in the slope at the Curie point were not sufficiently distinct to deduce a discontinuity in the temperature-dependence of the specific heat. As it was obvious that a far more precise technique was required, the specific heat was then determined from point to point by means of a twin calorimeter similar in principle to that used by Rusterholz[6]. The relation thus determined is shown in the accompanying figure. At the Curie point, which occurs at 125° C., there is a change in the specific heat amounting to about 0·0025 cal. per gm. per degree.

The permittivity was determined using a sample prepared by pressing the material into a disk and firing at 1,350° C. A substitution method was used at 1·5 Mc./s., and the results (see figure) show a maximum permittivity at 125° C., corresponding to the middle of the co-existence range for cubic and tetragonal structures. Within this range, the observed permittivity at any temperature is a value between that of the cubic and that of the tetragonal lattice, depending on the ratio between the two phases present. At temperatures above the co-existence range the permittivity (corrected for porosity) follows the Clausius–Mosotti formula fairly accurately with a value of $15 \cdot 3(4) \times 10^{-24}$ c.c. for the polarizability per unit cell, with no dipole contribution, as has been pointed out by van Santen and Jonker[7]. This would theoretically give rise to an infinite permittivity at 118° C., but owing to the change to the tetragonal structure a finite peak is observed. If, however, a bridge circuit fitted with an electronic indicator of balance (for example, a 'magic eye' tuning indicator) is set to a capacity higher than that corresponding to the normal permittivity peak, instantaneous values of permittivity considerably higher than the peak value may be observed when the sample is rapidly heated or cooled through the co-existence range. This we attribute to a finite time of transition between the two phases, resulting in instantaneous permittivities corresponding to those of the separate phases at temperatures at which they would not normally exist or would already be admixed with the other phase.

It is intended to publish fuller details of this work elsewhere. We wish to thank Mr. J. A. M. van Moll and the directors of Philips Lamps, Ltd., for permission to publish this note.

M. G. HARWOOD
P. POPPER
D. F. RUSHMAN

Material Research Laboratory,
Philips Lamps, Ltd.,
New Road, Mitcham Junction,
Surrey. April 14.

[1] Rushman and Strivens, *Trans. Farad. Soc.*, A, **42**, 231 (1946).
[2] Coursey and Brand, *Nature*, **157**, 297 (1946).
[3] Wul, *J. Phys.* (*U.S.S.R.*), **10**, 64 (1946).
[4] Jackson and Reddish, *Nature*, **156**, 717 (1945).
[5] Megaw, *Proc. Phys. Soc.*, **58**, 133 (1946).
[6] Rusterholz, *Helv. Phys. Acta*, **7**, 643 (1935).
[7] van Santen and Jonker, *Nature*, **159**, 333 (1947).

Solar Limb Flare and Associated Radio Fade-out, April 15, 1947

IN the report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich (June 7, 1947), reference is made to the occurrence of a severe magnetic disturbance on April 17–18, and of a major radio fade-out at 14.57 hr. U.T. on April 15, almost 46 hours prior to the commencement of the magnetic storm. No related solar flare had been identified.

Spectrohelioscope observations were made at the Solar Physics Observatory, Cambridge, on April 15 during 15.00–15.15 hr. U.T., until interrupted by cloud. There was nothing of note upon the solar disk; but on the south-west limb two comparatively quiescent prominences were visible with a very bright detached area above. The bright area could be seen in $H\alpha$ (6563 A.) and D_3 (5876 A.); the height above the limb was 2′, and the approximate latitude radially below 50° S. The intensity as a proportion of that of the continuous spectrum of the disk near $H\alpha$ is estimated at 50 per cent (15.00 hr.), 30 per cent (15.05 hr.) and 15 per cent (15.15 hr.). Observations on April 16 showed pronounced prominence activity in the same region, but of more usual brilliance.

It is considered that the radio fade-out is to be associated with this flare, which probably originated in the active areas in or around the great sunspot group of March 31–April 13[1]. This had passed over the limb almost two days previously to the outburst. The abnormal flare position may be responsible for the marked delay in the onset of the magnetic storm. It is noteworthy that no associated geomagnetic 'crochet' or increase in solar radio noise occurred. The previous intense limb flare of February 21, 1942[2], which was also accompanied by a radio fade-out, had a well-pronounced 'crochet'; radio noise observations were, of course, not available.

E. T. PIERCE

Solar Physics Observatory,
Cambridge University.
June 16.

[1] *Nature*, **159**, 549 (1947).
[2] Stratton, F. J. M., *Nature*, **157**, 48 (1946).

Cross-Sections for Production of Artificial Mesons

ANTICIPATING that mesons may be produced shortly in laboratory experiments by nucleons or photons of a few hundred million volts, we have applied the theory of radiation damping to compute the cross-sections for the production of mesons in two collision processes.

(1) *Nucleon + nucleon → meson + nucleon + nucleon*. For this process, we have used the symmetrical meson theory, in the Møller–Rosenfeld form, with the coupling constant $f_0^2/\hbar c = 0 \cdot 065$. $g_0^2/\hbar c$ has been neglected, and the mass μ of the meson is taken equal to one tenth of the mass of a nucleon. The following results have been obtained.

(*a*) Meson production starts when the kinetic energy E of the incident nucleon is greater than $2\mu c^2$.

(*b*) The total cross-section φ for the production of a meson is given in the following table. (Transverse and pseudo-scalar mesons are produced in the ratio 2 : 1; the values given in the table refer to the sum of transverse and pseudo-scalar mesons.)

TABLE 1. MESON PRODUCTION BY NUCLEON-NUCLEON COLLISIONS.

E (kinetic energy of the incident nucleon)	1·9	2·8	3·8	4·7	$\times 10^8$ eV.
φ for $P+P \to Y+$ (or $N+N \to Y-$)	0	0·80	5·7	16	$\times 10^{-27}$ cm.^{2}
φ for $P+P \to Y^0$ (or $N+N \to Y^0$	0	0·25	1·9	5·2	$\times 10^{-27}$ cm.^{2}
φ for $P+N \to Y+$ and $Y-$ (or $N+P \to Y-$ and $Y+$)	0	0·27	2·1	5·4	$\times 10^{-27}$ cm.^{2}
φ for $P+N \to Y^0$ (or $N+P \to Y^0$)	0	0·29	2·0	5·9	$\times 10^{-27}$ cm.^{2}