$$W(\varepsilon qq') = \int dp\,[B_1(\varepsilon q'qp) - B_1(moqp)]\,V^R(mpo) + \int dp\,B_1(\varepsilon q'qp)\,W(\varepsilon pq'o). \quad (14)$$

In an analogous way, the regularized function $\Lambda^R(qq')$ is found. In order to eliminate the complex expressions from the equations for $f_1(qq_0)$, we shall introduce a new function

$$u(q) = f_1(q)\left[1 + \frac{i}{2}\frac{q_0\omega_{q_0}E_{q_0}}{E_{q_0}+\omega_{q_0}} f_1(q_0)\right]^{-1}. \quad (15)$$

After replacing $\widetilde{\Gamma}(qq')$ and $\widetilde{\Gamma}'(qq')$ by regularized functions $\widetilde{\Gamma}^R(qq')$ and $\widetilde{\Gamma}'^R(qq')$, the equation for the function $w(q)$ becomes

$$u(q) = \widetilde{M}^R(q_0) + \int \frac{(q')^2\,dq'}{\varepsilon - E_{q'} - \omega_{q'}}\,\widetilde{M}^R(qq')\,u(q'). \quad (16)$$

The function $w(q_0)$ determines the phase-shift of the scattering of π-mesons on nucleons in the state with isotopic spin $I = 3/2$ by means of the following formula:

$$\delta_S = -\,\mathrm{arc\,tg}\left[\frac{\pi q_0\omega_{q_0}E_{q_0}}{E_{q_0}+\omega_{q_0}}\,u(q_0)\right]. \quad (17)$$

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On the Absolute Value of the Stripping Cross Section and Cross Section for Diffraction Scattering of the Deuteron

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A NUMBER of recent investigations were devoted to the interaction of deuterons with heavy nuclei.[1–5] The cross-section of the diffraction scattering of deuterons on nuclei was calculated in Refs. 3–5, while Ref. 4 treated the case of the diffractive scattering as well. The calculations (for an ideally black nucleus) were effected by seemingly different methods, which, however, can be shown to be essentially identical. Some difference in the final formulas is due to the fact that certain simplifying assumptions of Ref. 4 were too crude.

In Refs. 3 and 4, as well as in usual calculations of the stripping reactions cross-section[6], the wave function of the internal motion in the deuteron is taken as

$$\varphi \sim \exp(-\alpha r)/r,\ \hbar\alpha = \sqrt{M\varepsilon},$$

where M is the nucleonic mass and ϵ is the deuteron binding energy which corresponds to the assumption of a zero radius of the p–n force. The question arises of how a finite force radius would influence the cross sections of the above processes. If we assume a square-well potential of the p–n interaction of radius a and depth U

(where $Ua^2 \sim \pi\hbar^2/2M$),

it is possible to calculate the stripping and diffraction disintegration cross-section by means of the well-known wave function obtained for this case.[7] It is convenient to make use of Glauber's method[5] [see his formulas (5) and (6)]. As the result, we obtain the following expressions for the stripping cross-section σ_{strip} and the diffraction disintegration cross-section σ_{diffr} of deuterons on a black nucleus of radius R:

$$\frac{\sigma_{\text{strip}}}{2\pi R} = \frac{\alpha}{2(1+\alpha a)} \times \left[\frac{\cos^2\delta}{4\alpha^2}(1+2\alpha a) + \frac{a^2\cos^2\delta}{\pi+2\delta}(1+2\alpha a) + \frac{a^2}{4}\right], \quad (1)$$

$$\frac{\sigma_{\text{diffr}}}{2\pi R} = \frac{1}{8\alpha}\left(\frac{4}{3}\ln 2 - \frac{1}{3}\right) - \frac{a}{2}\left(\frac{3}{4} - \ln 2\right)$$

$$(\text{for } \alpha a \ll 1). \quad (2)$$

(the exact formula for σ_{diffr} is very cumbersome and for the values of a given in the table yields the same numerical results). In these formulas, δ is determined from the equation

$$\left(\frac{\pi}{2} + \delta\right) \operatorname{tg} \delta = \alpha a.$$

The case $a=0$ corresponds to the usual formula

$$\sigma_{\text{strip}} = \pi R R_d / 2 = 0.54 \cdot 10^{-13}\, 2\pi R \ \text{cm},^2$$

$$\sigma_{\text{diffr}} = \pi R R_d / 2\left(\frac{4}{3}\ln 2 - \frac{1}{3}\right) = 0.59\, \sigma_{\text{strip}}$$

From the above, numerical computation yields:

$a \cdot 10^{13}$ cm:	0	1	2,82
$(\sigma_{\text{strip}} / 2\pi R)\, 10^{13}$ cm:	0,54	0,69	0,87
$(\sigma_{\text{diffr}} / 2\pi R)\, 10^{13}$ cm:	0,32	0,31	0 30

It can be seen that the diffraction scattering cross section is insensitive to the choice of the force radius, while the stripping cross—section is rather strongly dependent on it (for the limiting reasonable choice

$$a = 2.82 \cdot 10^{-13} \ \text{cm},$$

the result differs by a factor of ~ 1.6). It is possible that this fact can explain the marked discrepancy with the experimentally found cross—section[8] which is larger almost by a factor of three than the one resulting from the equation

$$\sigma_{\text{strip}} = \pi R R_d / 2$$

(the effect of the diffraction disintegration is, evidently, contributing essentially to this difference).

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Angular Distribution of the Products of the S^{32} (d,p) S^{33} Reaction

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THE reactions of the (d,p) type have already been well studied for many light isotopes. For the majority of the nuclei investigated, however, the experiments were carried out for a single value of the incident particle energy. It is of considerable value, in the interest of a more accurate theory of the stripping reaction, to investigate the shape of the angular distribution of the products of such reactions for different energies of incident deuterons. We therefore measured the angular distribution of protons produced in the S^{32} (d,p) S^{33} reaction for 1.8 mev and 3.8 mev deuterons. This reaction was studied earlier by Holt and Marsham[1] for 8.18 mev protons.

The deuterons accelerated in a 72 cm cyclotron bombarded a target of sulphur ($\sim 1\ \mu$ thick) coated on painter's gold. The protons produced in the reaction were registered by nuclear emulsions of the type Ia–2 (100μ thick) placed around the target at the distance of 10 cm.

The angular distribution was measured for two groups of protons, p_0 and p_1, corresponding to the production of the final nucleus in the ground and the first excited states, respectively. The experimental results obtained by us are shown in Figs. 1 and 2, where θ is the angle in the center of mass system and $N(\theta)$ is the number of protons emitted at the angle θ; the dashed lines separate the isotropic part of the angular distribution. The theoretical curves, calculated according to the formula of Bhatia et al.[2] for $R = 6.6 \cdot 10^{-13}$ cm.