavourably with other annual publications dispensing information on current phenomena (*BAA Handbook; Whitakers' Almanack; The Times' Night Sky etc.*), it is likely that observers will tend to use it only for occasional reference at their local library. Also the keen reader of astronomical discovery and progress may object to buying a book which has about one-third of its pages devoted to material which can only appeal to the observer. In this way, neither of our "extreme types" is likely to add this volume to their individual collections, which would be a great pity. I feel it would have been better had the work been produced in two com-

panion volumes, one being the "Yearbook", the other an account of "Progress in Astronomy". The material on the astronomical phenomena for the year could then be expanded (always a good thing), and the excellent series of articles by authoritative writers would have a permanent place on very many personal bookshelves. Subsequently the price would be less discouraging to the keen younger student of Astronomy.

The material content and presentation of the book is commendable. The star charts, though necessarily small in scale, are good and clear and the constellation outlines are pleasing. One rather conspicuous fault is the practice of including the *Pleiades* in the outline of *Perseus*, and the linking of this same constellation to *Andromeda*. Though these extensions of outline may be intended as a guide, they give a beginner a false impression of the true extent of the constellations, apart from the deviation from the accepted outlines.

This publication certainly deserves every success, and I sincerely hope I am wrong about its duality of purpose.

H.N.D.W.

SKY DIARY AND NOTES FOR OBSERVERS

January-March 1962

H. N. D. WRIGHT

Note: All times in GMT

Occultations of stars by the Moon at convenient hours (Magnitude 6.5 and brighter, all disappearances)

Date	Time	Star	Mag	Moon's Altitude degs	Position Angle* degs
Jan 14	21h 56.8m	+10 401	6.2	40 SW	132
17	17h 31.7m	120 Tau	5.5	35 E	32
Feb 10	21h 08.9m	Mu Cet	4.4	30 WSW	22
12	18h 37.4m	Theta Tau	4.0	55 S	130
12	18h 41.8m	75 Tau	5.3	55 S	32
12	19h 43.2m	264B Tau	4.8	55 SSW	100
12	21h 35.7m	275B Tau	6.5	43 SW	106
12	22h 50.8m	Aldebaran	1.1	30 W	82
14	17h 51.5m	71 Ori	5.2	45 SE	71
Mar 11	22h 51.4m	Gamma Tau	3.9	10 W	123

* Angle round the limb of the Moon measured from the North Point of the disk, through E, S and W.

Early morning observers may care to watch the re-appearance of *Regulus* at 05h 18.7m on January 23. Mag 1.3. Position angle 317°, Moon at 35° WSW.

A daylight occultation of the planet *Mercury* occurs on March 4. Disappearance is at the bright limb, but the re-appearance phase should be well seen by those with access to fairly large telescopes. Magnitude is 0.3, and re-appearance takes place at 14h 19.4m PA 266°, Moon at 10° SW. A clear horizon to the SW and a very clear sky will be essential factors on this occasion.

Note the fine series of occultations of stars in the *Hyades* cluster on February 12, terminating with the disappearance of *Aldebaran*.

Availability of the brighter planets for observation

MERCURY may be glimpsed low in the SW after sunset towards the end of January. Greatest Elongation E of 19° occurs on January 21, and the planet will remain visible for about 1h after sunset for a few days. This is the best opportunity during the first three months of 1962 to locate this innermost planet of the Solar System. This is best done with telescopic aid, of course, though a high magnification is needed to recognise the phase which proceeds from half-phase or dichotomy at elongation toward a crescent form, on this occasion. At the close of the month Mercury is moving swiftly towards Inferior Conjunction on February 5. It will not be seen at all during the remainder of February, and, although Greatest Elongation W occurs on March 3, Mercury is too far South of the Sun in Declination to put in much of an appearance in the morning sky.

VENUS will not be seen until March, Superior Conjunction occuring on January 27. The angular rate of motion of Venus is so much slower than that of Mercury at these times, that a considerable period must elapse before the planet becomes visible again. In fact, it will take until the last week of March before Venus becomes really noticeable as a bright object (mag −3.4) low in the Western sky soon after sunset.

MARS remains badly placed observationally throughout the period. Like Mercury, the Red Planet is South of the Sun in Declination, with the further disadvantage that the brightness is only around 2nd magnitude. Technically, Mars is a morning object, but is very much submerged in the bright dawn sky.

JUPITER will be observable for about 1½h after sunset during the first few days of January. The position then steadily deteriorates and Jupiter withdraws into the daylight sky, toward Conjunction with the Sun on February 8. It will become visible again at the end of March very low in the ESE shortly before sunrise.

SATURN also will not become visible again until the end of March. Lying over 20° to the West of Jupiter on the Ecliptic, it will consequently be found at this time low in the SE sky at dawn. The waning crescent Moon will be close on the morning of March 31.

URANUS is comfortably placed for observation in the late evening sky in January. Its retrograde, or Westward, motion carries it only ¼° North of the star *Regulus* on February 1. Opposition occurs on February 17, which means that around this date the planet will be in the Southern sky at midnight. Probably the most convenient time to observe the planet will be in March, when the same conditions will apply at around 22h.

The Quadrantid Meteors

Conditions are favourable for this meteor shower in 1962. Maximum activity of short duration occurs on January 3-4, when the Moon is only three days before New. The radiant lies about 15° NE of the star *Beta Bootis*, and the best time to observe is from 03 to 04h, when this region of sky is fairly high in the NE.

Constellations and Stellar Objects near the meridian at 22.00h

Mid-Jan Auriga, Gemini, Taurus, Canis Minor, Orion, Canis Major, Lepus, Eridanus.
Star-Clusters M36, M37 and M38 in Auriga, M41 Canis Major (rather low, 4° below Sirius), Pleiades, Hyades.
Great Nebula in Orion, M42 with the Trapezium (Theta Orionis).

Mid-Feb Gemini, Cancer, Head of Hydra, Monoceros, Canis Minor, Canis Major.
Star-Clusters M35 in Gemini, Praesepe in Cancer, M46 in Puppis (not so low as it sounds).
Double Star Alpha Gem (Castor).

Mid-Mar Cancer, Leo, Hydra, Crater, Sextans.
Double Star Gamma Leonis.

SOCIETY NOTICES

1962		GENERAL MEETING
JANUARY 6	6 p.m.	Kent Room, Caxton Hall, London, S.W.1.
		OPEN MEETING
APRIL 14	2 p.m.	Great Hall, Caxton Hall, London, S.W.1.
		GENERAL MEETING
JULY 21	6 p.m.	Tudor Room, Caxton Hall, London, S.W.1.
		ANNUAL GENERAL MEETING
OCTOBER 20	6 p.m.	Tudor Room, Caxton Hall, London, S.W.1.

THE ANNUAL GENERAL MEETING

THE ANNUAL GENERAL MEETING of the Junior Astronomical Society was held at the Caxton Hall, London, on October 20, 1961. In welcoming members and visitors, MR. F. BEST, the President, pointed out that only members of the Society could take an active part in the meeting. He then called on MR. E. W. TURNER, the Secretary, for his report. Mr. Turner outlined the work involved in answering many hundreds of posial enquiries during the year and emphasised the expense involved when members did not enclose a stamped addressed envelope for reply. The Treasurer, MR. C. A. TOMES then presented his audited accounts, followed by the Editor and the Assistant Secretary, MISS E. R. ATWELL who reported a steady influx of new members. All these reports were adopted.

Reports were then made by MR. K. S. G. STOCKER, Director of the Lunar Occulation Section, MR. K. BRACKENBOROUGH, Director of the Naked-Eye Variable Star Section,. The report of MR. R. E. ELLIS, Director of the Lunar Section was read in his absence.

The ballot for the two vacancies on the Council was then held, the result being:

P. S. Litton 57; P. A. Moore 55; R. Seymour 13; L. Green 5. Mr. Litton and Mr. Moore were declared elected.

MEMBERS are reminded that their Annual Subscriptions became due on *September 21st last*, and are requested to assist the Society by remitting them as soon as possible. The Annual Subscription is 10s. Cheques and Postal Orders should be crossed and made payable to The Junior Astronomical Society, and sent to the Assistant Secretary, 131 Addiscombe Court Road, Croydon, Surrey.

ENQUIRIES. Please don't forget to enclose a stamped addressed envelope when you write to Officers, Members of the Council, Members of the Enquiry Panel or Group Secretaries!

MANUSCRIPTS submitted for publication should be sent to the Assistant Editor, Paul G. Murdin, 92 Northborough Road, Norbury, London, S.W.16. If possible they should be typewritten, on one side of the paper only and with ample margins. Titles, headings and sub-headings should *not* be underlined. All material is subject to Editorial amendment and copright is vested in the Junior Astronomical Society for the protection of the authors.

ALL ADVERTISEMENTS are accepted in good faith, but neither the Editors of *Hermes* nor the Junior Astronomical Society can accept responsibility for the quality of the goods advertised.

JUNIOR ASTRONOMICAL SOCIETY

INCOME & EXPENDITURE ACCOUNT for the Period 23rd SEPTEMBER 1960 to 24th SEPTEMBER 1961

EXPENDITURE	£ s d	£ s d	*INCOME*	£ s d	£ s d
PRINTING JOURNAL		250 11 8	MEMBERSHIP FEES (New Members)		8 3 0
POSTAGES ON JOURNAL		23 6 0	SUBSCRIPTIONS		
OTHER POSTAGES		12 18 6	Paid prior to September 22 1960...	47 19 0	
HIRE OF HALLS		30 18 6	Paid during current session ...	245 6 0	
HIRE OF LANTERNS & SLIDES... ...		5 17 0	Arrears Received	3 13 0	296 18 0
TELEPHONE CALLS		2 12 7	DONATIONS		
STATIONERY		9 4 8	Sundries	1 4 6	
PRINTING & DUPLICATING		14 8 8	BAA Carnegie Trust	39 0 0	40 4 6
TRAVELLING EXPENSES		3 16 5	ADVERTISERS		
SUNDRIES		27 15 11	Cash Received	65 14 5	
EXCESS OF INCOME OVER EXPENDITURE		56 0 0	Owing at September 24 1961 ...	19 0 0	84 14 5
			DIVIDEND ON INVESTMENT		
			5% Defence Bonds		7 10 0
	£ 437 9 11				£ 437 9 11

BALANCE SHEET as at 24th SEPTEMBER 1961

LIABILITIES	£ s d	£ s d	*ASSETS*	£ s d
INCOME AND EXPENDITURE ACCOUNT:			CASH AT BANK	208 12 10
Balance at September 22 1960	309 0 6		CASH IN HAND	2 15 2
Add: Excess of Income over Expenditure for the Year	56 0 0	365 0 6	ADVERTISERS—Sundry Debtors	19 0 0
ANNUAL SUBSCRIPTIONS IN ADVANCE		15 7 6	£150 of 5% DEFENCE BONDS at Cost	150 0 0
		£ 380 8 0		£ 380 8 0

AUDITOR'S CERTIFICATE

I have examined the records of the Junior Astronomical Society for the period to 24th September, 1961, and certify that the Balance Sheet as at 24th September, 1961, is drawn up in accordance with the records and information and explanations supplied to me.

It is correct to the best of my knowledge and belief.

4th October, 1961.

MAURICE BOARD
Chartered Accountant
Honorary Auditor

THE JUNIOR ASTRONOMICAL SOCIETY

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