

# News from Abroad

*A negative of mica sheet showing both crystal dislocations and charged particle tracks. For example, considering the two lines going almost diagonally across the centre of the photograph — one is in line with a crystal plane, the other is due to the passage of a charged particle (the particle tracks tend to be close to the lines of the dislocations because in these orientations the "nucleating centres" will join up to form a line).*

## Neutrinos on record

A few years ago, Dr. F.M. Russell, a scientist now working at the Rutherford Laboratory, UK, was pursuing one of his hobbies, mineralogy, while on holiday in North Carolina. He was examining specimens of mica when he noticed that some of the dark markings in the mica sheet did not line up with the markings that one would expect to see at dislocations in the structure of the mica. Being a physicist, he stopped to ask himself why and after months of independent research has concluded that the markings record neutrino events which occurred during the formation of the mica going back thousands of millions of years.

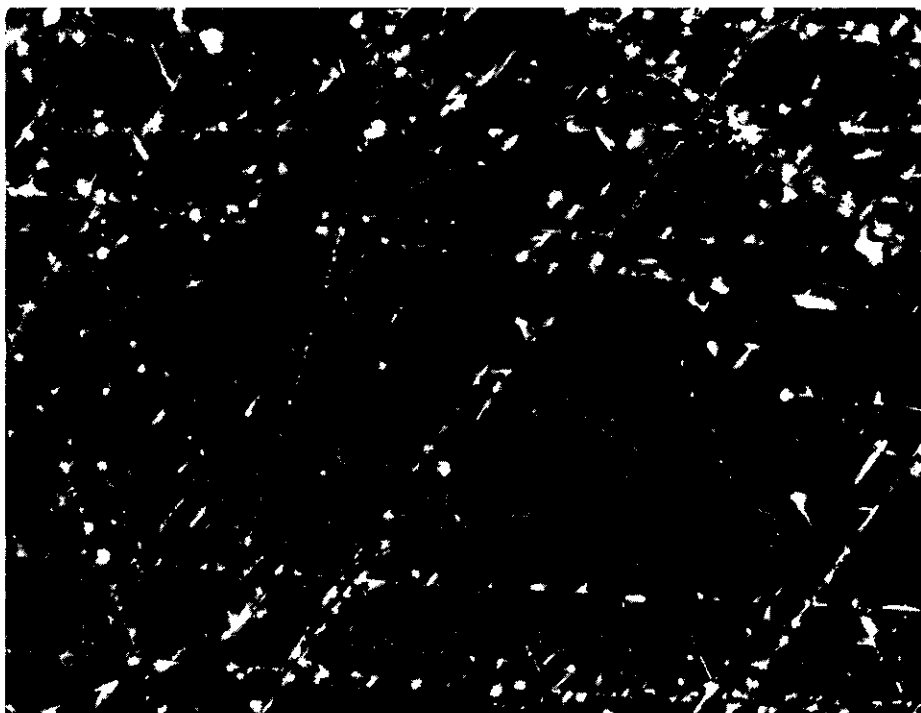
Mica is characterized by a particularly regular crystal structure. This structure gives six well defined orientations within the crystal where dislocations can occur. The dark lines most commonly found correspond to these dislocations to which iron atoms have migrated during the formation period (around 10 000 years) of the mica. Close observation reveals however that there are some markings which do not line up with any of the six crystal planes. The indication is that their origin does not lie in the structure of the mica itself, unless some unknown solid-state phenomenon was operating during the formation period. Their characteristics indicate that they are due to the passage of charged particles.

Mica is formed at depths of several kilometers, being brought to the surface often millions of years later during major movements of the earth's crust. Only neutrinos could penetrate to these depths and the markings would record the conversion of neutrinos to muon pairs, the charged muons affecting the mica.

One interesting possibility is that examination of mica deposits, which can be accurately dated back to over two thousand million years, could give evidence of any long-term changes in neutrino flux over this period of time.

## Stanford

In an experiment using the electron linear accelerator 'Mark III' at Stanford, Cali-



fornia, a group of scientists have succeeded in applying a new technique of electron scattering to the study of the shape of certain deformed, or nonspherical, atomic nuclei. The results were reported in *Physical Review Letters*, 17 April 1967, 'Scattering of fast Electrons by Oriented  $\text{Ho}^{165}$  Nuclei', R. S. Safrata, J. S. McCarthy, W. A. Little, M. R. Yearian, and R. Hofstadter.

A well-defined diffraction pattern was obtained for atomic nuclei in crystalline samples of an isotope of the rare-earth element holmium of mass number 165 subjected to an electron beam of energy 200 MeV. The diffraction pattern was produced by measuring with standard techniques the intensity of the scattered beam at different scattering angles. Different types of atomic nuclei show less abundant scattering at particular scattering angles, and from the distribution of these scattering 'dips', the shape of the particular nuclei under examination can be determined.

Spherical nuclei are known to give well-defined diffraction patterns, but deformed nuclei usually give a blurred pattern, with no particular dips from which the shape and charge distribution can be determined.

The Stanford group found, however, that when their test sample (a single crystal of holmium 165) was subjected to an external magnetic field, a well-defined pattern with significant dips became apparent.

The experiment was conducted at low temperature, with the sample located in a magnetic field produced by a pair of superconducting Helmholtz coils.

In considering their results, the Stanford team concluded that the diffraction patterns produced by the aligned holmium nuclei were not in agreement with any of the current theories. They feel that this may be due to certain particular characteristics of highly deformed atomic nuclei such as holmium and that the approximations and theoretical difficulties involved in estimating these factors are primarily responsible for the disagreement between the various theoretical models and the experimental results.

The group concludes that experiments involving electron scattering from oriented nuclei are far more sensitive to small changes in the factors describing the nuclear charge-density distribution than is the case with measurements on randomly oriented nuclei.