On the other hand, the gun filament current showed distinct optimum settings, above which the output decreased rapidly, suggesting that space charge may play some part in the acceptance process. The appearance at times of two stationary Geiger kicks among the random ones observed during the acceleration suggests that the orbits have a complex structure as reported for the synchrotron[5], or that some electrons, drifting to the wall, can survive and continue to be accelerated.

This acceptance and acceleration of electrons in so limited an orbit space may encourage designers to consider narrower guide-fields, more especially in very large machines.

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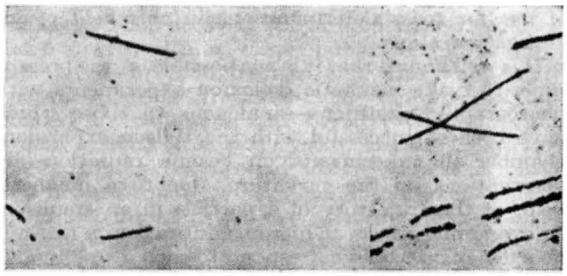
Applications of the Reflecting Microscope to the Nuclear Plates Technique

WE have found it instructive to reverse the normal microscope procedure in the examination of nuclear emulsions; invert the plate, feed light in through the cover slip, and observe through the backing plate. With high magnification, normal objectives and ordinary glass-backed gelatine, this is not possible; but it may be done by using a reflecting microscope[1]. In this way, with oil immersion, we observed several multiple stars, and found heavy fragments which were not visible by the normal mode of examination because they were obscured by the central body of the star. In some doubtful cases, this mode of examination proved decisive in the interpretation of the event.

It was but a step to sandwich two plates, with immersion oil or Canada balsam between them (emulsion inwards), and verify that we could observe right through both emulsions with unimpaired image quality. A plate, soaked in thorium nitrate, was dried and placed against an uncontaminated plate for three days. After separation, the plates were processed in the normal way, realigned by an X-ray marking grid, and the sandwich reconstituted. The accompanying microphotograph shows two tracks which originate from a star in one emulsion and end in the other.

Since this experiment was performed, the examination of sandwiches exposed at the Pic du Midi has proved that with a normal microscope it is comparatively easy to follow the passage of particles from one plate to another with separate examination of the two plates, but only if the density of events is low. Although in our case the density of stars in the soaked plate was rather high, of the order of 20 per sq. mm., we have been able to identify the mother star of every alpha particle investigated in the second plate. These conditions provided such a



stringent test of the applicability of the method in the photographic technique that we feel confident some applications, such as the dosage of radioactive substances, biological research with the auto-radiographic technique, and the measurement of long-range particles emitted by elements embedded in one of the two plates, are feasible.

The accompanying photograph shows that intimate contact between the plates was not obtained but that an air gap existed, mainly due to the large size of the plates used. With a known gap and known pressure of the gas, the 'magnification' of range thus obtained can be used for extending the field of application of the photographic plate. For example, the absorption of particles in the gas can be measured and the sign and mass of light charged particles determined by magnetic deflexion. Such an experiment is being carried out by Dr. C. F. Powell and Dr. S. Rosenblum (see following communication).

The long working distance of the reflecting microscope, which is proving useful in biological fields, will permit the examination in depth of emulsions so thick as to be beyond the range of ordinary objectives.

In the new nuclear plates the emulsion shrinkage on processing is of the order of 50 per cent, as compared with 15 per cent for the old half-tone plates, and the grain size is becoming smaller. Observation of such plates can be facilitated by using ultra-violet instead of visible light, a technique for which this instrument, being focally achromatic, is well suited.

We wish to express our gratitude to Dr. Burch for the use of the microscope, and to Dr. Burch and Dr. Powell for helpful discussion.

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A New Method for the Determination of the Mass of Mesons

WE have recently installed at the Jungfraujoch High-Altitude Research Station an apparatus for the determination of the masses, and the signs of the electric charge, of the various types of mesons observed in photographic emulsions exposed to the cosmic radiation. In view of the importance of obtaining reliable information on this subject, and of the desirability that similar experiments should be made by other investigators, we present a brief account of the main features of the method. In doing so, we also have in mind the possibility that charged mesons may be generated artificially in the near future by means of the large synchrotrons and synchrocyclotrons now approaching completion in the United States; and that our methods may be

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