STUDY OF ISOSPIN SYMMETRY IN ^{80}Zr

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The knowledge of the isospin impurity (i.e. isospin mixing) is important since it affects the properties of the Isobaric Analog States (IAS) and the Fermi beta-decay of the N = Z nuclei near the proton drip-line. Indeed, the effect of the isospin impurity on the beta-decay has implications in the Fermi transition rates, and thus on the Cabibbo-Kobayashi-Maskawa matrix.

The breaking of isospin symmetry increases with Coulomb interaction and can be observed through decays which would be forbidden by selection rules. This is the case of the E1 decay from self-conjugate nuclei in a isospin I=0 configuration. To fully exploit this property, one should go in the region of the Giant Dipole Resonance (GDR), where most of the E1 strength is concentrated. This approach has been employed to measure the isospin mixing in nuclei at finite temperature T, formed in fusion evaporation reactions. In this type of experiments the use of self-conjugate projectile and target nuclei ensures the population of a compound nucleus (CN) with I=0. The hindrance of the GDR gamma decay can be measured and thus the mixing amplitude deduced. A partial restoration of the isospin symmetry is expected at high temperature due to the decreasing of CN lifetime for particle decay.

In the present case isospin mixing was measured in the hot CN ^{80}Zr. This is the heaviest N=Z nucleus which can be formed with stable target and beam and only one datum exists at finite temperature [1]. In this mass region the deviations between different predictions are the largest and thus this nucleus provides a good test for theory [2]. The experimental method is based on the analysis of the GDR γ-ray emission in the fusion reactions ^{40}Ca+^{40}Ca at E= 136 MeV. The experiment was performed in Laboratori Nazioni di Legnaro using an array of segmented HPGe detectors and a large volume $LaBr_3$:Ce (AGATA-HECTOR$^+$ array).From data analysis three relevant results were obtained:

- The Coulomb spreading width was found not to depend on the excitation energy of the nucleus, in agreement with theory.
- The comparison between this measurement and that at higher temperature shows clearly the restoration effect of isospin symmetry.
- The combined analysis of the experimental data allowed to deduce for this nucleus the isospin mixing at T=0, information that in not accessible in other ways. A constraint to theory can thus be given [2].

In addition the isospin-symmetrybreaking correction δ_C used for the Fermi superallowed transitions was extracted from the present analysis and was found to follow the predicted trend and to be consistent with the β-decay data.

REFERENCES

[1] A. Corsi et al., Phys. Rev. C 84, 041304(R) (2011)
[2] W. Satula et al., Physcs Review Letters 103, 012502 (2009)