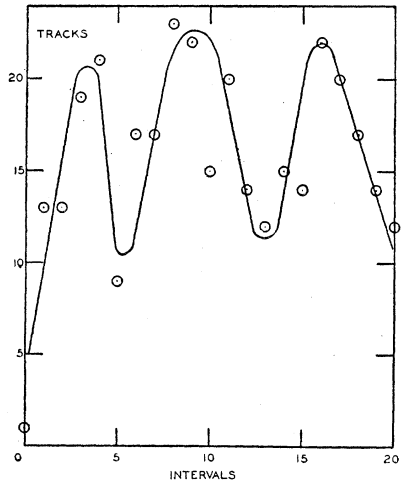

FIG. 1.

to the fact that the effect is masked by the straggling in hydrogen, which is greater than that in Bi.

With a smaller radial interval, 2 mm, the counts from the three charts were combined, and the results of plotting all the points for the first twenty intervals are shown in Fig. 1. Three groups are apparent, and the line drawn accordingly has three maxima.

Due to the fact that the separation of the groups is of the same order of magnitude as the straggling, it is necessary to have a great number of tracks, and for this reason the cloud-track method is inferior to that of the Geiger counter, for the strength of source used. It is realized that too much weight cannot be given to computations from so few tracks, but it is at least encouraging to observe

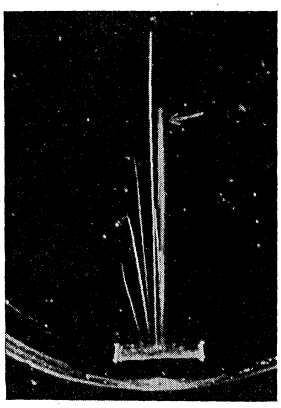

FIG. 2.

that the separations of all groups observed had about the expected values.

Fig. 2 shows a single photograph in which 8 tracks appear. Of these, 6 fall into three separate groups (2nd, 3rd, and 5th) with two particles in each. The arrow points to the rather obscure track in the 5th group. Another picture (not shown) has two groups of two each. There is small probability that two pictures of this simple sort would occur by accident in only 500.

I am indebted to Dr. Alfred Focke and to Professor Alois F. Kovarik for valuable advice, and to Dr. A. Pharo Gagge for the loan of the Leica camera.

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The Moments of Inertia and the Shape of the Ethylene Molecule

From recent data on the Raman rotation spectrum[1] and on bands in the photographic infrared[2] together with the older data on the infrared bands[3] it is now possible to calculate reliable values for the moments of inertia of the ethylene molecule. The bands so far investigated are in agreement with a plane symmetrical structure and the moments of inertia are found to be 33.2×10^{-40}, 27.5×10^{-40}, and 5.70×10^{-40} g cm^2, respectively, in the ground state. It is interesting that the smallest moment of inertia is slightly smaller than twice that of the formaldehyde molecule.[4] This is exactly what is expected since in formaldehyde the hydrogen atoms are probably attracted somewhat by the oxygen atom, while in ethylene the repulsion of the hydrogens on opposite ends of the molecule to some extent counteracts the repulsion between the pairs attached to the same carbon atom.

There seems no reason for assuming the tetrahedral angle between the C−H bonds in ethylene and to do so would require the C−H distance to be larger and the C−C distance smaller than appears reasonable. Values for the C−C and C−H distances and for the angle between the C−H bonds which are consistent with the moments of inertia and appear rather reasonable to the writer are: 1.37A, 1.04A and 126°, respectively.

It is expected that data will be given shortly on new ethylene bands observed in the photographic infrared together with an account of the vibrational and rotational structure of the spectrum.

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April 6, 1934.

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[1] C. M. Lewis and W. V. Houston, Phys. Rev. **44**, 903 (1933).
[2] Investigated in this laboratory by Mr. L. G. Bonner.
[3] A. Levin and C. F. Meyer, J. O. S. A. and R. S. I. **16**, 137 (1928).
[4] G. H. Dieke and G. B. Kistiakowsky, Phys. Rev. **45**, 4 (1934).