Owing to the extended source and target, the energy associated with each neutron group will not be Gaussian in shape. Therefore the usual method of assigning energies could not be used. The method used was to extrapolate the high energy side of each group to the abscissa. Then the probable straggling of the proton in the emulsion was subtracted, giving the neutron energy. For convenience, as is shown in Fig. 1, the groups were labeled. Group A contains 167 tracks while Groups B and C include 127 tracks. The highest energy group corresponding to a transition to the ground state of C^{12} was not analyzed since it contained only 9 tracks. The Q of the reaction for transition to the ground state used was 5.76 Mev. Table I gives the results of the experiment.

TABLE I. Energy levels in C^{12}.

Group	Max. neutron energy (Mev)	Q (Mev)	Energy level in C^{12} (Mev)	Hornyak and Lauritsen[a]
—	—	—	—	—
A	6.30	1.37	4.4±0.2	4.3
B	3.30	−1.34	7.1±0.2	7.1
C	2.35	−2.16	7.9±0.5	—

[a] W. F. Hornyak and T. Lauritsen, Rev. Mod. Phys. **20**, 206 (1948).

Groups A and B agree within the experimental error with those summarized by Hornyak and Lauritsen. The 7.9-Mev level has not been given previously. This level has a large error associated with it since the proton tracks at this energy are short. However, the group appears to be real.

As is shown in Fig. 1, the neutron Group A is very broad, indicating that a level structure may exist here. Using the geometry of the experiment, the width of the group can be calculated and then compared with experiment. If a single level should exist at 4.4 Mev, the calculated width is only about 65 percent of the experimental width.

More tracks are being measured to improve the present poor statistics. Also tracks are being measured in the backward direction, and it is planned to measure tracks in the 90° positions with the hope of obtaining some information on the angular distribution.

* Work done in partial fulfillment of requirements for the Master of Science degree.

[1] Lattes, Fowler, and Cuer, Proc. Phys. Soc. London **59**, 883 (1947).
[2] H. T. Richards, Phys. Rev. **59**, 796 (1941).

Scintillations in Liquids and Solutions

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THE most severe limitation on the use of scintillation counters in research work is the difficulty of obtaining suitable crystals of large size. This difficulty has much restricted the usefulness of these counters in cosmic-ray research. During the last year we[1] have tried to substitute for the crystal a suitable liquid or solution.[2]

First we made certain that under the action of α-, β- or γ-rays scintillations occur effectively in many liquids and solutions. We then tried to make a rapid quantitative comparison of various specimens in order to establish their usefulness, so far as efficiency is concerned, as a substitute for the crystals of scintillation counters. For this purpose we made use of a string electrometer with leak resistance and determined for each specimen the anode current of the photo-multiplier due to a constant flux of γ-rays (ThC″). The difference between the anode currents with and without the specimen in standardized geometrical conditions was assumed to be a conventional measure of the fluorescing power of the specimen itself.

With pure liquids we generally found very low fluorescing powers, no more than 10^{-1} or 10^{-2} of the fluorescing power of a naphthalene crystal of the same size. However, we obtained more interesting results and higher fluorescing powers with certain solutions. To give an example, the measurements concerning solutions of naphthalene in xylene are plotted in Fig. 1. Concentration values are plotted as abscissa. Different curves refer to different thicknesses of solution.

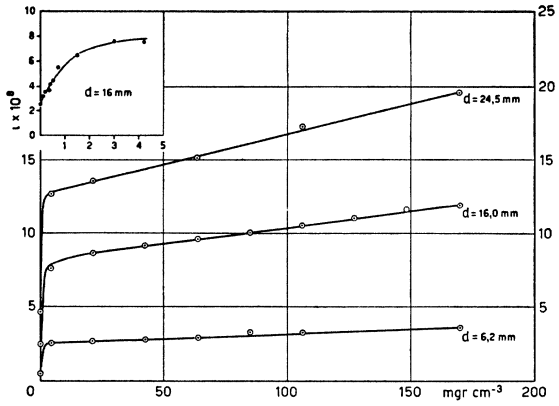

FIG. 1. Fluorescence of naphthalene in xylene.

As one sees, a very low concentration of naphthalene is sufficient to raise the fluorescing power strongly, while an increasing concentration then leaves the fluorescing power almost unvaried. The saturation value increases with the thickness of the solution, which shows that saturation is not due to absorption of light in the solution itself.

We realize that Perrin's law, referring to solutions which show fluorescence excited by ultraviolet light, is not even qualitatively satisfied here. Though we continued our measurements up to the highest concentration obtainable practically, we found no indication of an exponential decrease of the fluorescing power such as is given by Perrin's law.

The trend we found might perhaps be explained by the supposition that some rather stable fluorescing centers are formed in the solution, composed of a naphthalene molecule surrounded by an ordered array of a rather large number of xylene molecules, and that collisions have almost nothing to do with the de-excitation of such centers. This supposition is, supported, moreover, by the fact that liquid naphthalene hardly fluoresces at all, and that in many solvents it produces no increase in the fluorescing power.

Similar results were obtained with other solutions now under examination, some of which have a fluorescing power of the same order as solid crystals.

[1] Ageno, Chiozzotto, and Querzoli, Accad. naz. Lincei **6**, 626 (1949).
[2] Recently Reynolds, Harrison, and Salvini have taken up work on the same idea. (Phys. Rev. **78**, 488 (1950).

On the Relative Production of π^+- and π^--Mesons by Neutrons*

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WE have made an experiment to determine the relative yields of high energy π^+- and π^--mesons produced by a 270-Mev neutron beam[1] striking a carbon target. The general arrangement used for the investigation is shown in Fig. 1. The target was ½-inch thick graphite, inclined to the neutron beam so that it could be considered as thin for the mesons observed. Mesons with 50 to 65 Mev energy leaving the target at roughly 90° to the incident nuetron beam could be recorded in nuclear emulsions after passing through a ½-inch copper absorber. This energy and angle were