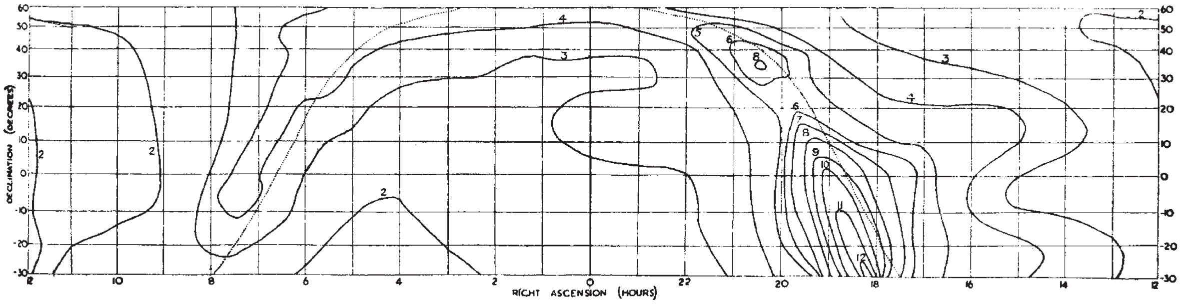

DISTRIBUTION OF INTENSITY OF COSMIC NOISE POWER FLUX AT 64 MC./S.

Unit of power flux on contours = $1{\cdot}1 \times 10^{-21}$ $\Delta\nu\Delta\omega$ watts per sq. m. ($\Delta\nu$ is band width, c./s.; $\Delta\omega$ is element of solid angle, steradians); cylindrical projection; galactic equator, ...

been made by us in a recent investigation at 64 Mc./s. ($\lambda \gtrsim 5$ m.). A radio receiving equipment with a Yagi aerial system provided a beam width to half-power of approximately ± 6° in elevation and ± 15° in bearing. The shape of the polar diagram was established by measurement using a small oscillator on a balloon. The maximum of the beam was at a fixed elevation of 12°, but the equipment could be rotated to any bearing. Calibrated measurements of the received noise signal were made during the period July 22–31, 1945, after a series of preliminary observations during the previous seven weeks had established periodicity in sidereal time and the absence of any marked solar influences.

The cosmic noise was recorded through 360° of bearing at each half-hour during the period of observation. To enable a detailed distribution of the source to be derived, the results were then analysed by the following method, not previously used in cosmic noise investigations. The observed distribution at the receiver for a given sidereal time was first plotted along a circle traced on the celestial sphere by the radio axis during a 360° rotation of bearing. Knowing the characteristics of the aerial beam, it was then possible to deduce a distribution along this circle which would, when integrated over the whole aerial beam, satisfactorily fit the observed intensities at the receiver. This was repeated for different sidereal times, and the intersecting circles then formed a lattice, from which contours could be drawn for the derived distribution of the source of cosmic noise between declinations − 30° and + 60°, as shown in the accompanying figure. The contours are seen to be roughly symmetrical with reference to the galactic equator. The main source of cosmic noise at approximately R.A. 1815 hr., Dec. − 30°, in the region Scorpio–Sagittarius, corresponds closely to the direction of the galactic centre, while a second marked peak (near one noted by Reber) occurs at R.A. 2030 hr., Dec. + 35° in Cygnus. The intensity in the region of the peak in Scorpio–Sagittarius was deduced to be $13{\cdot}2 \times 10^{-21}$ $\Delta\nu\Delta\omega$ watts/sq. metre, where $\Delta\nu$ is the band-width in cycles per sec. and $\Delta\omega$ the element of solid angle subtended in steradians.

J. S. HEY.
J. W. PHILLIPS.
S. J. PARSONS.

Ministry of Supply,
London, S.W.15.
Jan. 28.

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Solar Eruption of February–March, 1942

MR. J. S. HEY'S recent report[1] on excessive solar radiation in the 4–6 metre band observed on February 27–28, 1942, and Prof. F. J. M. Stratton's enumeration of associated observations[2] invite a reminder of two other exceptional features of the solar activity on the same occasion.

According to Prof. A. Duperier[3] the magnetic storm of March 1, 1942, provided a most remarkable example of world-wide changes in cosmic ray intensities. The decrease began shortly before the onset of the magnetic storm and reached the unusually high value of about 11 per cent.

Observing the coronal emission lines above the big limb eruption on February 21, Waldmeier[4] noted that the 5694 A. line, usually very faint, had an intensity about three times that of the green line, 5303 A., the latter being itself considerably enhanced. The outburst of the yellow line thus acted as the signal of solar activity with prominent terrestrial consequences. Unfortunately, the origin of 5694 A. is still uncertain. The tentative identification with Ca XV requires that a second line with similar characteristics should appear in the visible region[5].

BENGT EDLÉN.

Physics Institute, University of Lund,
Lund.
Feb. 7.

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Preparation of Synthetic Quartz

THE extensive use of quartz in piezoelectric oscillators has stimulated the production of synthetic quartz crystals. Spezia[1] in 1906 grew quartz at a temperature somewhat below 300° C. from an aqueous solution containing sodium metasilicate and sodium chloride. His method was to dissolve quartz in the hotter part of the container and deposit it in the cooler part. We have repeated Spezia's experiments so far as to confirm his results, but the period of months which is required for appreciable growth to occur makes the method unsuitable for industrial production.

We have found that fused silica is mainly converted into quartz when heated in a solution of sodium metasilicate at a suitable temperature. Some of the crystals obtained in this way are perfect but very small. The primary rhombohedron $\{10\bar{1}1\}$ tends to be better developed than the rhombohedron $\{10\bar{1}\bar{1}\}$. The prism faces $\{10\bar{1}0\}$ are also well developed. The form of the fused silica rod was usually preserved, many cavities filled with quartz crystals being found inside. When a natural quartz crystal was suspended by silver wire in the neighbourhood of the fused silica and a suitable mineralizer added to the solution, we found the silica rod dissolved almost completely and an appreciable growth of the seed crystal was obtained in a period of hours. As a rule the natural rhombohedral faces developed more smoothly than the prism faces, which were often rather drusy. Generally the positive rhombohedron faces were smooth and glassy clear, but closer inspection often revealed them to be like shingled roofs, and the individual shingles appeared to consist of layers which had grown out from centres of growth distributed at more or less regular intervals over the surface. The lattice spacings of the synthetic quartz are not distinguishable from those of the natural crystals on an X-ray powder photograph taken in a camera of 19 cm. diameter.

This work, of which a fuller account will be published later, has been done in co-operation with the Research Laboratories of the General Electric Company, Ltd., Wembley, and we are grateful to the director for permission to publish.

NORA WOOSTER.
W. A. WOOSTER.

Brooklyn Crystallographic Laboratory,
Cherry Hinton Road, Cambridge.
Dec. 19.

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Dielectric Constants of Some Titanates

IN a recent issue of *Nature*[1], B. Wul and I. M. Golgman refer to investigations in the U.S.S.R. on the dielectric properties of some titanates. Secrecy restrictions have previously prevented the publication of other work on the same subject.

Especially during the last four years have extensive studies been made in our research laboratories, working in collaboration not only to explore the best methods for preparing and fabricating materials of this type on a factory as distinct from a laboratory scale, but also to investigate their electrical and physical properties and to develop therefrom practical forms of electrical condensers utilizing those special properties. We discovered during 1942 that the introduction of alkaline earth or certain other metallic titanates in lieu of titanium dioxide into ceramic dielectric bodies (obtained by firing the ceramic mix at around 1,350° C.) raised the permittivity to much higher values than had previously been known.

In all such bodies we found that the permittivity is subject to very large changes with temperature, and that it reaches a maximum value at some temperature which is characteristic of the material itself. A permittivity peak of approximately 8,000 has been observed for barium titanate at 125° C., and it is believed that calcium titanate and strontium titanate reach similar peaks at temperatures below − 200° C. It has also been proved that the value of the peak permittivity is a function *inter alia* of the firing conditions under which the ceramic body has been produced. Some specimens have been prepared with peak permittivities greater than 10,000, one having reached 44,000. These extreme figures, however, are not representative of practical forms of good ceramic dielectric material, since they are accompanied (at least at present) by other less favourable electrical properties, such as lower resistivity and high power-factor. The specimen just mentioned, having a peak permittivity of 44,000, exhibited a resistivity of 10^6 ohm cm. and a power-factor (tan δ) of $14{\cdot}6$ per cent at 1 kc./s. and 20° C., which may be compared with values of 1 to $1{\cdot}5 \times 10^{12}$ ohm cm., and less than 2 per cent as representative at the same temperature of specimens showing more normal peak permittivities of 7,000–8,000. The figures quoted are found to