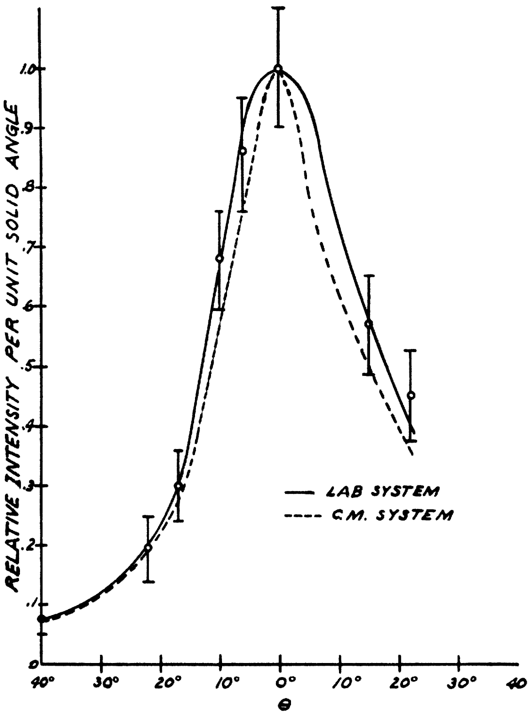

FIG. 2. Angular distribution of neutrons from a $LiBO_2$ target bombarded by 15-Mev deuterons. θ is angle between the direction of maximum neutron intensity and other measured intensities.

To obtain a better understanding of the above described phenomena, experiments are now in progress to improve this data. A four-proportional counter telescope has been built. Better experimental accuracy is expected since the error due to room scattered neutrons is eliminated. Furthermore, it will be possible to measure the neutron spectrum at different angles.

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* Assisted by the ONR under Contract N7onr-30304.

** AEC Fellow.

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Proton Stopping Power of Gold

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June 2, 1949

THE previously reported measurements of the proton stopping power of beryllium[1] have been extended to gold, using the proton resonances F-339 and Al-986 as energy indicators.

A foil thickness of about $\frac{1}{2}$ mg/cm^2 was chosen for the experiment in order to obtain a shift of the resonance peaks of approximately three times the half-width calculated from the theory of straggling.

The results found are given in Table I for three different foils, each consisting of three layers of commercial gold-leaf (content of copper less than 1 percent). An example of the measurements on the line F-339 is reproduced in Fig. 1. The broadening of the peak is only slightly greater than should be expected because of the straggling, indicating that the foils are only slightly inhomogeneous.

TABLE I. Proton stopping power for three different foils.

Resonance	Total thickness mg/cm^2	Shift kev	Mean energy kev	Stopping power kev per mg/cm^2
F-339	0.46	39	364	85
F-339	0.52	42	366	81
Al-986	0.46	27	1001	59
Al-986	0.51	30	1002	59
Al-986	0.52	31	1003	60

Wilcox[2] reports a value of 67 kev per mg/cm^2 for the stopping power of gold at a proton energy of 365 kev. This value is about 20 percent smaller than ours, but in the experiment of Wilcox, the energy shift is only of the same order of magnitude as the half-width, and the results are, for this reason, probably less accurate. The reported difference of 10 percent between the values for protons and deuterons of the same velocity may, therefore, also be expected to be within the experimental uncertainty. This explanation is in agreement with later experiments by Hall and Warshaw.[3]

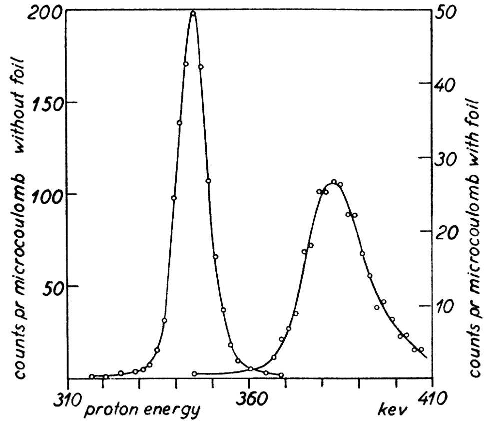

FIG. 1. The F-339 resonance measured without foil and with a 0.46 mg/cm^2 gold-foil inserted in the proton beam.

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The Density Field in Mach Reflection of Shock Waves

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WHEN two shock waves interact with one another the result is not always a simple crossing of the two waves as would be expected from a linear theory. The nature of the more complicated phenomenon was observed by Mach.[1] Von Neumann[2] has pointed out that the interaction is equivalent to the oblique reflection of a single shock from a rigid wall and he proposed a theory by which the strengths and angles of the other discontinuities could be predicted at the point of intersection from the direction of the incoming flow and the strength of the incident shock. His theory of Mach reflection assumed that the three shocks and a slip stream were the only discontinuities present and that the pressure was constant in each of the three angular domains bounded by the three shocks at least in the neighborhood of the intersection. The experimental results of Smith[3] who determined

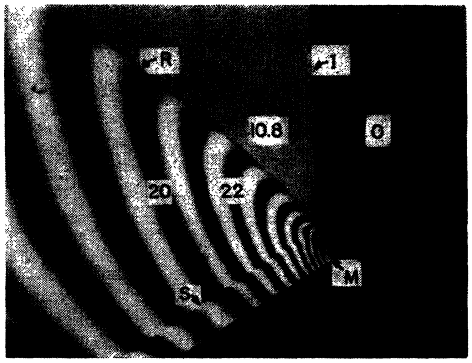

FIG. 1. Interferogram of Mach reflection. The adjustment of the instrument is such that fringes represent density contours a few of which have been numbered in the order of increasing density.

the angles involved do not agree with this "three shock" theory of von Neumann. The correct interpretation of the reflection phenomenon is very fundamental to the theory of fluid dynamics and an experiment is underway to determine the density field in air when a shock wave is reflected from a wall. Results for a particular set of initial conditions are given in this letter.

A shock tube is used[4] to generate plane shock waves which are reflected on a plane rigid wall. The phenomenon is viewed through an interferometer of the Mach-Zehnder type[5] in a direction parallel to the intersection of the plane of the shock front and the wall. A flash (~1 microsecond) interferogram with the instrument adjusted for constant difference in light paths over the entire field of view in the absence of any disturbance is shown in Fig. 1. With this "single fringe" adjustment the fringes appearing in the photograph represent contours of equal fringe shifts and hence contours of constant density or isopycnals in the gas. The incident shock I in the figure is vertical and moving at supersonic speed toward the right. The ratio of the pressure in front to that behind it is 0.80 and the angle between the shock and the wall is 60 degrees. It is followed by the reflected shock R and their point of intersection is joined to the wall by the "Mach" shock M. Trailing behind the triple intersection of the shocks is the slip stream S running nearly parallel to the wall. This discontinuity represents a stream line for the flow relative to the intersection.

Only in the region behind the reflected and Mach shocks is there a detectable variation in the density. Behind the Mach wave and near the wall the gradient of the density points forward (toward the right) indicating that in this region the shock is being followed by a rarefaction. As the point of observation recedes from the reflected shock along a stream line somewhat above the slip stream the density rises to a maximum and then falls again. At higher angles of incidence and weaker shocks this effect is much more pronounced. No certain evidence for an angular variation of density near the intersection has been found.

The theoretical explanation of these results is at present unknown, but the contours resemble somewhat those indicated by Bargmann[6] for glancing incidence, a case which he found amenable to theoretical treatment. The investigations are being continued and in particular the case of nearly glancing incidence is being explored.

The major financial support for this work was provided by the ONR, Contract N6ori-105 Task II.

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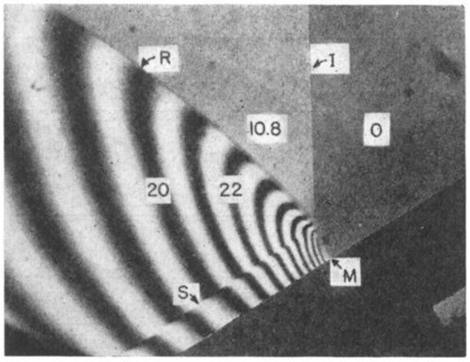

FIG. 1. Interferogram of Mach reflection. The adjustment of the instrument is such that fringes represent density contours a few of which have been numbered in the order of increasing density.