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Title: **Search for the Jacobi instability in rapidly rotating ^{46}Ti***

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Hot and rotating nuclei are expected to develop many different shapes with increasing rotational frequency. At low angular momentum, if their thermal energy is low, shell effects are dominant and nuclei are either spherical or prolate with rather small deformations. When the thermal energy is sufficiently large, the role of shell effects becomes smaller and according to the liquid drop model [1] the nucleus, under the influence of rotation, undergoes a prolate(spherical)-oblate shape phase transition. The size of the oblate deformation increases with the rotational frequency. When the rotational frequency is sufficiently large, the nucleus might undergo another shape phase transition, in which the nucleus becomes triaxially elongated. This transition called Jacobi transition (Jacobi instability) is expected to be rather better seen in light nuclei, where high rotational frequencies can be reached before the fission competition dominates. For example for nuclei with mass A≈45 the critical angular momentum for the Jacobi transition is expected to be at ≈30 $\hbar$.

The first experimental evidence for the Jacobi shape transition was obtained for the ^{45}Sc compound nuclei based on inclusive spectra [2]. In the photon absorption cross-section, apart from the lorentzian shape centered at 18 MeV corresponding to the GDR of nuclei with small deformation, a shoulder at $E_\gamma \approx 25$ MeV was found. This has suggested large effective deformation of the compound system at high rotational frequencies. However, the corresponding A_2 coefficient of the angular distributions did not show the correct expected behaviour.

To verify the existence of Jacobi shapes and to understand the unexpected behaviour of the measured angular anisotropy another experiment was made for the neighbouring ^{46}Ti nucleus. It allowed to obtaine more exclusive data corresponding to better selected regions of the angular momentum. For this experiment the HECTOR array [3] and the accelerator facility of the Niels Bohr Institute in Risø (Denmark) were employed. The reaction used was 98 MeV ^{18}O on ^{28}Si target, producing the compound nucleus ^{46}Ti at the excitation energy of 81 MeV, and with angular momentum distribution having $l_{max} \approx 32\ \hbar$. The high-energy spectra, measured in the BaF_2 detectors at different angles, were obtained as a function of the multiplicity filter's folds. The results of this experiment, confirming the existence of Jacobi shapes, will be presented and the comparison to the theoretical prediction will be discussed.

References

[1] S. Cohen, F. Plasil, W.J. Świątecki, Ann. Phys. (N.Y.) 82 (1974) 557.

[2] M. Kicińska-Habior et al., Phys. Lett. B308 (1993) 225.

[3] A. Maj et al., Nucl. Phys. A571 (1994) 185.

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