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THE ORDINARY GENERAL MEETING OF THE ASSOCIATION

Held on Wednesday, 1958 June 25,
at the Royal Institution, London, W 1

Dr A. Hunter, *President*
E. A. Beet and D. A. Campbell, *Secretaries*

Mr Campbell read the minutes of the Ordinary General Meeting of 1958 May 28, which were approved and signed.

The President.—Since we last met the Association has lost by death one of its best-known Members, Mr Jack Miller. Ever since he joined in 1935 he has played an unobtrusive but effective part in the Association's affairs. Many Members will recall his colour films of the recent total solar eslipse in Sweden (where he accompanied the Joint R.A.S.-B.A.A. party), and in Ceylon (where his help to the professional expedition was greatly valued). He has served on the Council for the past three years, and it is certain that his sound advice will be greatly missed by that body. But it is perhaps for his generosity in all kinds of astronomical projects that he will be most remembered: he has been a benefactor, on a scale unusual in these days of heavy taxation, to astronomy in general and to this Association in particular. I will ask you to stand in silence for a few moments in his memory.

I regret to announce also the death of Miss Alice Grace Cook of Stowmarket in Suffolk. Elected a member in 1911, she took an active part in observational astronomy and acted with Mrs F. Wilson as deputy to the Rev. Martin Davidson, then Director of the Meteor Section, during his service in the 1914-18 war. She held the post of Director from 1920 to 1923. In 1920 she was awarded the E. C. Pickering Fellowship for Women Astronomers. She was with four others the first of her sex to be elected to Fellowship of the R.A.S. in 1916. Her interest in astronomy persisted into later life and she became a founder member of the Ipswich and District Astronomical Society as recently as 1950. We mourn the passing of one of England's most distinguished women astronomers.

I have now a happier announcement to make. At its meeting this afternoon the Council accepted an invitation by the Carnegie United Kingdom Trust to administer a grant of £600 for the encouragement of amateur astronomy in several specific ways which are common to the aims both of the Trust and of the Association. These will be reported to the Association in due course, but I can say now that the Sections principally benefiting will be the Computing Section and the Radio and Electronics Section. Part of the grant is earmarked for tutorial purposes, both the payment of out-of-pocket expenses for lecturers and the purchase of projection equipment for loan. The Association is indebted to Dr D. C. Martin, Assistant Secretary of the Royal Society for putting our case with skill and energy to the Trustees, and to Mr C. A. Ronan for much valuable liaison work during the negotiations. We are greatly indebted to the Trust for this opportunity to encourage practical amateur astronomy in ways that would otherwise have been debarred to us for financial reasons.

MR BEET read the list of Officers and Ordinary Members of the Council nominated by the Council for the ballot for the session 1957-58.

THE PRESIDENT reminded members that, according to Bylaw 10, any member was at liberty to propose additional names for the ballot, which names, if duly seconded, would be added to the Council list. No additional names were proposed.

THE PRESIDENT appointed Mr W. M. Baxter and Miss I. K. Carter as Scrutineers of the Ballot.

MR BEET read the list of presents received: *How to Make a Telescope* by Jean Texereau (New York, 1957) and *Space Traveller's Guide to Mars* by I. M. Levitt (London, 1957), both from their publishers, and a Zöllner star spectroscope from Harold Thomson. The meeting expressed its thanks to the donors. MR BEET also announced that *The Sun* by G. Abetti, translated by J. B. Sidgwick (London, 1957), had been bought for the library.

THE PRESIDENT referred to the list, displayed at the meeting, of thirteen candidates for membership of the Association. He reported that the Council had that afternoon elected, subject to confirmation by the meeting, the thirty-seven candidates proposed at the previous meeting; these elections were confirmed.

THE PRESIDENT then formally admitted to the Association fourteen members who had not signed the roll before.

MR CAMPBELL read the list of papers received.

THE PRESIDENT appealed to speakers at meetings to help the editor of the *Journal* by letting him have their version of what they had said as soon as they possibly could.

THE PRESIDENT.—We have here today Mr Barrow from the University of Florida, who will tell us about the work they are doing there on radio astronomy.

MR C. H. BARROW.—Mr President, Ladies and Gentlemen: This is the first time that I have had the privilege of speaking at a meeting of this Association and I am afraid that I must begin with an apology; a number of the colour slides which I had intended to show you have, unfortunately, been mislaid in transit between New York and London. I hope, however, that I can still give you a short account of the radio astronomy investigations with which I have been associated.

I went to the University of Florida in 1955 and soon after this, working with Mr T. D. Carr, a radio astronomy research programme was initiated. Our chief interest was the radio noise from Jupiter. This noise had originally been discovered by Burke and Franklin in 1955 and had been confirmed by Shain who found that he had recorded the noise accidentally during an investigation of Galactic Noise in 1950 and 1951. Shain proposed an interesting method of interpretation of the data, on a statistical basis, and we proposed to apply his methods to original data.

At the outset of the programme our equipment was modest; we built an 18 Mc/s broadside array, consisting of eight dipoles above a plane reflecting screen (described in the *Journal*, **67**, 200, 1957), giving a reception beam having a width of about 30° in the East-West direction and about 80° in the North-South direction to half-power points. The beam was swept across the sky by the rotation of the Earth, in the East-West direction, and by phasing, the beam could be steered, to some extent, in a North-South direction.

Data were collected for some three months at the beginning of 1957 and the interpretation of this showed that the radio emission was produced by two, or possibly three, localized regions on Jupiter. We can express the time at which the noise bursts occur in terms of the longitude of the central meridian of the planet; this enables us to find the approximate position of the sources in System II longitude but tells us very little about the latitude of these sources. It is also probable that there is an ionospheric layer in Jupiter's atmosphere having an electron density of the order of $10^6/cm^3$ which is comparable to that of the F-layer of the Earth at mid-day. An attempt was made to correlate the radio data with visual observations made by the Jupiter Section of the B.A.A. and the American organization, the Association of Lunar and Planetary Observers. One radio source was found to be near to the position of the South Tropical Disturbance but the rotation periods were not in agreement. There did not appear to be any other possible correlation.

Other planets were observed and, while radio noise from Saturn was suspected on one or two occasions, observations of Venus yielded negative results. Kraus, at Ohio State University, has reported radio noise from Venus but this is still, so far, unconfirmed.

It must be said that at certain times of the year conditions in Florida are not ideal for this sort of work. The main trouble comes from thunderstorm activity during the summer months and, at times, this can cause almost continuous interference. We always kept watch at night in an effort to distinguish between signals from Jupiter and interference, but it soon became clear that summer work was almost impossible. Accordingly, we concentrated upon the winter months for our observations.

At 18 Mc/s we were often near to the critical frequency of the Earth's ionosphere. Burke and Franklin had shown that the radio noise was more prevalent in the lower frequencies and this had influenced us in our choice of 18 Mc/s as working frequency. Variations in the transparency of the terrestrial ionosphere were noticed on a number of occasions.

In the summer of 1957 we received a grant from the National Science Foundation and this enabled us to increase the size of the radio astronomy group to seven members and to extend our observations to 22 and 27 Mc/s as well as 18 Mc/s. At this point I would like to show you some colour slides of some of our aerial systems and receiving apparatus.

[Mr Barrow then showed several slides.]

Some of our most interesting results this year have been obtained with the new 22 Mc/s polarimeter, built by Mr R. Pepple, consisting of two crossed Yagi aerials. Several polarization observations have been made and all of these indicate right-handed circular polarization (in the radio astronomy sense). They further raise the possibility of a magnetic field on Jupiter. Carr has shown that the magnitude of such a field can be determined from the polarimeter observations, using the Appleton-Hartree magneto-ionic theory, providing that the latitude of the source on Jupiter is known. Unfortunately, as I explained previously, we have not yet been able to place any of the sources in latitude.

The signals from Jupiter are rather more powerful than those observed from many other sources in the sky. In 1957, at 18 Mc/s, the maximum radio-power flux-density received was greater than $8{\cdot}5 \times 10^{-20}$ watts/m^2/(c/s) (as compared to flux densities of the order of 10^{-25} and 10^{-26} watts/m^2/(c/s) received at Cambridge from other sources at higher frequencies). In 1958 the maximum intensity received from Jupiter was rather lower than in 1957 and so also was the general noise level due to the galaxy. It is unlikely that any appreciable change in the galactic noise can have occurred (we have, in fact, used the galactic noise as an approximate standard) and the lower intensity is most likely due to a change in the transparency of the Earth's ionosphere due to the recent sunspot maximum. The change in intensity of the Jupiter noise is probably due to a change in conditions on Jupiter in addition to terrestrial effects. At 22 Mc/s, in 1958, the flux-density was somewhat higher than at 18 Mc/s; nothing was recorded, with any certainty, at 27 Mc/s.

In conclusion, I would emphasize that the method of interpretation of these observations is essentially a statistical one applied, at present, to a limited amount of data. We can only hope that the conclusions reached so far will become more significant in the light of further subsequent observations.

Mr J. Heywood.—It was last year in this very room, when reading you the first policy directive of the Section, that I commented on the first of Mr Barrow's results. Then I believed the data to be insufficient, and I still believe this to be so. Nevertheless, I find the attempt to derive an ionosphere from the results most encouraging. At the same time, may I suggest that this is not the only possible mechanism which could arise from a consideration of plasma ? At the moment, Jupiter is difficult to observe in England, yet there is room for radio work to be done on the planet in England since we are away from the maximum thunderstorm belt upon which Florida is unfortunately situated. Although I have searched for a site, I have up to the present been unsuccessful; but I intend to persevere. Now, if I may ask Mr Barrow some questions: Firstly, on what frequency does he think we should observe Jupiter ? At the moment we have observed on three frequencies, all of which are fairly close to one another. Does he think there is a simple spectral-power law, say inverse square ? Since I haven't had time to work out the limits which the ionosphere will impose on observations, perhaps he would also indicate how low in frequency we might expect to go during the next two years. Secondly, may I ask if a simple drift interferometer at 30 Mc/s would be of any use ? Considerable resolution can be obtained with such a system, although it would require a fairly large garden.

Another asset would be the use of a third search Yagi aerial. One can suggest an initial outlay of about sixty pounds. Thirdly, am I correct in saying that the simple aerial system of dipoles and wire reflectors which I showed on your behalf at a meeting last year proved most satisfactory ?

MR BARROW.—We should, I think, work from 40 Mc/s down to the lowest frequency possible. Solar studies, in Australia, have been carried out at frequencies down to 40 Mc/s and if we were to work below this frequency we might be able to make a useful contribution to solar observations as well as making further planetary observations. In Australia a rhombic aerial, with mechanical tuning and a cathode-ray oscilloscope display, was used, individual bursts being photographed automatically. This method might be adapted for lower frequencies although the aerial would be very large. Perhaps, for an amateur worker, a set of broadside arrays would be more suitable. These will give good results and they are quite easy to build although they are still rather large. The 18 Mc/s array at the University of Florida was about 130 ft by 80 ft. An interferometer, of course, requires an even larger piece of ground. The beam-width of a Yagi aerial, when mounted as shown in the slides, is quite narrow in the east-west direction, probably less than 15°. It is wider in the north-south direction and is apt to pick up considerable local interference. An interferometer arrangement would help to distinguish this.

MR HEYWOOD.—A phase-switching interferometer is the answer to the problem of local noise. If any one wants to erect some wire dipoles in his back garden, may I ask him to write to me before he starts ? At these frequencies one is likely to run into a considerable amount of interference, and I could make suggestions on how to search the band and how to track the planet.

THE PRESIDENT.—Thunderstorms may prevent Mr Barrow from working in the summer, but his loss is our gain, for he can come over here to tell us about his work. I will ask you to thank him for doing so. [*Applause.*] We will now have Mr Noon's monthly notes.

MR E. H. NOON.—Mr President, Ladies and Gentlemen, according to our *Handbook*, conditions will be unusually favourable for the observation of Meteors during the coming autumn months. From August 11 to 15 we shall have the Perseids with a high radiant altitude of 60°. From October 8 to 11 the Giacobinids with a rather low radiant altitude of 18°. These will be immediately followed by the Orionids from October 15 to 20. Then the Taurids, November 1 to 15, and the Leonids, November 15 to 17.

Every effort should be made to observe the Giacobinids, especially on October 9 before dawn. Although this is rather a narrow stream, watch should be kept a few nights before and after October 9. There is a possibility that the Earth will pass through one of the meteor shoals that precede and follow the Comet Giacobini-Zinner. This happened in 1933 and again in 1946. A description of these fine showers can be found in the B.A.A. *Journals*, **44** (3), 1933 and **57** (2), 1946.

Over 200 meteors per minute were observed in the 1933 shower and over

100 per minute in 1946 shower. It is by no means certain that we shall see a similar shower this year; nevertheless, beginners should prepare themselves for the observation by reading the meteor section in the B.A.A. booklet, *Aims and Methods*. I mention this now because the event will have passed before the Association meets again.

I should now like to remind you of one other event which occurred just 200 years ago, the production of the first achromatic object-glass by John Dollond in 1758. In this present age of exciting activity is it so easy to forget the pioneers in Astronomy, so I hope you will agree that this is a very fitting time (and a very fitting place) to pay tribute to one who did so much to bring the small refractor within reach of the amateur. May I remind you of the story ?

In 1685 one Jean d'Holland fled to England from the Huguenot persecutors and settled in Spitalfields as a silk weaver. In 1706 his son John Dollond was born, and by 1730 we find John a successful silk weaver with an infant son Peter.

Peter grew up with an interest in optics, and with his father's encouragement opened a small optical workshop in Vine Street in 1750. Two years later John decided to follow in his son's footsteps, and he gave up silk weaving for a partnership in his son's business. John's inventive mind combined with Peter's practical skill rapidly brought success to the venture.

In 1758 John produced and patented the first achromatic object glass. This was demonstrated to the Royal Society, who afterwards awarded him the Copley Medal.

Up to this time the development of the refracting telescope had been delayed owing to the colour-fringed hazy images produced by the simple double convex object-glasses of that time.

Dollond's addition of a flint-glass concave lens to the crown-glass double convex lens, greatly minimized the chromatic dispersion, and this made it possible to produce an almost colour-free image from object-glasses of shorter focal length.

Unfortunately John did not live to see the full development of his achromatic telescope. It was left to his son Peter to complete the instrument; this was done a year or two after his father's death.

The commercial value of such an instrument was quickly seen by Dollond's competitors, and they at once found reason to contest Dollond's right to a patent. It was discovered that, twenty-five years previously, Chester Moor Hall had described a similar means of producing an achromatic lens.

After a Court appeal it was ruled that although Chester Moor Hall had previously suggested the method, the patent had rightly been granted to John Dollond for its production. The Judge remarked that ' it was not the person who locked his invention in his escritoire that ought to profit by a patent for such invention, but he who brought it forth for the benefit of the public '.

If we today agree with this ruling, we must also give credit to John Dollond for making the first heliometer, even though the idea of using a divided object-glass as a micrometer was thought of by Savery of Oxford in 1743.

Nevertheless, on this bicentenary of these achievements we must remember with gratitude not only John Dollond who first did these things, but his predecessors who first thought of them, and his son Peter who made them available for the most rapid advancement of observational astronomy.

THE PRESIDENT.—Thank you, Mr Noon. [*Applause.*] Mr Taylor has just three minutes, if he can tell us about the third Russian satellite in that time.

MR G. E. TAYLOR.—From orbital data up to June 10 it appears that the American artificial satellite Explorer III will not survive for much longer. Using this orbital information as a basis for prediction, I think its death is likely to occur on about June 29.

The latest Russian satellite, Sputnik III, is in orbit, accompanied by its carrier rocket and three pieces of nose cone, the latter being only visible with optical aid. This, in effect, means another five satellites for this planet. I am reminded of the comment on the vast number of minor planets made many years ago when they were described as ' vermin of the skies '. I am afraid that someone will produce some equally unkind epithet for our artificial satellites !

An interesting point regarding the periods of the two main objects, the sputnik and the rocket, is that they appear never to have had the same original period. This is possibly due to some considerable force being used to separate the two bodies. The original period of the sputnik was $106^{m}\cdot0$ but the observations of the rocket suggest that its original period was not more than $105^{m}\cdot75$. This difference was not apparent with the first Russian satellite and its carrier rocket. By June 27 the rocket will have overtaken the satellite four times. Tomorrow morning the satellite will pass over extreme SE England at 01·37 U.T. and the rocket will cross SE England at 01·59 U.T. both moving from SW to NE.

One of our members, Mr U. M. Bias, of Rivera, Uruguay, sent a useful series of observations of the rocket and enabled me to compute the predictions for the B.A.A. *Circular* just issued. An observation this morning indicates that these predictions will be slightly early and that in three weeks' time (mid-July) the correction might amount to about a quarter-of-an-hour. The rocket varies in magnitude from about -2 or -3 to about $+2$, when seen at a high altitude, in a period of about 6^{s}. The satellite is more difficult to locate—I have not yet seen it myself—due to twilight lasting all night and the fact that its maximum magnitude is likely to be about $+2$ or $+3$.

THE PRESIDENT.—Thank you, Mr Taylor. [*Applause.*] The meeting is now adjourned until 1958 October 29 at 5 o'clock, the occasion of our Annual General Meeting.