tering, could not be detected in He II. — On warming through the λ-point we observed a sudden increase of the scattering by about 10%.

The extinction coefficient of light due to scattering in liquid helium has been calculated to be

$$h_{\text{total}} = \frac{\omega^4 (\varepsilon - 1)^2}{6 \pi c^4 \varrho u^2} k T \qquad (1)$$

where ω and c refer to the frequency and velocity of light, and u is the velocity of (first) sound.

The absolute value of the scattered light intensity measured in our experiments agrees within 15% with the expectation of expression (1) over the whole temperature range. For a more precise comparison of the temperature dependence between our data and expression (1) we have matched in Fig. 2 at $T = 1.5$ °K our points and the solid curve representing the theoretical expectation (1). Below 2.1 °K the light scattering varies with temperature exactly as predicted. However, above the λ-point there is an additional scattering which is not yet understood at present. At the λ-point itself one would expect a maximum of the scattering amplitude but only within an extremely narrow temperature interval: No indication of any maximum was observed in our experiments.

The expected Rayleigh contribution

$$((c_P - c_V)/c_P) \cdot h_{\text{total}}$$

to the total scattering h_{total} is also shown in Fig. 2 a by a dotted line. Since it becomes evidently negligible below the λ-point the light scattering in He II reported here is probably caused only by Brillouin scattering on first sound.

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Tracks of Iron Ions in Olivine Crystals

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As Fleischer et al. [1, 2] showed, fossil heavy charged-particle tracks in meteoritic minerals can be used to study the elemental abundance of very heavy cosmic rays and the history of meteorites. Recently Price et al. [3] have been able to set an upper limit for the rate of space erosion of a meteorite by studying the distribution of charged-particle tracks in minerals of this meteorite.

In many meteorites the very heavy nuclei of the primary cosmic radiation are considered to be the dominant source of the fossil tracks. But no experiments have been made to show directly whether iron nuclei (which is the most abundant element in the VH group of the cosmic radiation) are registered in form of an etchable track for example in olivine as a common meteoritic mineral. The reason is that it is difficult to produce iron ions for acceleration in a heavy ion accelerator. From the known registration characteristics of olivine for artificially accelerated arsenic and iodine ions it cannot be extrapolated whether iron is registered or not [4].

Therefore we used the recoil-method as described by Horn and von Oertzen [5]: polished (100)-faces of olivine crystals $[(Mg, Fe)_2SiO_4]$ have been exposed at an angle of 45° to an intense beam of 45 MeV ^{32}S ions ($\sim 10^{14}/cm^2$) from the Heidelberg Tandem van de Graaff. The sulphur ions are not registered in olivine [6]. The iron ions of the crystal lattice of olivine are knocked on by elastic scattering. From the kinematics of elastic scattering the energies of the iron nuclei emitted under different angles relative to the primary direction can be derived. By etching the olivine crystals with 48% HF (20 sec, 23°) tracks are revealed (Fig. 1 *) which must be due to iron nuclei. From earlier experiments it was known that the lightest detectable ion that would give an etchable track in olivine must have an atomic number larger $Z = 20$ [6]. Therefore of the elements in olivine only iron should be considered as a source of recoil tracks.

The maximum track length of the recoil nuclei observed at 0° to the beam direction is $(5 \pm 0.5)\ \mu$ — the corresponding energy being 42 MeV. Measuring the maximum track lengths at angles of 20° (36,5 MeV) and 35° (28 MeV) respectively (Fig. 2) the maximum angle has been deduced at which tracks are formed. At large angles corresponding to low recoil energies length and angle measurements are impossible.

The curve shown in Fig. 2 was calculated using for the energy dependence of the energy loss of iron ions in olivine between 0.3 and 0.8 MeV/nucleon (which is the energy range of the iron ions produced in the recoil experiment) the expression

$$\mathrm{d}E/\mathrm{d}X = C \cdot \ln E .$$

That this description is quite accurate can be seen in the semilogarithmic plots of $\mathrm{d}E/\mathrm{d}X$ versus E in ref. [4, 7].

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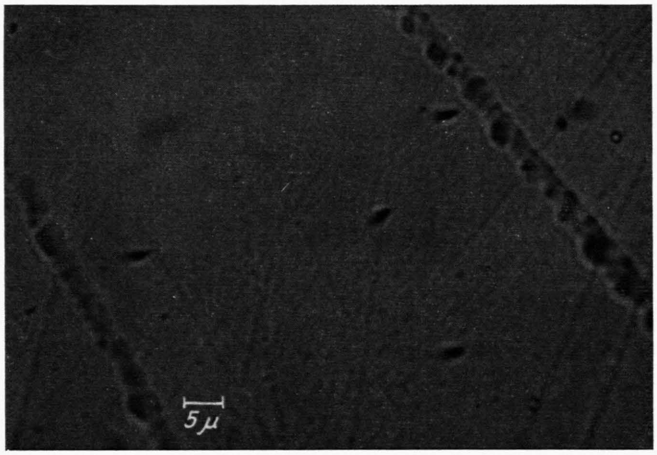

Fig. 1. Tracks of iron recoil nuclei in olivine. The crystal was etched for 20 sec in 48% HF at room temperature. Primary beam: 45 MeV, ^{32}S.

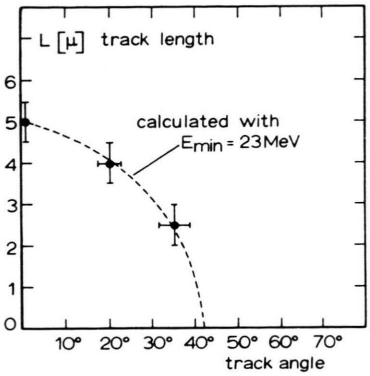

Fig. 2. Observed and calculated track length of iron recoil nuclei in olivine at different angles relative to the primary beam direction (primary beam — 45 MeV, ^{32}S).

The observed track length $L(E)$ was then calculated

$$L(E) = \int_{E_{\min}}^{E} (\mathrm{d}X/\mathrm{d}E)\,\mathrm{d}E = \frac{1}{C} \cdot \int_{E_{\min}}^{E} \mathrm{d}E/\ln E$$

$$= C_1 \cdot [\mathrm{Li}(E) - \mathrm{Li}(E_{\min})] \,.$$

$\mathrm{Li}(x)$ is the tabulated logarithmic integral. The constant C_1 was adjusted by normalizing the curve to $L(42\ \mathrm{MeV}) = 5\ \mu$.

From the maximum angle deduced from Fig. 2 the minimum energy, $E_{\min}$, for track formation by iron nuclei in olivine crystals can be calculated. $E_{\min}$ was found to be (23 ± 1) MeV. By referring to the $\mathrm{d}E/\mathrm{d}X$ versus E curve for Fe ions [7] the critical rate of energy loss for olivine was estimated to be (16 ± 1) MeV/mg $\cdot \mathrm{cm}^{-2}$.

Finally we want to call attention to a further source of fossil tracks in meteoritic minerals which has not been considered in the work of Fleischer et al. [1,2]. Particles of the primary cosmic radiation which are not registered in the meteoritic minerals can produce tracks by elastic scattering of heavy nuclei which are constituents of the minerals studied. The characteristics of such tracks of recoil nuclei (for example iron in olivine) will be similar to those of primarily registered very heavy nuclei. The length distribution will be peaked at low track lengths just as in the case of tracks by primary iron ions. The cross section for elastic scattering of α-particles and the elements of the M group (C, N, O, F) of the cosmic radiation on iron nuclei increases with decreasing energy. Therefore one expects an increasing fraction of recoil tracks with increasing depth of the sample position in the meteorite. This fact will be enhanced by the smaller absorption rate of the light primary particles relative to nuclei of the very heavy group of the cosmic radiation which are considered as the dominant source of the fossil tracks.

Taking the relative abundance of elements as given by Waddington [8] a rough estimate gives a negligible (smaller 1%) contribution of recoil tracks at surface regions of a meteorite. The interpretation of the observed fossil tracks in these regions will not be affected by recoil events on iron nuclei in olivine. For samples from the interior of a meteorite a more carefull investigation should be adequate.

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Einfluß der Elektroden auf den Stromtransport in flüssigem Benzol

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Die spezifische Leitfähigkeit σ von flüssigem Benzol wurde bereits mehrfach gemessen [1–4], doch stimmen die Angaben verschiedener Autoren nicht miteinander überein. Die publizierten Werte für σ bei Zimmertemperatur liegen im Bereich zwischen 10^{-14} und 10^{-18} $(\Omega\,\mathrm{cm})^{-1}$, die Temperaturabhängigkeit von σ ergab Aktivierungsenergien zwischen 0,29 und 0,42 eV.

Die Messungen, über die hier berichtet werden soll, zeigten einen starken Einfluß der Elektroden auf das elektrische Verhalten des Benzols. Untersucht wurde analysenreines Benzol, das durch Destillation weiter gereinigt und mit Molekularsieben getrocknet worden war. In einer Meßzelle, die es ermöglichte, gleichzeitig drei elektrisch voneinander isolierte zylindrische Elektrodenpaare (Fläche 21 cm², Abstand 0,1 cm, Durchmesser der inneren Elektrode 2,9 cm) aus verschiedenem Material anzuordnen, wurden Strom-Spannungs-Kennlinien als Funktion der Temperatur gemessen. Es wurden Elektroden aus Kupfer, Nickel, Gold und Zinn untersucht. Die Größe der gemessenen Ströme hing bei sonst gleichen Bedingungen stark von den verwendeten Elektroden und der Polarität der angelegten Spannung ab. Selbst bei Elektroden aus gleichem Material war der absolute Wert des Stromes vom Vorzeichen der angelegten Spannung abhängig. Wenn zwei Elektroden aus verschiedenem Material verwendet wurden, war der Einfluß der Polarität jedoch größer. In einem Fall änderte sich der Strom beim Umpolen der Spannung sogar um den Faktor 60 (Abb. 1).

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