Values of certain parameters of Mossbauer spectra: H_{eff} - effective magnetic field at Fe^{57} nucleus in the corresponding sublattice; $(S_1 - S_2)$ - quantity characterizing the quadrupole splitting (S_1 - distance between first and second lines of six-line spectrum, S_2 - distance between fifth and sixth lines); $\delta_a - \delta_{a'}$ and $\delta_d - \delta_{d'}$ - differences of the isomer shifts for the sublattices a and a', d and d'.

T, °K	H^a_{eff}, kOe	$H^{a'}_{eff}$, kOe	H^d_{eff}, kOe	$H^{d'}_{eff}$ kOe	$(S_1 - S_2)^a$, mm/sec	$(S_1 - S_2)^{a'}$, mm/sec	$(S_1 - S_2)^d$, mm/sec	$(S_1 - S_2)^{d'}$, mm/sec	$\delta_a - \delta_{a'}$, mm/sec	$\delta_d - \delta_{d'}$, mm/sec
300	464 ±5	442 ±5	373 ±5	367 ±5	−0,18 ±0,07	−0,28 ±0,07	−0,18 ±0,07	−0,21 ±0,07	+0,05 ±0,07	+0,18 ±0,07
78	547 ±6	530 ±6	468 ±6	470 ±6	−0,16 ±0,08	−0,08 ±0,08	+0,04 ±0,08	+0,04 ±0,08	0 ±0,08	+0,36 ±0,08

between the EFG axis in the field H_{eff} (which coincides with the easiest magnetization axis). This case was considered in sufficient detail in [1, 3], and was apparently observed experimentally by van Loef [4].

A preliminary analysis shows that the effect observed by us cannot be fully explained by any of the aforementioned mechanisms.

The author thanks L. M. Isakov for interest in the work and T. M. Krylov for supplying the samples.

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ANGULAR DEPENDENCE TO TWO-PHOTON ABSORPTION IN A ZINC-SULFIDE CRYSTAL

M. D. Galanin and Z. A. Chizhikova
P. N. Lebedev Physics Institute, USSR Academy of Sciences
Submitted 14 September 1968
ZhETF Pis. Red. 8, No. 10, 571 - 574 (20 November 1968)

We measured the dependence of two-photon absorption in a crystal of zinc sulfide on the mutual orientation of the polarization of the light and the crystallographic axes. The results show that the two-photon transition in the region near 5 eV occurs between the bands Γ_{15} and Γ_1.

To measure the angular dependences of the two-photon absorption we used a procedure with two independent light sources, as described in [1, 2]. In this procedure, the light from the two sources passes through the crystal in opposite directions, both beams are linearly polarized, and the directions of the electric vectors $\vec{E}_1$ and $\vec{E}_2$ in the beams can be established parallel or perpendicular to each other. The high-power light source was a ruby laser with power of about 10 MW/cm^2. The two-photon absorption was determined by measuring the decrease of the transmission of the light from the second source (ordinary flash lamp) at the instant of action of the light from the laser on the crystal.

The investigated 1.5 x 0.6 cm crystal, grown from the melt, has in accordance with [3, 4] a hexagonal structure. The orientation of the crystal was determined from the cleavage plane (according to [4] this is the (1120) plane) and the direction of the optical axis. In the latter case, the direction of propagation of both light beams was perpendicular to the cleavage plane.

The wavelength of the second source was varied with the aid of a monochromator between 540 and 400 nm, corresponding to an energy 4 - 5 eV for the sum of the two photons. The spectrum of the two-photon absorption in this region (Fig. 1, room temperature, flux 3 x 10^{25} photons/cm^2 sec) agrees well with the data obtained for the longer-wavelength region with the aid of a neodymium laser [5].

The angular dependences were measured for the short-wave part of this section of the spectrum. The directions of the electric factor $\vec{E}_1$ of the laser light and of the vector $\vec{E}_2$ of the light of the second source were set parallel or perpendicular to each other, and the dependence of the absorption on the angle of rotation θ of the crystal relative to the direction of the propagation of the light beams was measured.

Observations along the optical axis revealed no dependence on θ, but the absorption at $\vec{E}_1 \parallel \vec{E}_2$ was 1.6 ± 0.2 times larger than for $\vec{E}_1 \perp \vec{E}_2$. Observations perpendicular to the optical axis revealed a distinct angular dependence, which differed greatly from $\vec{E}_1 \parallel \vec{E}_2$ and $\vec{E}_1 \perp \vec{E}_2$ (Fig. 2).

The theory of the angular dependence of two photon absorption was presented in [6] for interband or exciton transitions in crystals, and showed that the form of the angular dependence is determined by the symmetry of the states between which the two-photon transition takes place. In our investigations [1, 2] the application of this method to molecular crystals has made it possible to determine uniquely the symmetry of the final state in two-photon absorption.

The ZnS crystal has no inversion center and it can be expected that the two-photon

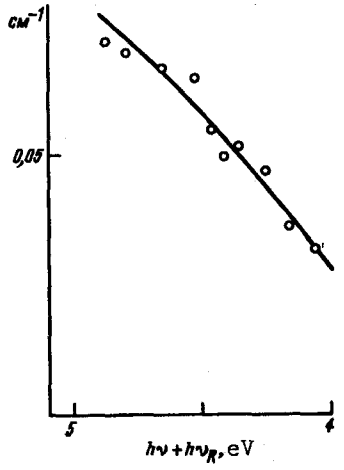

Fig. 1. Spectrum of two-photon absorption of ZnS

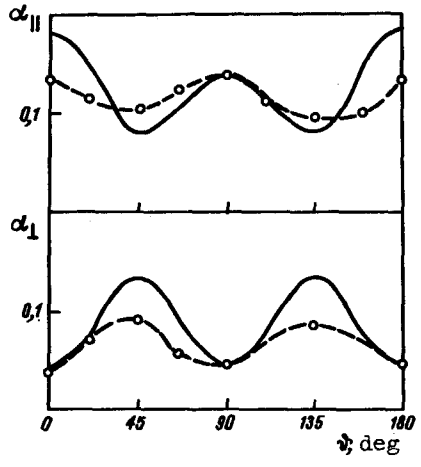

Fig. 2. Angular dependences of two-photon absorption observed perpendicular to the optic axis. Solid curves - calculated.

	Along axis		Perpendicular to axis	
	$E_1 \parallel E_2$	$E_1 \perp E_2$	$E_1 \parallel E_2$	$E_1 \mid E_2$
$\Gamma_1 (A_1)$	1	0	1	0
$\Gamma_{12}(E)$	1/4	1/4	$1/4l^4 + 2l^2n^2$	$1/2(l^2+n^4) - 3/4\,l^2n^2$
$\Gamma_{15}(T_2)$	1	2/3	$1+1/3n^4 - 2l^2n^2$	$1 - 2/3(l^2+n^4) + 11/9\,l^2n^2$
$\Gamma_{25}(T_1)$	0	1	0	1

transitions occur in the same states that are known from the single-photon absorption spectrum. The spectra of the hexagonal and cubic ZnS are very similar [7, 8], since the splitting in the hexagonal field is small. It can therefore be assumed that, in spite of the hexagonal structure of the investigated crystal, the observed symmetry of the transitions under conditions of room temperature and broad bands will correspond to the cubic group. The investigated region of the spectrum lies between the maxima of the ordinary absorption 3.8 and 5.8 eV. The first maximum corresponds to the transition $\Gamma_{15} \to \Gamma_1$ and the second was initially ascribed to the transition $\Gamma_{15} \to \Gamma_{15}$, but it is noted in [10], in connection with the theoretical calculations of [9], that its interpretation should be reviewed.

The angular dependences for the representations of the cubic group as functions of the cosines of the angles between $\vec{E}_1$ and $\vec{E}_2$ and the axis of the cubic coordinate system are given in [6]. For comparison with experiment, it is necessary to transform the coordinates, taking into account the fact that the optical axis in a hexagonal crystal corresponds to the [111] direction in the cubic structure [7], and the $(11\bar{2}0)$ plane corresponds to a plane perpendicular to (110) and passing through the [111] direction. The angular dependences as functions of the cosines of the angles n and l between the vector $\vec{E}_1$ and the axes of the hexagonal coordinate system obtained in this case are listed in the table for the two particular cases $\vec{E}_1 \parallel \vec{E}_2$ and $\vec{E}_1 \perp \vec{E}_2$ (the parentheses contain the representations in the notation used in [6]). In observations perpendicular to the axis $n = \cos\theta$ and $l = \sin\theta$, where $\sin\theta$ is the angle of rotation of the crystal reckoned from the direction of the axis.

The angular dependence for the $\Gamma_{15} \to \Gamma_1$ should be determined by the representation Γ_{15} (since Γ_1 is fully symmetrical), and that for the $\Gamma_{15} \to \Gamma_{15}$ transition should be determined by the direct product $\Gamma_{15} \times \Gamma_{15}$, which includes all four representations indicated in the table. Our experimental data are in satisfactory agreement with the theoretical angular dependence for $\Gamma_{15} \to \Gamma_1$. Actually, for observation along the axis, the ratio $\alpha_\parallel/\alpha_\perp$ should be 3/2, which agrees within the limits of errors with the experimental value $\alpha_\parallel/\alpha_\perp = 1.6 \pm 0.2$. The calculated angular dependences of the $\Gamma_{15} \to \Gamma_1$ transition for observation across the axis are shown in Fig. 2 and we see that they also agree qualitatively with the experimental data. The weaker modulation of the experimental curves, compared with the calculated ones, can be attributed to insufficient collimation of the light beam of the second

source (±5°) and to the inaccurate orientation of the crystal, although one cannot exclude fully the influence of the small contribution of other transitions.

The authors thank L. A. Sysoev for supplying the zinc-sulfide crystals.

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SINGLE CHARGE EXCHANGE OF π^+ MESONS AND SPECTROSCOPY OF LIGHT NUCLEI

T. I. Kopaleishvili
Tbilisi State University
Submitted 5 July 1968
ZhETF Pis. Red. 8, No. 10, 575-579 (20 November 1968)

In a recently published paper [1] it was proposed to use single charge exchange of $\pi^{\pm}$ mesons on light nuclei to obtain information on the np correlation in the nucleus. In the opinion of the author of [1], it is necessary to use for this purpose the differential cross section of the charge exchange $A(\pi^{\pm}, \pi^0)B$, summed over all possible states of the final nucleus, i.e., it is necessary to use the sum rules for the differential cross section.

In our opinion, the process of single charge exchange of $\pi^{\pm}$ mesons can be used also for spectroscopic purposes. In this paper we discuss such a possibility in the case of light nuclei, for which the isospin T (which plays an important role in our reasoning) is a sufficiently good quantum number. As is well known, T = 0 or 1/2 for stable light nuclei in the ground state. Therefore, the nucleus B obtained in the reaction $A(\pi^{\pm}, \pi^0)B$ will be characterized by an isospin value T_b larger by one unit than the isospin of the nucleus A (T_a). It is clear that the production of a nucleus B in different energy states will correspond, generally speaking, to the different maxima in the energy spectrum of the π^0 mesons. One can expect the character of this spectrum to depend on the π^0-meson emission angle. By investigating the spectrum of the π^0 mesons and their angular distribution, it is possible in principle to obtain information on those excited states of the target nucleus A, which are characterized by the value of the isospin larger by unity than the isospin of the ground state. It is obvious that to obtain such information it is necessary that: 1) the reaction cross section be sufficiently large, 2) that the pion resolution energy (especially that of the π^0 mesons) be sufficiently good. As to the π^0-meson angular distribution, it can apparently be easily measured.

To illustrate the foregoing, let us consider by way of an example the charge exchange of π^+ and π^- mesons on the nucleus He^4 ($T = 0$, $J^{\pi} = 0^+$) with production of the nuclei Li^4 and H^4 respectively in definite energy states. We chose this example because, first, the ques-