**Evidence of rotational behavior in 120Te isotope**

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In recent years the region in the vicinity of tin isotopes has been intensively investigated both from experimental and theoretical perspectives. In particular, the excitation energies and the reduced transition probabilities across the Z=50 chain has been examined in detail. The Te nuclei with 52 protons lies in the transitional region between the spherical nuclei at *Z* = 50 and deformed Xe and Ba nuclei. For the mid-shell 120,122,124Te nuclei the partial level show the expected vibrational-like structure with equal energy spacing between the phonon states [1]. This observation is quite in contrast to the measured quadrupole moments Q2+ for the doubly even Te isotopes [2, 3]. These quadrupole moments can reach 60% of the one predicted by the symmetric rigid rotor.

In our recent Coulomb excitation experiment [4] at IUAC, New Delhi we used 58Ni beam @ 175MeV to excite 120,122,124Te isotopes. In these measurements the scattered particles were detected at forward angles. The B(E2; 0+ → 2+ ) value in 120Te was re-measured with a much higher precision to allow a comparison with the predictions of the large scale shell model calculations (LSSM). Based on all experimental findings including the excitation of higher excited states for 120,122,124Te one obtains the best agreement with an asymmetric rotor behavior. Calculations were performed using the Davydov-Filippov model which reproduce the reduced transition probabilities with β=0.19 and γ~27°. But, microscopic calculation (using the Skryme effective interaction) performed point towards a vibrational structure with a mean value of γ~30°. The most sensitive probe to characterize a nuclear excitation is via the measurement of quadrupole moments.

Therefore, to further investigate the second order effects (diagonal matrix elements) in 120Te, an experiment was performed at Heavy Ion Laboratory, Warsaw, where particle detectors are in the backward direction enabling a more precise and sensitive measurement of the quadrupole moments. The measurement was carried out using a highly enriched 120Te target and a 32S beam @ 100 MeV from the U-200P cyclotron at HIL. A multi-step Coulomb excitation of 120Te was observed up to 4+ state in the g.s. band. Along with second 0+ and second 2+ states were also populated. The relative signs and magnitude of the transitional matrix elements between populated states were determined. The diagonal matrix element for the 2+ state was determined and has significant value different from zero with a negative sign, which shows a rotational character of the collective structure of 120Te. The results will be interpreted with the collective models of nuclear structure.

References

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