quadrupole interaction and that defined by Eq. (2) is

$$[eQ(\partial^2 V/\partial z^2)]_{G,S,S}=\frac{2I+3}{4I}eQ(\partial^2 V/\partial z^2). \qquad (6)$$

Thus, the published values of the "quadrupole coupling" of iodine ($I=5/2$) in CH_3I[2] and ICN[3] should be multiplied by the factor $4I/2I+3=5/4$, giving values of $eQ(\partial^2 V/\partial z^2)$ of -1900 mc/sec. and -2588 mc/sec., respectively.

The factor $4I/2I+3$ for chlorine and bromine ($I=3/2$) turns out to be equal to 1. Thus, the "quadrupole couplings" given by the above authors for these nuclei in BrCN,[3] CH_3Cl, and CH_3Br[4] are identical with those which would have been obtained by the use of Eq. (2).

Although Townes, Holden, Bardeen, and Merritt[1] have not published the formula which they used to determine "quadrupole couplings", their definition of $eQ(\partial^2 V/\partial z^2)$ appears to be identical with ours.

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Alpha-2 Neutrons Nuclear Reactions

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During a series of investigations with 15-Mev alpha-particles, we also started a systematic search for the $(\alpha, 2n)$ reaction to test the predictions of the statistical theory[1] of nuclei. The following elements have been investigated:

V, Co, Cu, Ga, As, Rb, Y, Rh, Ag, In, and I.

We found the following reactions:

$Ga^{69}(\alpha, n)As^{72}(26^h)$, $Ga^{71}(\alpha, n)As^{74}(16^d)$,
$Rb^{87}(\alpha, n)Y^{90}(60^h)$, $I^{127}(\alpha, n)Cs^{130}$(30 min.).

In no case was there any indication of an $(\alpha, 2n)$ reaction.

At the end of 1942~18-Mev alpha-particles became available, and preliminary experiments were carried out with cobalt and rhodium. In bombarding cobalt, both the Cu^{62} activity of 10 min., as well as the Cu^{61} activity of 3.4 hr. were found, indicating the existence of both (α, n) and $(\alpha, 2n)$ reactions. Bombarding rhodium, the 8.2-day activity of Ag^{106} resulting from the (α, n) reaction and, in addition, a ~40-day activity were found, indicating the existence of the $(\alpha, 2n)$ reaction. We assign this period to the Ag^{105} isotope.[2]

The investigation was interrupted because of the authors' assignments to war research activities and was continued only recently.

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The Relative Yields of (α, n) and $(\alpha, 2n)$ Reactions for Ag and Rh with 15–20-Mev Alpha-Particles*,[1]

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The statistical theory of nuclear reactions, as developed by Weisskopf and Ewing,[2] predicts a Maxwell-like distribution for the energy spectrum of the neutrons evaporated from a heavy, highly excited compound nucleus formed by α-particle bombardment. If the energy of the emitted neutron is sufficiently small so as to leave the residual nucleus in an excited state above the dissociation energy, the emission of a second neutron will be by far the most probable event.

From the energy distribution of the neutrons given by the statistical theory, the cross section for the $(\alpha, 2n)$ reaction is calculated to be

$$\sigma_{\alpha,2n}=\sigma_\alpha[1-(1+\Delta E/kT)e^{-\Delta E/kT}], \qquad (1)$$

where $\Delta E=E_\alpha-T_{\alpha,2n}$ is the excess of the α-particle energy over the threshold $T_{\alpha,2n}$ of the $(\alpha, 2n)$ reaction, T is the temperature of the residual nucleus for an excitation energy

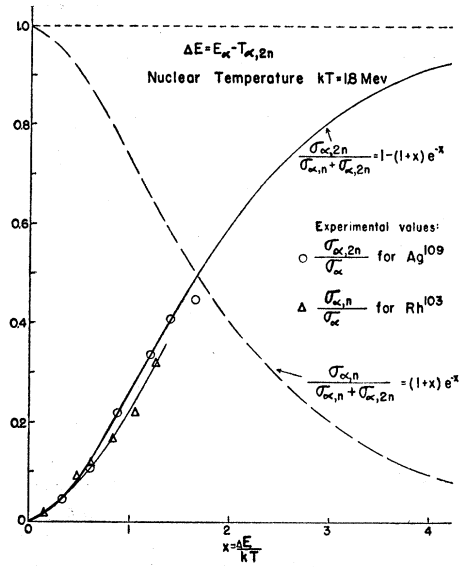

FIG. 1. Excitation curves for the (α, n) and $(\alpha, 2n)$ reactions with Rh.