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Neutron deficient exotic nuclei and
the Physics of the "proton rich side" of the nuclear chart

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Spectroscopy studies of N≈Z nuclei

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The properties and structure of nuclei with equal number of protons and neutrons have been in the last decades an intense field of research, both experimentally and theoretically. The structure of these nuclei provide essential infomation, among other things, about the isospin symmetry of the nuclear force as well as on proton-neutron correlations. As an example, the isobaric analogue states in mirror nuclei have shed light on the presence of isospin non-conserving forces in nuclear matter. From the detailed studies of energy differences between those states, an important theoretical understanding of the nuclear force in the f p shell [1], has been achieved, recently extended to include the g9/2 [2, 3]. Furthermore, N = Z nuclei present enhanced correlations between neutrons and protons that occupy orbitals with the same quantum numbers. For heavier N = Z nuclei the T = 0 isoscalar correlations become more relevant than the usual T = 1 isovector pairing, giving rise to an unusual type of nuclear superfluidity [4].
Spectroscopy of excited states of these neutron-deficient nuclei has been demonstrated to be a powerful tool to understand in detail the nature of the nuclear force. This has been possible thanks to the advent, in the last decades, of large γ -ray arrays with the associated complementary detectors that allowed to access these very exotic N≈Z nuclei at high spins. Future studies of the exotic neutron-deficient nuclei will mainly require the use of reactions induced by intense radioactive heavy-ion beams as those provided by near-future facilities and in the future by Eurisol. This will allow an unprecedented study of the heaviest N = Z nuclei located even further from the line of beta stability. In this presentation, the isospin symmetry
and the proton-neutron correlations will be discussed with special attention to the perspectives offered by the new radioactive-ion beam facilities.

1. M.A. Bentley and S.M. Lenzi, Prog. Part. and Nucl. Phys. 59, 497 (2007).
2. R. Orlandi et al., Phys. Rev. Lett. 103, 052501 (2009).
3. K. Kaneko et al., Phys. Rev. C 82, 061301R (2010).
4. B. Cederwall et al., Nature 469 (2011).

Summary

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