THE DEFORMATION OF ^{26}MG FROM PARTICLE-GAMMA ANGULAR CORRELATIONS

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Particle-γ angular correlations provide more detailed information about reaction mechanisms and nuclear structure than differential cross sections. In the special case of $(\alpha,\alpha_1\gamma)$ angular correlations on even-even nuclei it is possible to determine the individual reaction amplitudes, which describe the transitions to the various magnetic substates of the excited residual state. Therefore $(\alpha,\alpha_1\gamma)$ angular correlation measurements are especially suitable for the study of reaction- and structure-models and their parameters.

The "in-plane" angular correlation function for α-particle scattering and the spin sequence 0^+-2^+-0^+ is given by

$$W(\theta_\alpha=\frac{\pi}{2},\phi_\alpha ; \theta_\gamma=\frac{\pi}{2}, \phi_\gamma) = A(\phi_\alpha) + C(\phi_\alpha) \cdot \sin^2 2(\phi_\gamma-\phi_2(\phi_\alpha)).$$

The quantities A, C and ϕ_2 which depend on the α-particle scattering angle ϕ_α are simply related to reaction amplitudes [1].

Using the 104 MeV α-particle beam of the Karlsruhe isochronous cyclotron we measured $(\alpha,\alpha_1\gamma)$ in-plane correlations on ^{24}Mg, ^{28}Si and ^{26}Mg. The experiments were performed with a multidetector arrangement consisting of four Si(Li) α-particle detectors and two Ge(Li) γ-detectors. The data were analyzed in terms of coupled channels on the basis of the symmetric rotator model in the frame of the extended optical model. The correlation data, especially the amplitude C of the angular correlation function, were found to be very sensitive to the sign of the intrinsic quadrupole deformation [2]. The characteristic prolate-oblate effects turned out to be independent of the used potential parameters.

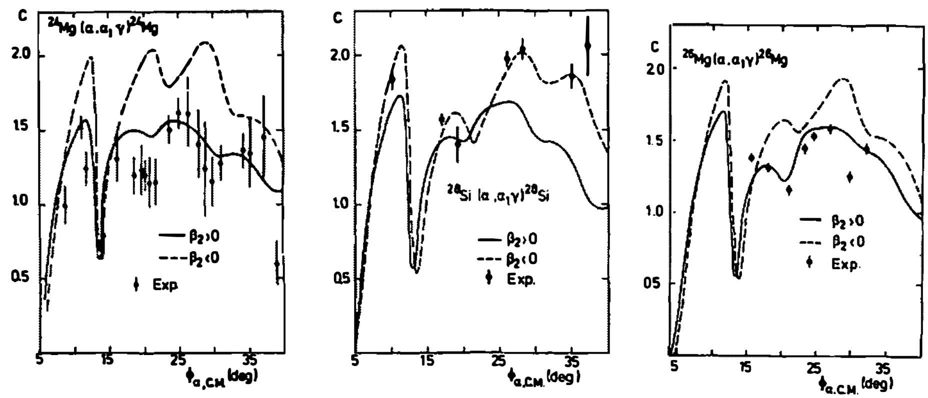

Fig. 1: Experimental correlation amplitudes C of the reactions ^{24}Mg, ^{28}Si, ^{26}Mg(α,$\alpha_1\gamma$) and coupled channels predictions for prolate and oblate deformation.

In fig. 1 the correlation amplitudes C are shown for the three nuclei investigated. The curves represent CC calculations with the parameters resulting from the best fits to the respective differential cross sections for prolate and oblate deformation. For ^{24}Mg and ^{28}Si prolate and oblate deformation respectively is favoured already in the best fits to the elastic and inelastic cross sections, although in both cases the cross sections can be reproduced well by calculations with both signs of deformation [3]. The drastic prolate-oblate effects in the correlation amplitude C, however, allow an unambiguous decision on the deformation sign [2].

In contrast to ^{24}Mg and ^{28}Si the sign of the quadrupole deformation of ^{26}Mg is not definitely assigned. From the cross sections, which again are described very well by CC calculations [3] no indication about the deformation sign can be obtained. Obviously the correlation data (fig. 1) clearly suggest prolate deformation for ^{26}Mg providing α-γ angular correlations to be a powerful tool to get information about the deformation of nuclei.

1. H. Wagner et al., Phys. Lett. 47B, 497 (1973)
2. W. Eyrich et al., Phys. Lett. 63B, 406 (1976)
and Nucl. Phys. A287, 119 (1977)
3. H. Rebel et al., Nucl. Phys. A182, 145 (1972)