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RADIATION LABORATORY

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Radiation Laboratory

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SUMMARY OF RESEARCH PROGRESS MEETING OF DECEMBER 4, 1952

Sergey Shewchuck

January 14, 1953

Berkeley, California

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Radiation Laboratory, Department of Physics,
University of California, Berkeley, California

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I. Landau Effect with 32 Mev Protons. R. Eisberg.

The experiment which served as the subject of this talk is described in report UCRL-2031, entitled "Statistical Fluctuations in Ionization by 31.5 Mev Protons", by G. J. Igo, D. D. Clark and R. M. Eisberg, dated November 24, 1952. The introductory paragraph is quoted as follows:

Useful methods of identifying particles of different mass often involve a measurement of specific ionization and some other parameter such as momentum, energy, or range. These schemes require a counter of small stopping power and good proportionality to measure the ionization. It has often been thought that a gas proportional counter admirably satisfies these requirements, on the assumption that the statistical fluctuations in the energy loss of the particles traversing the counter are governed by the statistical fluctuations in the number of ion pairs, as calculated on the basis of about 25 ev per ion pair. Experiment and the theory of Landau and of Symon indicate, however, that the fluctuations are considerably larger.

II. n - p Scattering of "300" Mev Neutrons. W. P. Ball.

Most of the previous work on n-p scattering at energies of 40 to 260 Mev has been done by conducting measurements on the scattered proton rather than on the neutron, the latter being much more difficult. Hence, data for neutron scattering angles of considerably less than 60° has been lacking. This experiment was concerned with the detection of neutrons at these small scattering angles. The resulting protons for such small neutron angles have too small an energy to be measured easily. The apparatus used was the same as that described previously in report UCRL-1938 for measuring neutrons scattered by various materials.

All neutrons with energies above 210 Mev were counted at all angles. When the new data for 90 Mev and 260 Mev were added to the curve plots from other published data on the n-p differential cross section versus

neutron scattering angle, there resulted a rather fortuitous smooth fit. See Figure 1. The complete curves with the new data show that the cross section rises steeply toward 0°. Also, the curves appear to be symmetrical. The data does not exactly fit either the Christian and Hart or Jastrow theories, but leans somewhat toward the former. Average statistical error for the new data is roughly 30 percent.

III. Geologic History of the Earth's Magnetic Field. H. Bradner.

Assistance is being given to Scripps Institution of Oceonography at La Jolla, California, on a problem of determining the geological changes in the earth's field as indicated by the residual magnetism in sedimentary rocks. The difficulty consisted chiefly in devising a small shipboard magnetometer sensitive enough to detect the minute variations and orientation in the residual magnetism contained in ocean bottom samples.

Two classes of data seem to exist regarding the earth's magnetic field. One class tends to prove that the earth's magnetic field has always been about the same as it is today. The other gives evidence indicating apparently that the north magnetic pole has made great movements from time to time, even to being located in the south. These data are obtained from tests on the residual orientation in the crystals of small samples of undisturbed volcanic or sedimentary rocks in various localities. It is assumed that the volcanic rocks were magnetized parallel to the earth's field at the time that the rock cooled below the curie point. In sedimentary rocks the direction of magnetization would be in the direction of the earth's prevailing field at the time that the crystals became compacted in place. Disturbances, however, could be caused conceivably by large lightning storms, geologic upheavals, magnetostrictive strains, or relaxation of the orientation of semi-permanent magnetic crystals. In New England's sediment layers it appears that the orientation of the earth's magnetic field must have always been about the same as it is today. In South Africa, certain 100-mile long dikes indicate along their entire length that the magnetic field was pointing south. Other dikes show the same effect. Still others point north in some sections and south in nearby areas.

During the past 300 years in which accurate measurements of the earth's field have been made the position of the north pole has wandered a few degrees, and the magnitude of the field has steadily decreased approximately two percent per hundred years.

Scripps Institution is proposing to take and to test samples from the bottom of deep ocean beds in the Pacific. A sensitive magnetometer has been built to be used on shipboard. It was designed by Ronald Mason of Scripps, Hugh Bradner and Ray Robertson of UCRL. The instrument can measure the residual magnetic field of a sample with a sensitivity of 10^{-7} of the earth's field. If the background from stray generator fields can be reduced by correct placement of a bucking coil the sensitivity should be increased to 10^{-8} of the earth's field.

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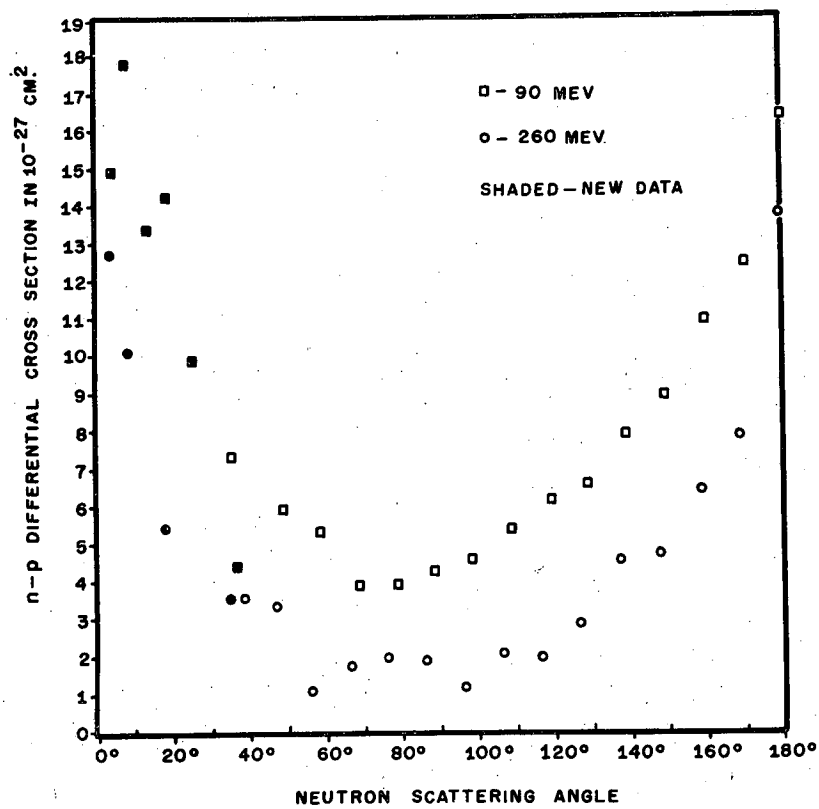
n-p DIFFERENTIAL CROSS SECTION IN 10^{-27} CM.^{2}
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
□ - 90 MEV
○ - 260 MEV
SHADED - NEW DATA
0°
20°
40°
60°
80°
100°
120°
140°
160°
180°
NEUTRON SCATTERING ANGLE

MU-4670

Fig. 1