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MED and TED in the rotational A=78, 82 T=1 triplets

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Isobaric multiplets along N=Z line have been object of constant interest due to the fact that this region of the nuclide chart is the only place where it is possible to find answers to some fundamental problems in nuclear physics, such as the isospin symmetry. Isospin symmetry is violated by the electromagnetic interaction and by nuclear forces. One of the consequences of this symmetry is that the level schemes of mirror nuclei (obtained interchanging neutrons and protons) should be identical in the absence of symmetry-breaking interactions. Signatures of the isospin symmetry breaking in mirror nuclei are, therefore, the differences between the excitation energy of analogue states, called mirror energy differences (MED). Although the Coulomb interaction is the main responsible for the isospin symmetry breaking (ISB), sizable contributions may arise from the residual nuclear interaction [1,2]. This has been systematically studied in the f7/2 shell. However, the particularity of the structure of nuclei of the f7/2 shell is that this orbital largely dominates the wave functions. This may mask the fact that the ISB VB term could not be an exception of this orbital, but, more generally, could appear in other orbitals. The extension of these investigations to other mass regions is therefore very important to check the limits of validity of the isospin symmetry for different masses, to look for possible ISB contributions, such as those identified in the f7/2 shell, and to search for other isospin non-conserving effects. Preliminary calculations on this line suggest that the additional isovector VB term is necessary to reproduce the MED in the sd shell.
While MED are very sensitive to the nuclear structures properties (and in particular in monopole effects), the difference of excitation energy of analogue states in triple T=1nuclei (TED), depend only on multipole effects [3,4].

In this LoI we propose to measure the MED and TED in the triplet T=1 A=82 and A=78, by measuring for the first time excited states in 82Mo and 78Zr. These nuclei will be populated by two-neutron knock out from 84Mo and 80Zr. With present day primary beam of 124Xe on a Be target. In the same experiment it be also possible to measure the MED in the T=1/2 mirrors A=83 and A=79 for the first time in one-proton and one-neutron knock out. These studies will allow to extend the systematics to nuclei in which the wavefunctions are characterized by configurations where the role of the g9/2 orbit is dominant and therefore determine the eventual ISB arising from this orbital in both the TED and the MED.
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