OBSERVATION OF STIMULATED RAMAN SCATTERING OF LIGHT IN CRYSTALLINE POWDERS

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Stimulated Raman scattering of light (SRS) has been observed so far in transparent media. According to the prevailing opinions, it can occur only in such media. Nonetheless, we succeeded in observing SRS spectra in fine-crystal powders. We used the ordinary scheme for observing SRS. Spectra were obtained and investigated for four substances (stilbene, 4,4'-para-azoxyanisol, azoxyphenetole, anisal-para-amino-azobenzene). For all substances, the first Stokes component was observed in the spectrum. For stilbene, the first anti-Stokes component was observed. The absence of the latter for the other samples can be attributed to the presence of strong absorption in this region. In individual cases, a weak second Stokes component was observed. We note that the spectrum always revealed only one line, even after multiple laser flashes (up to 10 flashes) registered at the same spot on the photographic plate. The line obtained in this manner was greatly overexposed.

The obtained spectra were compared with the spectra of ordinary Raman scattering. The comparison has shown that the observed lines correspond to the strongest lines in the spectrum of ordinary Raman scattering ($\Delta V = 1593\ cm^{-1}$ for stilbene, $\Delta V = 1145\ cm^{-1}$ for anisal-para-amino-azobenzene, $\Delta V = 1328\ cm^{-1}$ for azoxyphentole, and $\Delta V = 1280\ cm^{-1}$ for 4,4'-para-azoxyanisol). The foregoing facts allow us to assume that the observed phenomenon is stimulated Raman scattering of light in the powder.

The possibility of observing SRS in fine-crystal substances can in all probability be explained as follows. Multiple passage of light through the individual crystallites causes the intensity of the SRS line to increase exponentially with the path length. This increase can mask the reduction in intensity due to the dispersion of the sample. It is important to note that we were unable to excite SRS in a stilbene single crystal of 10 mm thickness.

The observed SRS phenomena in powders extend greatly the number of objects for which these spectra can be obtained.

EFFECTS OF NUCLEAR AND COULMB INTERACTION OF NUCLEONS IN THE FINAL STATE IN THE CASE OF THREE PARTICLE PHOTODISINTEGRATION OF THE He^3 NUCLEUS

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In a recent article, Dzhibuti et al. [1] criticized the work reported in [2,3]. The main content of their remarks reduces to the following.

It is stated that the theory with distorted waves in the final state, developed in [2,3], is not suitable for a description of the energy spectra of the neutrons in the reaction

$$\gamma + He^3 \to p + p + n. \qquad (1)$$

The authors of [1], to the contrary, are of the opinion that the Born approximation (plane waves in the final state) describes satisfactorily both the neutron spectrum and the spectrum of the protons in the reaction (1).

As a consequence, the hypothesis is advanced that the effects of the Coulomb and nuclear forces almost cancel each other in the process under consideration.

The starting point of all these conclusions by Dzhibuti et al. was an error in Fig. 15 of [2]. In order to construct the plots correctly in this figure, all the ordinates of the theoretical distributions must be multiplied by a factor $[2t^{1/2}(1 - t^{1/2})]^{-1}$, where t is the ratio of the nucleon energy E_N to its maximum possible energy E_M (a corrected figure was published by us in the Russian version of the article [4] and in [5]). Calling attention to this error, which in our opinion is insignificant, Dzhibuti et al. [1], unfortunately, then continued to give an incorrect general interpretation of the results of [2,3]. In comparing different variants of the theoretical neutron spectra with the experimental data, the authors of [1] arbitrarily normalized the spectrum obtained with the distorted waves and identified it with the results of [2,3]. The figure in the paper of Dzhibuti et al. [1] is so constructed that the ordinate scale for curves 1 - 4 (calculation with plane waves) was chosen to be most favorable for comparison of theory with experiment, whereas the scale of curve 5 (calculation with distorted waves) was chosen too small, giving an incorrect impression that there is a sharp discrepancy between theory and experiment. Actually, if curve 5 is suitably normalized (neither of the compared theories claims to yield the absolute value of the cross section), it is possible to describe satisfactorily the form of the spectrum, with the exception of a narrow region corresponding to small relative proton momenta ($0.9 \lesssim t \leq 1.0$). But this discrepancy is expected, since the theory in [2,3] has been developed for the tritium nucleus, and in the case of the He^3 nucleus there should appear Coulomb effects which are important precisely in the region of small relative proton momenta. In comparing the theory of [2,3] with the experimental data on He^3, we started from the assumption that the Coulomb effects have little influence on the photodisintegration cross sections and on the photonucleon spectra. As already noted above, Dzhibuti et al. held to a different point of view concerning the ratio of the nuclear and Coulomb interaction of the nucleons also in the final states of the process under consideration. In order to estimate the actual role of the Coulomb effects in reaction (1), we have carried out special calculations. Figures 1 and 2 show respectively the energy spectra of the neutrons and protons calculated under the assumption of the single-particle nuclear excitation mechanism [5], the only modification to the computation scheme of [5] being the addition of the Coulomb field to the nuclear potential of the (p, p) interaction in the channel

$$\gamma + He^3 \to (p+p)_{I=0^+} + n. \qquad (2)$$

All the theoretical histograms, both with plane waves (circles) and with distorted waves (points), have been constructed for an energy $E_\gamma - Q = 8$ MeV, corresponding approximately to the maximum of the cross section of the reaction (1) (E_γ - energy of the γ quantum, $Q = 7.72$ Mev - reaction threshold). The experimental histograms [2] are represented by dashed lines. The normalization of the theoretical cross section curves is chosen such that the areas of the experimental and theoretical histograms are equal.

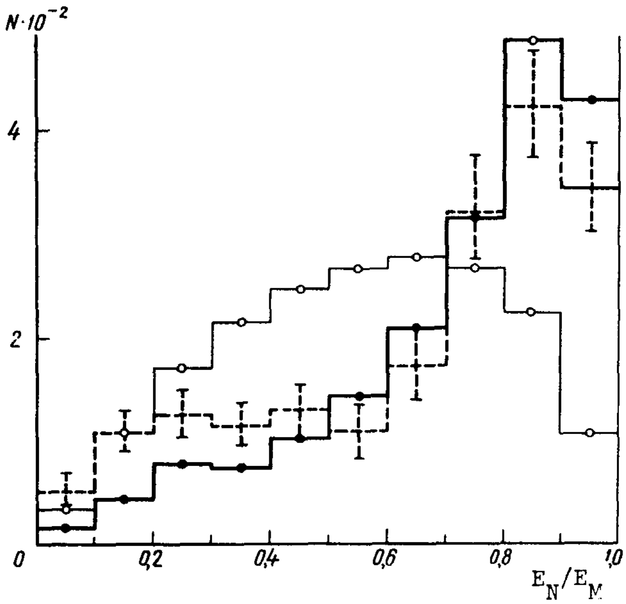

Fig. 1

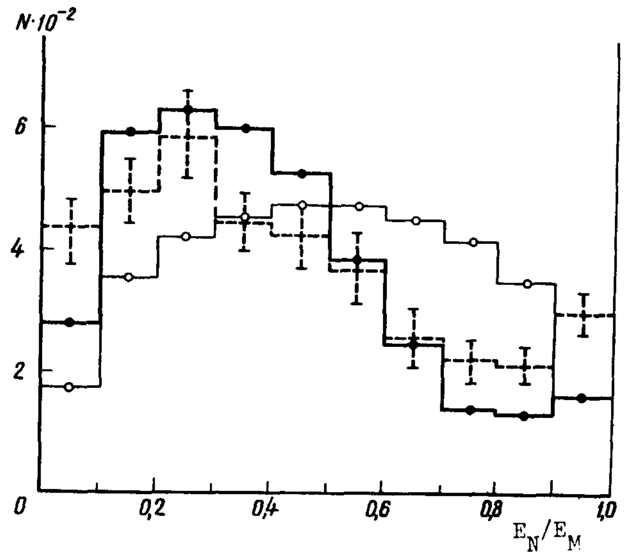

Fig. 2

In comparing the histograms, attention should be called first of all to the fact that the results of calculations with plane and distorted waves are significantly different. This would not take place if the nuclear forces were approximately balanced by the Coulomb field. Further, in spite of the opinion of Dzhibuti et al., it is seen from the figures that the theory with the distorted waves describes satisfactorily the experimental spectra, whereas calculations with plane waves are patently not in agreement with the experimental data.

Thus, the criticism in [1] of the work in [2,3] appears to be entirely inconsistent.

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