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g-factor Measurements for Isomeric States in 174W

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A lively topic of the nuclear physic investigation concerns the study of high-K isomeric states. These states are useful to understand the nuclear structure and can provide crucial information for testing the theoretical models. Furthermore, the knowledge of the properties of these long-living states may be useful for practical applications in medicine and energy storage methods.

The K quantum number is defined as the projection of the total angular momentum on the symmetry axis of symmetrically deformed nuclei, and the decay among states characterized by different values of K is governed by selection rules. Even if K isomers have been observed in many nuclei, mostly in the A ~ 180 region of the nuclide chart corresponding to well deformed nuclei (like Hf, W and Os isotopes), their decay mechanism is not yet well understood. One hypothesis is the mechanism of K-mixing, in which the mixing of configurations with different K gives the reduced hindrance factor of these states [1]. Another mechanism is the gamma-tunneling, in which non-axial fluctuations of the nuclear shape are responsible for the tunneling of the nucleus between configurations with different values of the triaxiality parameter gamma. This latter mechanism has proved to well describe the behaviour of K isomers in the A ~ 180 region [2].

In this contribution we report on a recent study of the isomeric states of 174W through the measurement of their giromagnetic factors. This nucleus is of particular interest since the 12+ isomer shows a decay branch going directly to the ground state band, thus implying a change of 12 units of K. The gamma-tunneling mechanism fail to account for the properties of this particular state [3]. In order to analyse this state in term of K-mixing, the knowledge of its multi-quasiparticle configuration is necessary. The nuclear observable connected to the configuration of multi-quasiparticle of the level is the magnetic dipole moment, which can be determined through giromagnetic factor measurements.

The experiment was performed at Legnaro National Laboratory, exploiting the well known TDPAD technique, using the existence GAMIPE apparatus which will be described in detail. The isomeric states were populated using the reaction 162Dy(16O,4n)174W at beam energy of 84MeV.

The measured value of g-factor has been compared with theoretical estimates for achieved the multi-quasiparticles configuration of the level 12+. This result will be the starting point for the explanation of the decay mechanism of this level through the K-mixing model.

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[2] K. Narimatsu et al., Nucl. Phys. A 601, 69 (1996)
[3] S.K. Tandel et al., Phys. Rev. C 73, 044306 (2006)

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