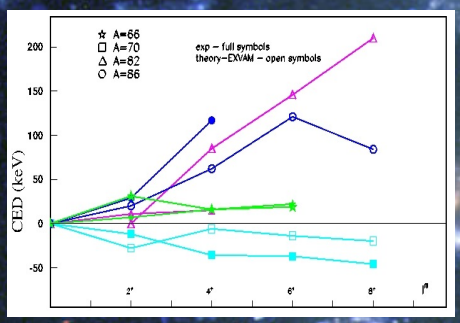
Advanced Microscopic Studies on Structure and Dynamics of Exotic Nuclei

Research activities in theoretical nuclear physics are devoted to nuclei with unusual N/Z ratios which are proper candidates to get insight into the fundamental interactions and symmetries having relevance for nucleosynthesis and significance for astrophysical scenarios concerning the rp-process and r-process path. Our studies include the beyond-mean-field microscopic many-body variational approaches belonging to the Vampir-Monster model family adequate to address essential questions concerning the structure and dynamics of medium mass nuclei near the drip lines.

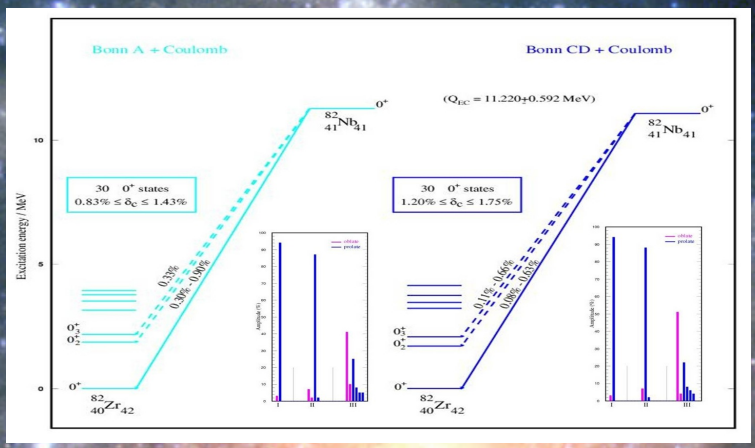
We also focus on a systematic derivation of suitable effective nucleon-nucleon interactions from modern charge-dependent forces tailored to be used with large model spaces and state-of-the-art Vampir models as an essential step on the way to the realistic description of exotic nuclear phenomena.

The goals are reached within European and international collaborations like: NUSTAR (HISPEC-DESPEC), DFG, ISOLDE, ENSAR-THEXO, NuPNET-SARFEN, FRIB.

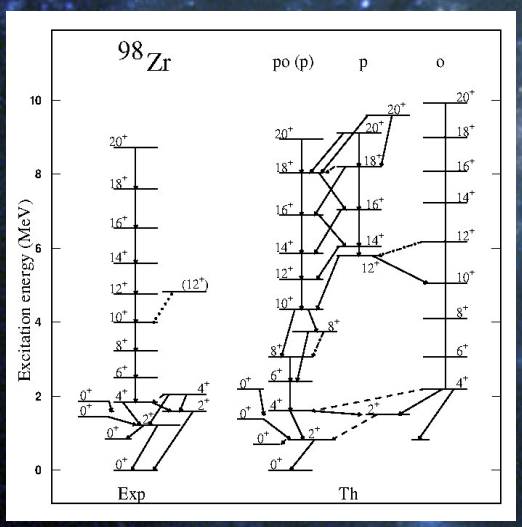
Significant recent results addressing different open questions are illustrated in the following figures



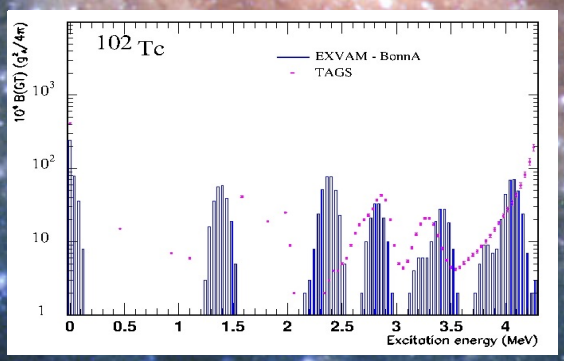
Isospin-symmetry-breaking and shape-coexistence effects on Coulomb Energy Differences



Isospin- and shape-mixing effects on superallowed Fermi β-decay between T=1 analogue states



Shape coexistence and mixing in neutron-rich nuclei



Beyond-mean-field description of exotic Gamow-Teller β-decay

References

- A. Petrovici, K.W. Schmid, O. Radu, A. Faessler, Phys. Rev C 78 (2008) 044315
- A. Petrovici, K.W. Schmid, O. Radu, A. Faessler, Phys. Rev C 78 (2008) 064311
- A. Petrovici, J. Phys. G: Nucl. Part. Phys. 37 (2010) 064036
- A. Petrovici, K.W. Schmid, A. Faessler, Prog. Part. Nucl. Phys. 66 (2011) 287
- A. Petrovici, Phys. Rev. C 85 (2012) 034337
- D. Jordan, A. Petrovici et al., Phys. Rev. C 87 (2013) 044318