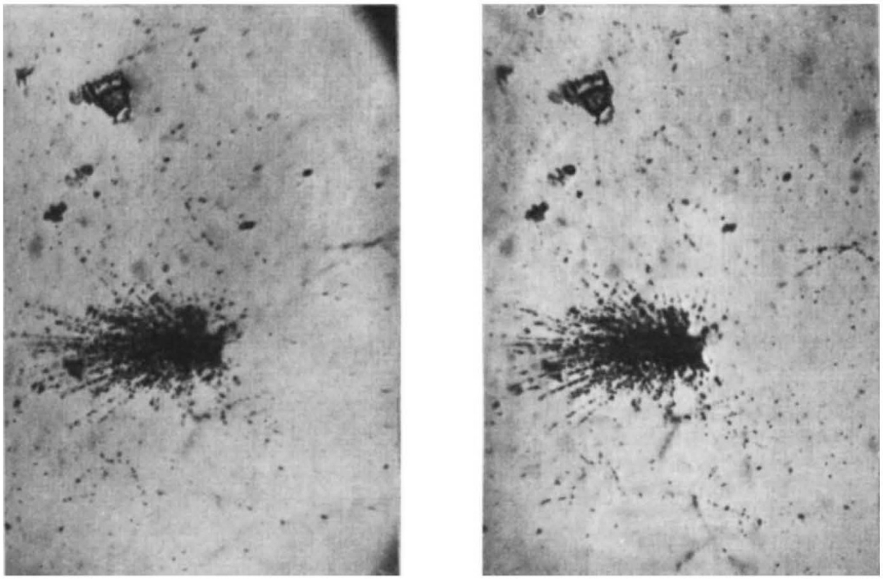
A Cosmic Ray Burst of a Hundred Particles

NUCLEAR disintegrations caused by cosmic rays can be observed only rarely in the Wilson cloud



chamber. We have developed in recent years[1] a more effective method of observing these nuclear disintegrations. In this method photographic plates coated with thick emulsions (thickness$\sim$50 μ) are exposed to the action of cosmic rays and then developed.

I have recently[2] made experiments at sea-level and at an altitude of 9,000 metres with such plates placed horizontally with their emulsions downwards, and I have found that the number of disintegrations and heavy particles per disintegration increases rapidly with increasing altitude. One case, which is reproduced herewith, is a burst of a hundred heavy particles. The two pictures are stereoscopic microphotographs taken with a magnification of 190. More tracks can be seen by stereoscopic examination of the original plate than on the reproduction. It can also be seen that all the particles diverge from one centre which is within the emulsion. The centre is quite large and contains many unresolved tracks. The black centre may be caused not only by heavy particles but also by the electron stream accompanying the burst. (Separate electron tracks cannot be seen as the emulsion is insensitive to them.)

In this burst there are twelve tracks of length equivalent to 18 cm. normal air situated within a cone of 30°. Assuming that these are proton tracks, the total energy calculated from the range is 40 Mev. In addition to these there are thirty tracks each with a range of 12 cm. (in normal air) within a cone of 70°. The appearance of the tracks at their ends suggests that they may be due to α-particles. If the tracks are due to protons their total energy is approximately 50 Mev. There are also between fifty and sixty particles lying in a cone of wide angle with ranges of approximately 5 cm. Assuming that these particles are protons, their total energy must be 80–90 Mev. Thus the total energy of the whole burst must be at least 200 Mev.

As can be seen clearly in the reproduction, the burst is accompanied by a number of separate small disintegrations. Within the field of vision, which was of 0·4 mm. in radius, four disintegrations with three tracks, one disintegration with four particles, three disintegrations each with five particles and two showers of heavy particles were found. There were thus ten disintegrations of total energy 50 Mev. within an area of 0·4 mm.[2], a disintegration density which is seventy times greater than is ordinarily found on these plates.

It should be noted that there are also many disintegrations outside of the field of vision of the microscope.

A more detailed account will appear in the *C.R. Acad. USSR.*

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Optical Properties of Dental Enamel

IT has been known for many years that dental enamel is birefringent; and its optical properties have been studied intensively by W. J. Schmidt and his pupils[1]. In a recent paper[2], I have shown by X-ray examination that an enamel prism contains a multitude of regularly arranged crystallites of apatite, and have worked out in detail the orientation of these crystallites for human deciduous enamel. It was therefore felt to be of interest to determine whether the optical and X-ray results could be correlated.

The main feature of the structure suggested by X-rays is the presence in a single enamel prism of two groups of submicroscopic crystallites of hydroxyapatite, the hexagonal axes of one group being inclined to the prism direction at about 5°, and those of the other group at about 40°. The intensity of the light transmitted by such an arrangement of crystallites, when the enamel is examined between crossed nicols, has been worked out; and it has been found that the calculated extinction phenomena, for both longitudinal and transverse sections of prisms, correspond closely with those actually observed by Schmidt, Keil and other workers.

The problem is essentially that of calculating the interference effects due to the superposition of two