The structure of exotic nuclei close to the proton drip–line

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Recent studies with exotic nuclei far from the stability region, lead to the discovery of one and two proton radioactivity[1], from ground state of spherical, as well as deformed nuclei. Isomeric decay and fine structure were also measured, and in some cases, a prompt proton and alpha particle emission was observed. It was established that, the majority of prompt particle decays proceeds from superdeformed initial states, into spherical daughter states, revealing a change of deformation during the decay.

Proton radioactivity has been the unique way to probe nuclear structure mechanisms in this region of stability. Since proton emitters lie beyond the proton drip–line, they also give the possibility of observing Nilsson resonances[2, 3]. In fact, the experimental data on proton radioactivity in regions where theoretical models predict a certain deformation for the nucleus, is consistent with the idea that the proton was in a single particle resonance state, in the field of the daughter nucleus. An important aspect of such calculations[4] is the inclusion of the nuclear structure properties of the core, like the rotational spectrum of the daughter nucleus, and the pairing residual interaction.

We are planning to address various questions concerning what we have learned from the data and how far our theoretical models have taken us in the region of neutron deficient nuclei at the borders of stability.

References

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