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CIA-29

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Group Ref: TMG-M23

This document consists of 20 pages

March 31, 1952

MINUTES OF THE TWENTY-THIRD MEETING OF THE THEORETICAL MEGATON GROUP

26 March 1952

1. The twenty-third meeting of the TMG convened at 9:00 AM on Wednesday, 26 March 1952, in the W-Division Conference Room. Those present were:

G. Bell
H. A. Bethe
A. A. Broyles
E. D. Cashwell
F. de Hoffmann
D. C. Dodder
C. Evans
F. Evans
D. K. Froman
W. B. Goad
R. W. Goranson
M. G. Holloway
R M. Landshoff
J. C. Mark, Chairman
H. L. Mayer
L. W. Nordheim
W. E. Ogle
J. C. Potts
F. Reines
J. R. Reitz
P. R. Stein
J L. Tuck

2. The 4th paragraph on page 5 of the previous minutes is an incomplete statement.

DOE (3)

3. Radiation Implosion Calculations (SEAC)

WD - Hamly

This calculation is to be repeated for a lower deuterium compression. It is anticipated that in about two weeks Matterhorn will discuss these results at LASL.

4. DD, TD and He^3D Cross Sections (Tuck)

The above cross sections were completed several months ago up to a deuteron bombarding voltage of 120 kev. The method is an absolute one, in which the cross section σ is given by

$$\frac{Y}{n_1 n_2 \Sigma \, dedw}$$

where Y = yield of disintegrations, n_1 = number of beam particles, n_2 = target gas density in atoms per cm^3 and Σ dedw is a geometrical factor calculated from the measured counter slits and the known divergence of the bombarding beam, produced by scattering in the 100 atom thick SiO window which admits the beam into the target gas. If the beam energy is reduced, the divergence increases, being given, in the average, by

$$\left[\overline{\theta^2}\right]^{1/2} = \sqrt{\left(\frac{2\pi Z^2 e^4 N}{E^2} \ln \frac{E a}{Z^{4/3} e^2}\right)}$$

where N = window atomic density and E = incident energy.

The calculation of Σ dedw becomes complicated when the scattering is large so that a conservative lower energy limit has been set to the full applicability of the experiment, which is when the total correction for scattering in the window, as compared with a parallel beam, exceeds the probable over-all accuracy of the experiment, i.e. 6%.

Only the TD measurements go to low enough energies (9 kev) for this limit to be applied; for DD and He^3D the scattering is negligible for the lowest energies at which the correction is large enough to be measurable by the technique.

As a check on the results, since there exist few other absolute measurements for comparison at the low energies, one has to rely on the behavior of the Gamow plots. These plot $\ln(E\sigma)$ versus $E^{-1/2}$ and, when $E << $ coulomb barrier (206 kev for DD), the relation should be linear with the slope

$$\frac{\sqrt{2\pi e^2 \sqrt{M}}}{\hbar}$$

At 20 kev one can calculate that the slope should be within 1/2% of its asymptotic zero energy value. When the DD and He^3D data are plotted in this way good straight lines result with slopes close to the above theoretical value (the observed ratio of the two slopes is 2.01 as compared with the theoretical value of 2.00).

For TD the experimental values lie above the Gamow straight line in the neighborhood of the 120 kev resonance but become asymptotic to the derived slope at the lowest significant points.

It has also been possible to measure the branching ratio for DDn/DDp so that one now has all the data necessary for the calculation of reaction rates in D, T and He^3 over the significant range. Moreover, good behavior of the Gamow plots gives confidence for extrapolation of the results to lower energies if required.

5. (a)

(b)

DOE b(3)

DOE b(3)

The first time effect will persist if over sufficiently spaced distances whereas the latter will tend to wash out.

The Group agreed to adopt the proposal of Mark.

6. [redacted]

DOE (3) b

re

es

DOE (3) b

Since even this latter amount of energy did not appear to be cause for worry it was decided that a new calculation on a larger bomb is not necessary for sound proofing purposes, and therefore can wait until there should be a decision to alter the bomb yield.

DOE

7. [redacted]

DOE (3) b

[redacted]

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FIG. 1

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FIG. 2

FIG 3

FIG. 4

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(9)

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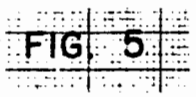
DOE
b(3)



KEUFFEL & ESSER CO., N. Y., NO 389-110
Logarithmic, 2 × 2 Cycles.

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From these data Mayer has obtained the approximate relationship

DOE b(3)

DOE b(3)

DOE b(3)

DOE b(3)

The calculational procedure included three different approximations:

I.

II.

III.

DOE b(3)

DOE b(3)

DOE b(3)

This is good only to the first order in s.

(b)

DOE b(3)

DOE b(3)

9.

DOE b(3)

10. Radiation Flow Calculations (de Hoffmann, M. Goldstein, Stein, and Rand)

The notation follows that given in the 21st and 22nd minutes.

DOE
b(3)

R. W. Goranson

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Fig. 6

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Fig. 1

Fig. 8

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Fig. 9

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Table 1

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Distribution:

1A - H. H. Barschall
2A - G. Bell
3A - H. A. Bethe
4A - W Bouricius
5A - N. E. Bradbury
6A - S. W. Burriss
7A - B. G. Carlson
8A - F. de Hoffmann
9A - F. Evans
10A - B. E. Freeman
11A - D. K. Froman
12A - R. B. Gibney
13A - R. W. Goranson
14A - A. C. Graves
15A - L. E. Hightower
16A - M. G. Holloway
17A - F. C. Hoyt
18A - E. R. Jette
19A - R. M. Landshoff
20A - R. B. Lazarus
21A - C. L. Longmire
22A - J. C. Mark
23A - H. L. Mayer
24A - N. Metropolis
25A - L. W. Nordheim
26A - W. E. Ogle
27A - F. Reines
28A - J. R. Reitz
29A - R. D. Richtmyer
30A - M. Rosenbluth
31A - R. W. Spence
32A - P. R. Stein
33A - E. Teller
34A - J. L. Tuck
35A - S. M. Ulam
36A - M. C. Walske
37A - B. E. Watt
38A - J. A. Wheeler
39A - H. F. York
40A - Report Library
41A - Report Library
42A - File