The first alternative can be discounted since supersonic waves do not in general effect a breakdown of molecules the molecular weight of which is less than about 10,000; molecular weights of this order have never been reported for coals. The second is improbable in view of information so far available about the micellar structure, behaviour and stability. There remains the third alternative, namely, the dispersion of micelles. This is supported by the observation[3] that coal extracts possess distinct colloidal properties, and if coupled with the fact that the extract formed in a supersonic field is itself only very slightly soluble in pyridine, suggests that coals simulate thixotropic substances; in other words, their pre-existing micellar structure can be disturbed by a sufficiently high energy input, but largely reconstituted when the cause of the disturbance is removed.

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[2] Bangham, D. H., Introductory Lecture, Conf. Ultrafine Structure of Coals and Cokes (BCURA, 1944).
[3] Dryden, I. G. C., *Nature*, **162**, 959 (1948). Berkowitz, N. (unpublished work).

λ-Mesons in Air Showers

In *Nature* of January 29, 1949 (p. 181), Prof. L. Jánossy and C. B. A. McCusker presented evidence for the existence of light mesons called 'λ-mesons' in the air showers of cosmic rays, and deduced several properties of these new particles. We think that the evidence has been misinterpreted and can be accounted for more simply without invoking new particles; and that mesons do not exist in the air showers—nor, probably, do they exist anywhere else.

The essential evidence presented by Jánossy and McCusker was that the number of 'penetrating' particles recorded under a lead shield was reduced by (24 ± 6) per cent when an *extra* lead shield, 1·7 cm. thick, was placed 50 cm. above the original absorber. Jánossy and McCusker do not state the thickness of their original absorber; but we conclude from their sketch of the apparatus and from their statement that the experiment was a repetition of a similar one by Miss Chaudhuri, that the thickness was 15 cm. or less.

We have found[1] that a comparable reduction in the number of particles penetrating the shield occurs independently of whether the extra absorber is placed far above the original shield or immediately on top of it, and that the particles that are absorbed are the photons and electrons of the air showers, rather than any kind of meson. W. W. Brown and A. S. McKay, who have studied air showers with a cloud chamber shielded by 15 cm. of lead, confirm that many of the particles that penetrate the shield are photons and electrons (results of investigation not yet published).

In considering the effectiveness of a lead shield in removing electrons and photons, it is frequently overlooked that the energy spectrum of the soft component in extensive showers is very different from that of the soft component observed independently of showers, and that the spectrum of the particles in the showers is about the same for the showers observed at sea-level as for the showers observed on high mountains. Also it is overlooked that each electron or photon of high energy that strikes the lead generates many low-energy photons of long range that may release electrons in counter walls under large thicknesses of lead[2]. Hence at least 20 cm. of lead is required to reduce the soft component of the showers to a level of intensity that is small compared with that of the penetrating particles.

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Deviation at Vertical Incidence in the Ionosphere

With regard to G. Millington's communication[1], we should like to point out that, so early as 1946, we directed attention to this phenomenon and set up the differential equation of the ordinary and extraordinary rays. We calculated the deviation for a vertical sounding made in Paris on 5 Mc./s. and found it equal to a few kilometres. We also suggested the use of this deviation for explaining the relative variation of amplitude of split echoes[2,3].

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[1] Millington, G., *Nature*, **163**, 213 (1949).
[2] Cotte, M., *C.R. Acad. Sci.*, **222**, 605 (1946).
[3] Cotte, M., Note preliminaire No. 96, Laboratoire National de Radioélectricité, Nov. 4, 1946.

I am grateful to Prof. M. Cotte for directing my attention to the fact that he has already published the explicit forms of the deviation due to the earth's magnetic field and discussed the order of the separation of the reflexion points and its effect on the relative fading of the ordinary and extraordinary waves. The forms of the deviation quoted by me were derived some years ago (though not yet published) from Booker's analysis. They are implicit in Booker's paper and were doubtless known to him when he originally discussed the phenomenon.

The main purpose of my note was to stress its implications in the interpretation of Pf records relative to the value of the gyro-frequency and the making of observations during an eclipse. In this connexion it is interesting to record that I have received a letter from Dr. L. V. Berkner in which he mentions the use that they have made of the effect to derive the horizontal gradient and changes therein in the ionosphere at the onset of a magnetic storm[1], and says: "We are very pleased to see your emphasis of this point as it relates to the interpretation of radio echo observations during solar eclipse. I had overlooked this point and feel quite certain that it will not only modify the interpretation of the observations somewhat, but will add to the power of the radio methods in drawing more general conclusions."

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[1] Berkner, L. V., and Seaton, S. L., *Terr. Mag.*, **45**, 393 (1940).