 LAMS-113

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SUMMARY OF MEETING OF PROJECT Y TECHNICAL BOARD ON JULY 13, 1944

A. DISCUSSION OF EXPERIMENTAL METHODS FOR INVESTIGATING PRESSURES AND DENSITIES IN IMPLOSION

I. Ra-La Experiment

1. Alvarez discussed the present status of the experiment. Two new developments are the realization that the observations will be largely determined by the energy degradation of the γ-rays in scattering and that various advantages can be obtained by performing a homogeneous experiment with single metal instead of the two metal methods originally planned.

2. Weisskopf discussed the homogeneous experiment in detail. With silver and an approximately 0.4 linear scale I/I_0 would be 73 percent at collapse but no compression, 45 percent with average IBM density based on 3000 m/sec initial velocity, and 15 percent with predicted IBM density distribution. Also for the homogeneous case the pressure should be greater, the Taylor instability will be less, and the H.E. will be of a more convenient thickness.

3. In the discussion of these reports, Oppenheimer urged that the first Ra-La experiment should be of the homogeneous type since it is the most likely to succeed and since there is now time to change plans before the first radioactive material is delivered in August. He also urged that small and intermediate scale experiments with simpler forms of instrumentation should, where possible, be performed prior to the Ra-La experiments on the type of implosion planned with the Ra-La. It was suggested that an investigation be made of the effects of possible holes in the collapsing metal in allowing γ-rays to leak out and consequently mask the compression.

WD - Principles + Testing
Neutron Components

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II. Heated D-D Experiment

1. Teller discussed the method proposed by Rabi which relies on the measurement of the D-D neutrons produced by collisions in deuterium heated to a temperature of over 50 ev by the adiabatic compression of the implosion. If the implosion were spherically symmetrical, if the initial gas in the sphere were atomic deuterium at 0.01 bars and 3000° K, and if the final pressure were 10 megabars, the final temperature should be about 75 ev. For a while it was hoped that the delay in the onset of ionization would raise this markedly but the effect is now apparently small due to excitation speeding the ionization. 64 ev should produce 0.3×10^{12} neuts/sec which might be barely measureable.

2. The greatest difficulty is cooling of the gas if the implosion is not accurately spherically symmetrical or if metal particles are in the gas cavity. If the gas is distributed in filaments whose minimum dimension is less than 0.02 mm, the cooling will be excessive. This is not unlikely with reasonable spherical asymmetry since the diameter of the sphere in the symmetric case is only 2 mm.

3. It was generally agreed that the experiment would yield valuable information if it gave a positive result but would be useless otherwise. It was further agreed that the experimental techniques could probably be overcome but that the key to the problem was probable excessive cooling if the implosion were not spherically symmetrical to a high degree. Wilson and Alvarez were requested to investigate the experimental techniques in greater detail and Teller to further check the theory. Active work to begin the experiment would, however, not be started at this time. McMillan suggested that Teller investigate the effect of cathodic sputtering in cooling the gas.

III. Magnetic Method

1. Fowler discussed his work in measuring the change of field produced by a collapsing conducting sphere in a magnetic field. So far he has not measured the collapsed outer radius but this may be possible if his measurements are refined and calibrated absolutely. Alvarez suggested that electrical integration with a charging condenser prior to amplification might help in the absolute measurement of the collapsed radius. It was agreed that the absolute measurement of the radius should be pushed even though it may be difficult to get sufficient accuracy to measure the density.

2. The use of a thin metal liner inside of a non-conducting shell should make the measurement of collapsed density somewhat easier.

3. It is hoped that some indications as to the pressure reached may be obtained by filling the metal shell with hydrogen and by measuring the deceleration of the outside surface.

4. The above led to the suggestion in the meeting that an attempt might be made to measure the pressure by the onset of hydrogen ionization in hydrogen gas in an imploding non-conducting shell.

5. Some investigation of symmetry may be possible by using a small metal sphere in the center of the imploding non-conducting shell and two coils balanced in such a way as to give no indication for a symmetrical implosion.

6. It was agreed that this magnetic technique was very promising and should be vigorously pushed. It is apparent that there is an urgent need for a heavy non-conductor that will not conduct at high temperatures and pressures.

IV. High-Hydrided Active Material

1. Since the cylindrical version of Jumbo now appears somewhat promising, the highly hydrided experiments were discussed by Teller. With 500 grams of highly hydrided 25 and 10 curies of PoBe one would probably get 13 generations with 7 generations being detectable. There should be no danger of a nuclear explosion. Resonance absorber brakes can be used to add to the safety. Teller estimated that a compression about half that predicted could be detected. Teller emphasized the effect of uncertainty in temperature in making the interpretation of results difficult. The effect of temperature uncertainty could perhaps be overcome by comparing two results with different amounts of impurity.

2. The close dependence of this experiment on the success or failure of Jumbo was emphasized. Oppenheimer recommended that work on the experiment should be continued but chiefly as a measure of despair.

V. Other Methods

1. The only suggestion as to other methods of observation was made by Neddermeyer who revived the method of studying jets. All agreed these would be difficult to interpret.

B. EFFECTS ON PROGRAM OF SPONTANEOUS FISSION OBSERVATIONS WITH HEAVILY IRRADIATED 49

1. Segre's latest results were discussed. It appeared very likely that the spontaneous fission was from 410. It was agreed, however, that experiments to eliminate other possibilities should continue at high priority. Kennedy suggested X-ray analysis to disprove the possibility of 510 or 610 and all agreed this should be an excellent method.

2. Oppenheimer stated he would get additional quantities of 410 produced for experimental study.

3. Oppenheimer stated he had written Lawrence concerning the possibility of electromagnetic separation of 410. He considered, however, that it was very unlikely by this or other means that we would get reasonably neutron free 49 anywhere near the present scheduled time.

4. It was agreed that these results would probably drastically curtail the present high purity and analysis program for 49 in the Chemistry Division and the 49 gun program in the Ordnance Division. It was, however, decided that the curtailment should be initiated only gradually and in about two weeks to prevent over hasty and later regretted actions.

C. Other Matters

1. Oppenheimer reported to everyone's satisfaction that it was now decided to use Abelson type thermal diffusion plants to enrich material prior to the electromagnetic separation.

2. Oppenheimer briefly reported on the corrosion trouble being experienced in piles run at very high power. This may result in lowered operating power and lowered 49 production.

N. F. Ramsey

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