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Importance of proton drip-line nuclei to nuclear astrophysics

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Nuclear structure far from stability plays a crucial role in the processes that lead to the formation of the elements. In the specific case of the proton drip-line, its location constrains the path of nucleosynthesis in explosive astrophysical scenarios such as in supernovae and X-ray bursters.
In such scenarios, the density and temperature are so high, that rapid proton capture can occur, and unstable nuclei will be generated up to and beyond the proton drip-line. The path for these reactions depends on the level structure and existence of resonances in proton rich nuclei.
In order to achieve a theoretical understanding of the rapid proton capture (rp) process, the separation energies of proton drip-line nuclei are needed as input in the network calculations.
Direct experiments with unstable nuclei are still challenging, creating an obstacle to our understanding of their structure. However, the observation of proton emission and its theoretical interpretation has made possible to access the nuclear structure properties in the neutron deficient region of the nuclear chart, for nuclei with charges between 50 and 81[1,2]. It has also provided an indirect way to determine separation energies.
Proton radioactivity from nuclei with Z<50 is also of particular interest to estimate the time scale of the (rp) capture path, controlled by the properties of the waiting points isotopes, like for example the nucleus 72Kr, whose properties have not yet been constrained by direct measurements. The knowledge of the proton separation energies, and half-lives of the neighbour nuclei, would allow to establish the most probable path through 72Kr. This can be achieved
analysing the decay properties of Rb isotopes, recently produced at Riken [3].
It is the purpose of this talk to discuss recent developments in the field, and deduce constraints to the astrophysical processes.

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