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NEWSLETTER

No. 109

June 1970

Work of the Solar Physics Group

The sun accounts for approximately 99.2% of the mass of the solar system. Its diameter at the visible boundary is about 1.4×10^6 km which subtends an angle of about 0.5° at the earth. About 99% of the electromagnetic energy radiated by the sun occurs within the range of wavelengths between 0.1 and 4 microns (10^{-5} to 4×10^{-4} cm), having a characteristic black-body temperature of approximately 6000°K . Of the remaining 1%, part is radiated at wavelengths greater than 0.1 cm and this is the region of interest to the solar physics group. At these wavelengths the solar emission can be considered to have three components (i) the quiet sun or thermal component (ii) the slowly varying component, also thermal in nature and originating in localised hot spots, and (iii) the burst or impulsive component which is non-thermal and due to acceleration of electrons by various solar processes. For increasing values of wavelength above about 1 cm, the location of the source of the quiet sun component is situated progressively further outwards from the visible surface and its characteristic black body temperature increases. The reason for this is that electromagnetic waves cannot propagate through the solar plasma unless the frequency is greater than the local plasma frequency. This depends upon the local electron density which decreases with increasing distance from the solar centre while the local kinetic temperature increases.

Not all of the solar radiation propagated in the direction of the earth reaches the surface of the earth, a fraction being absorbed in passage through the atmosphere. The scientific work of the group falls naturally into two parts, namely

studies of solar bursts and studies of tropospheric attenuation using the sun as a convenient radio source.

The centre of activity and the source of raw data for the solar physics group is, of course, the solar observatory which is located in the compound behind hut 5. Six radiometers monitor solar radiation at wavelengths of 10.7, 3.2, 2.5, 1.6, 0.81 and 0.42 cm (i.e. with frequencies of 2.8, 9.4, 12, 19, 37 and 71 GHz) having beamwidths of 3.5, 2.0, 2.0, 1.2, 1.0 and 0.5° at the 3 dB points. All of these radiometers are owned by R.S.R.S. except the 12 GHz instrument which is owned by the Post Office but operated by R.S.R.S. staff. The various frequencies are chosen to be well down within the so-called atmospheric windows between the pressure-broadened absorption bands. These occur as a result of interaction of the electromagnetic waves with the oxygen and water vapour molecules, which possess permanent magnetic and electric dipole moments respectively. Additional variable attenuation is caused by cloud, fog, and rain (especially rain) must be added to this background contribution from oxygen and water vapour. At 2.8 GHz, both the left hand and right hand circularly polarized components of the solar radiation are monitored by a receiver, also known as a polarimeter, on an alt-azimuth mounting which is controlled by an equatorially-driven, alt-azimuth coordinate converter situated inside the observatory. At the other frequencies a linearly-polarised component of the sun's radiation is monitored by radiometer receivers set on equatorial mountings. This means that to first order the sun can be tracked by driving the telescopes around the equatorial axis at a rate of one revolution per day (i.e. at 19 and 71 GHz) or by driving forward for 16 hours at solar rate and backward for 8 hours at twice solar rate (i.e. 9.4 and 37 GHz). The solar declination change, occurring as a result of the inclination of the axis of rotation of the earth not being perpendicular to the ecliptic and to the motion of the earth around the sun, necessitates small changes being made in the elevation of the telescope with respect to the equatorial axis. This pointing correction may be effected either by manual adjustment (i.e. at 2.8, 19 and 71 GHz) preferably several times per day, or, in the case of the newer mountings carrying the 9.4, 12 and 37 GHz radiometers, by a small motor programmed to give the required declination change appropriate to the time of year.

The radiometers are conventional Dicke-type receivers which are used in applications where the signal of interest is a noise-type signal with amplitude smaller than the noise generated in the receiver amplifiers etc. The main feature of this type of receiver is that a modulation is imposed on the incoming signal at the input of the receiving section. After suitable mixing, amplification and demodulation, the signal is separated from the noise by a signal recovery technique using a reference signal having the same frequency and phase as the modulation.

For the solar work, data on solar radio bursts is extracted from the chart records and tabulated according to an internationally-agreed format. This information

is then circulated in a bulletin issued monthly to about 180 observatories and interested parties throughout the world. Some of the more intense radio emissions are accompanied by other emissions as well, notably high-energy solar protons which can produce considerable ionospheric disturbance, particularly in the polar regions. They also constitute a radiation hazard to personnel in high flying aircraft such as Concorde and the manned space flight. In this context, R.S.R.S. sends information on bursts to the United States during the Apollo missions. With special reference to the Slough data, Dr. Croom has carried out an investigation to ascertain whether or not it is possible to predict the emission of solar protons before their arrival in the vicinity of the earth from an analysis of characteristic features of the radio bursts. He has found good correlation at 19 GHz. Another aspect of the work has involved the Chilbolton aerial for solar mapping and location of localised 'hot' spots at a wavelength of 3 cm.

Up to the present, tropospheric studies have concentrated on providing statistics on the atmospheric attenuation at 19 GHz. Such data are particularly required at frequencies above 10 GHz for use in the planning of earth-satellite links. Forthcoming meetings of the C.C.I.R. (International Radio Consultative Committee) and the WARC (World Administrative Radio Conference) will be considering the statistical data available and will make recommendations and frequency allocations accordingly. Two years' data have now been analysed at 19 GHz. Until December 1969, this analysis was carried out by hand calculation, a laborious and time-consuming process. Since January 1970, a computer programme has been developed to do most of the work. It is still necessary to perform manual digitisation from the chart records, but this too will be avoided when the 30-channel data logging system now on order comes into operation. An analysis similar to that at 19 GHz has recently been started at 37 GHz. It should be noted that during periods of attenuation, the sky emission signal increases due to radiation from the clouds and rain. The Post Office using their radiometer, which is fitted with a mechanical nodding device, monitors sky emission as well and this is used in the analysis. The instruments owned by R.S.R.S., on the other hand, continually track the sun so as not to lose solar burst information. This complicates the analysis of the tropospheric data and imposes a limit of about 10 dB on the measuring range. However, in the near future, the radiometers operating at 9.4, 19, 37 and 71 GHz will be converted to dual-feed beam-switching instruments, at a switching rate of about 1 kHz and will monitor solar emission with respect to sky emission with virtually no loss of solar data.

The future programme includes the following topics (a) attenuation statistics at 71 GHz (b) investigation of the wavelength-dependence of the attenuation under various meteorological conditions and (c) a diversity experiment at 37 GHz using a second mobile radiometer now on order.

P. G. Davies

A TALE OF NINE KITTIES

by

FUSSY GALORE

Nine lives has every cat they say
and nine cats have nine tails.
One tale have I of nine cats
and how they came our way.

My tale begins in the winter of 1966/67. I have always been strangely attracted to stray cats, and no sooner have I clapped eyes on one than it's having a banquet. But I rather overdid it this time, and almost had kittens myself many times before we finally got things under control.

I was doing a spot of painting at the time - around the window on the kitchen door - when a movement outside caught my eye. I was both surprised and relieved when it turned out to be a tortoiseshell cat and three gorgeous little kittens. Very quietly, I started to open the door, but in a flash they disappeared into the night, obviously terrified. So, I put this banquet outside! They soon returned to gobble it up and, as they were undoubtedly wild and very thin and hungry, I naturally determined to have them. My husband didn't realise at the time what I was letting him in for, and seemed almost as keen as I was on the idea of making friends with them. But it wasn't as easy as I thought, and we very soon discovered that if we wanted to look at them we would have to behave and keep perfectly still. They began to come regularly for an evening meal, and as time went by they got used to the strange monsters watching them. After a few weeks the mother stopped coming and we never saw her again, but her babies still came without fail.

It was a long time before I was allowed to get close to them, but even then I was not permitted to touch, and as they weren't getting any younger we began to worry about the population explosion. Having been told that ginger females are very rare, we were quite confident that the orange one was a male. We had also heard that tortoiseshell boys are impossible, so that one must be a girl. We could only hope and pray that the tabby one was another boy. Well, of course, we had to be lucky and stumble across one of those very rare ginger females, and tabby was in fact the only boy!

As the girls got fatter, I began to have nightmares about crowds of multi-coloured cats of various shapes and sizes. I figured that if these two had three each we'd have nine already! And, if two from each litter were females, in six months time we'd have twenty-seven. I was desperate! I now spent/

spent virtually all my spare time purring, miaowing, and slowly but surely going quite mad. It was obvious they were going to beat me to it and have their babies before I could get them to a vet. Then, of course, there would be the task of taming and neutering the new generation as well. If ever a mind boggled, mine did then.

The kittens were about two months old before they were brought for inspection and we were relieved to find that the two litters together only amounted to three little ones. However, the tortoiseshell lady escaped the net long enough to have another litter of three before we got her under control. And so there were nine! Fortunately, the younger generation weren't as wild as their mothers had been and, after a few months, they were fit for distribution. However, I don't have too many cat-crazy friends, and we were finally left with a total of six, including two of those very rare ginger females.

Tabby is still in possession of all his faculties and, after three years, I am not yet allowed to touch him - he's no fool! The others have now taken over the house completely, and for sleeping accommodation they prefer the guest room. Understandably, they are not too happy when we have guests, and form a noisy queue outside the door. They take a pretty dim view of it when they find their beds lined up on the landing, and end up almost anywhere else in protest. They are all very affectionate, not only with us but amongst themselves, which is most unusual. Even two males will often cram themselves into a bed only big enough for one, heads pressed together and arms flung round each others necks.

In November 1968, when Billy (another orange one) was one year old, we lost him on the way to see the vet, some seven miles from home, and through the long cold winter months much of our spare time was spent searching for him. We left no stone unturned until we found him, exactly four months later. His wild upbringing must have helped him to survive the bitter winter weather, and we were thankful then that he was such a good hunter, although in the past he had received many a smack for bringing field mice and voles home for tea. It was a wonderful reunion, and he climbed all over us in his excitement. His relatives were also very glad to see him again, especially his little orange mother, who cleaned him all over from top to toe.

This saga is now much too long
for doggy folks to bear.

So now I'll put an end to it -
this pussy cat affair.

A Short Table Top Rally

The object of this "exercise" is to plot the route given below, as if you are navigating in a rally. As normal with motor club rallies, simple questions will be asked about the route. In the case of a "table-top" the answers may be read from the map. No white roads are used.

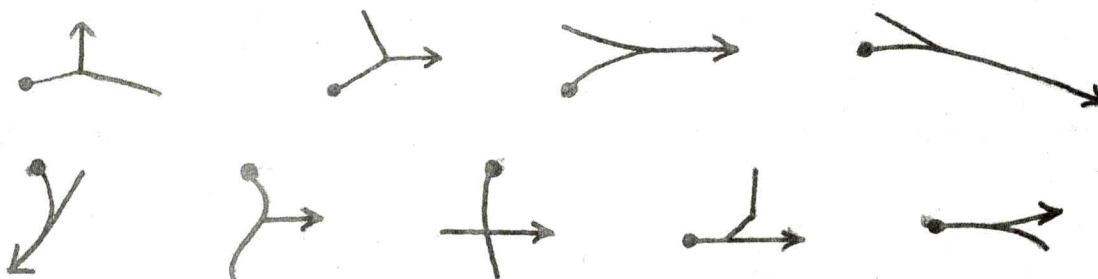
Map O.S.1" Map.159 (The Chilterns)

Start 709 819

Proceed to SH 337 and approximately N to 1st Junction, and TR. Then at successive junctions TR, FL, TL, TR

Question 1: What is the next SH No.?

Follow the tulip:-



Question 2: What plant name is just North of the road?

Follow SH's 329, 326, 156, 102, 170.

Question 3: What road have you just joined?

Proceed NE until you arrive at the junction with the A308, and follow this road until it crosses the A4. Follow the A4 eastwards until it crosses the B3026. Turn right

Question 4: What manor name?

Follow the herring-bone:-



Question 5: Has the church indicated got a tower, a spire, or neither?

Finish at 995½ 776: The next R.S.R.S. rally starts from here on Sunday July 26th at 1100 a.m. In addition to the equipment you used for this "table-top", a car and driver are essential. A pair of compasses, a protractor and a ruler may prove useful.

R. Marsh

Staff News

Congratulations to:

Jim and Margaret King on the birth of their son, Andrew James on 5th June.

Prab. Gondhalekar on his being awarded a Ph.D. from London University for research into the infra-red spectrum of Hafnium.

Mr. P. A. Bradley	now P.S.O.
Mr. A. J. Gibson	" S.O.
Mr. M. J. James	" E.O.
Miss V. M. Lovell	" E.O.
Mr. K. Slater	" E.O.
Mrs E. Hurst	" S.S.A.
Mrs E. Morgan	" S.S.A.

Welcome to:

E. M. Thornber	Sandwich Course Student
J. E. Allnutt	Senior Scientific Officer
J. D. Burge	Experimental Officer
D. L. Petrie	Tech. Officer Grade III
P. A. Hicks	Principal Photographer

Resignations:

D. P. Wormald	Asst. Experimental Officer
Miss W. Leonard	Clerical Officer
J. R. Smeathers	Scientific Officer
K. A. Acheson	Scientific Assistant
A. G. Wilson (retired)	Senior Scientific Assistant
G. K. Tan	Technical Officer (Singapore)

Other Changes

C. Strevens	A.E.O. transferred from Div. 2 to Div. 4
D. A. Cowcher	E.O. (Returned from Falkland Islands)

R.S.R.S. NEWS

THIS MONTH'S ODD ITEM

An extract from the June 'Physics Bulletin' reads:-

'RRE have produced a very small local radar outfit called SPRAT, which can actually differentiate between a man and a woman as the reflecting object because of the higher harmonics produced by the woman when she walks.'

Hence:-

If Group Leaders say your work is 'old hat',
Consider the scope now suggested by SPRAT.
Instead of assistants in projects platonic,
Why not use them in studies of higher harmonics?
With suitable bribery or terms of endearment
You've access to sources uniquely coherent.
So bring out those minis and transparent skirts,
To extend the researches first started by Hertz.

Station News

Mr. Meadows attended the 19th AGARD Avionics Panel Technical Symposium on Advanced Radar Systems, which was held in Istanbul during the week beginning May 25th. Mr. C. Boulton presented a paper to the 20th Symposium on Data Handling Systems.

Mr. R. Dalziel, Dr. J. King, Dr. J. Hall, Dr. E. Bramley and Dr. G. Thomas attended a meeting of the Inter-Union Commission on Solar Terrestrial Physics in Leningrad, from May 10th-20th.

"Give a Lift/Get a Lift"

Although one may not feel able to join one of the car pools that exist to and from R.S.R.S. it may be that many of us would be able to offer a lift to other R.S.R.S. staff from time to time, even if it would involve a small deviation from our normal route. On the other hand one may occasionally be unable to use one's car and, since public transport to R.S.R.S. is notoriously difficult, a lift at such times would be most welcome.

In order to help drivers to know of others from R.S.R.S. on or near their normal route a card box has been placed in the library, and it would be helpful if anyone interested in participating in a "give a lift/get a lift" scheme could put in a card with their address and telephone number, usual route and usual number of seats available.

M. P. M. Hall

Sports and Social Club News

The return cricket, tennis and bowls matches will take place at A.C.O. on July 23rd.

Which

Which subscriptions will be due again after the July issue. Our bulk subscription gives us a good discount (usually 21/- instead of 30/-). Money Which and Motoring Which are issued quarterly. One or both may be taken in addition to Which (each 21/- extra).

At renewal time I will order any other Consumer Association publications requested and paid for by members. I have a list of these and the Good Food Guide is included.

Please may I have renewal subscriptions and orders for publication by Thursday 16th July.

Veronica Lovell

Cricket

5 May v. Clewer Manor (away) R.S.R.S. lost by 7 wickets.

R.S.R.S. 56 all out (Dunford 21)

Clewer Manor 57 - 3

14 May v Windsor Great Park (away) R.S.R.S. won by 16 runs

R.S.R.S. 55-8 (Martin 28)

Windsor Great Park 39-9 (Eccles 4-10)

2 June Smith-Rose Cup SOUTH won by 5 wickets

NORTH 88 all out (Bannister 20; Dickinson 25; G. Thomas 26; Davies 4-27)

Moosajee 4-17)

SOUTH 89-5 (Bellchambers 37; Moosagee 30 n.o.)

18 June v ACO (home) R.S.R.S. lost by 4 wickets

R.S.R.S. 85 all out (Davies 41; Corbett-Singleton 18; Eccles 14)

A.C.O. 86-6 (Moosajee 4 wickets).

The first match of the season found us rather short of practice against a strong side, and despite a good knock by Eric Dunford we were beaten fairly decisively. Our batting was also shaky in the match against Windsor G.P., half the runs coming from Barry Martin. However, some good bowling, particularly by David Eccles, resulted in our first win.

The annual NORTH-SOUTH match in the Smith-Rose Cup competition was an exciting affair, with the result in doubt until the last over. It provided some enjoyable cricket both for the 'regulars' and for the 'once-a-year' participants. The home fixture with ACO also provided an exciting finish, with ACO scoring the winning run off the third ball of the last over. The R.S.R.S. innings recovered from 13 for 5 to 85 all out, due mainly to an excellent 'swing' by Peter Davies. With a little more luck our bowlers, particularly Aly Moosajee, might have won the match for us.

Graham Thomas

The missing words in 'A Tale of Motoring Madness', a drama which appeared in last month's issue, are as follows:-

Dennis, Rover, Avon, Mobil, Henley, Thames, Morris, Dodge, Burmah, Saab, Jet, Lotus, Singer, Miaihasu, Triumph, Hunter, Jaguar, Gipsy, Auto Union, National, Shell, Viscount, Javelin, Ensign, Automatic, Rebel, Morgan, Escort, Transit, Bedford, Rekord, Savage, Rapier, Plymouth, Knight, Midget, Mini, E Type, Rolls, Herald, Princess, Sovereign, Summit, Bond, Total, Victor.

Table Top Rally Answers

1. 272
2. "IVY" Gate
3. A404
4. Huntercombe Manor
5. The church (or chapel) does not have a tower or a spire.

If you finished this "rally" successfully, why not come on our next rally, starting from R.S.R.S. car park at 1100 a.m. on Sunday July 26th. If you failed to complete the course, you can learn from your mistakes. You may have better luck on the actual rally.

Professor Sydney Chapman

The death occurred recently of Professor Sydney Chapman, F.R.S. at the age of 82.

A world figure, indeed a legend, in geophysics, his contributions to geomagnetism and to the kinetic theory of gases were of major importance. In the field of ionospheric physics he is commemorated in the 'Chapman layer' electron density profile, and in a professional career which extended over more than sixty years he contributed greatly to international science in such roles as President of the I.G.Y. Commission, President of the International Union for Geodesy and Geophysics and many similar appointments. He was a member of the Radio Research Board from 1934-1938 and from 1939-1946.

A man of international outlook and travel, he will doubtless be remembered for his devotion to bicycling. Whenever he could cycle he did, indeed he used this means of movement to travel from Montreal to Washington for the 1939 I.G.U. meeting!

Some three generations of workers have derived direct benefit from Sydney Chapman; future generations will surely remark with gratitude on the foundations which he built.

Letter to the Outstations

Dear Colleagues,

The record of the death of Professor Sydney Chapman, which you will have seen on another page, marks the end of a scientific career which had its beginnings when Kelvin was still living and men in their sixties could have adult memories of Faraday. Inevitably there were various legends associated with Chapman and his bicycle; one, which at any rate ought to be true, relates how one hot summer's day he unexpectedly appeared at Ditton Park. After duly propping his cycle against the wall of the Old Building he entered and enquired as to which room the Radio Research Board was meeting in. It wasn't, and the news was gently broken to him that the venue was in London. Without more ado he mounted and departed in that direction though whether even such an accomplished cyclist as he was arrived in time to attend the meeting is not recorded.

Despite having rid ourselves of a general election and all the political detritus associated therewith, I feel it worthwhile to reproduce this list, provided by a friend, of the expenses involved in the sturdier days of eatanswill:-

ELECTION EXPENSES

Wootton Bassett in 1774

(For food and drink at the inns)		£.	s.	d.
Star	. . . . .	52	4	7
King of Prussia	. . . . .	90	10	0
Shoulder of Mutton	. . . . .	56	10	0
Horse and Jockey	. . . . .	107	4	0
Wm. Henley's	. . . . .	35	0	0
Waggon and Horses	. . . . .	78	11	0
Oak	. . . . .	336	0	0
Three Tuns	. . . . .	54	0	0
Three Goats' Herds	. . . . .	47	0	0
Cross Keys	. . . . .	90	0	0
Hay and Corn	. . . . .	3	16	0
King's Head	. . . . .	76	17	1
For Cockades	. . . . .	77	13	0
First Canvass	. . . . .	152	0	0
Money paid for various expenses	. . . . .	11	11	0
Total of votes, then computed at 135, 30 guineas each		4252	10	0
Money to men deserted or dead	. . . . .	441	1	1
		<hr/>		
		£5962	7	9
Item	. . . . .	11	0	0
		<hr/>		
		£5973	7	9

The preponderance of money spent at the Oak tavern suggests that it must have had some attraction other than just the beer. How eminently satisfactory to have one's floating vote safely anchored in the bosom of mine host's daughter; such argument would convince even such an apolitical as,

Yours sincerely,
The Editor

June 1970

REPRINT LIST

D. M. Willis

The Electrostatic Field at the Magnetopause
Planetary and Space Sci. 1970, 18, 749-769.

L. Thomas

Interference Effects at V.L.F. caused by Heavy
ions in the Lower Ionosphere
J.A.T.P. 1969, 32, 767-774.

Internal Memoranda - nil