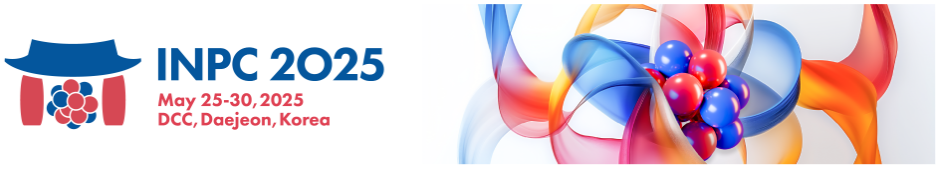

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Nuclear structure beyond the proton dripline

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The current studies of proton-unbound nuclei to be reviewed.
Nuclear structure beyond the proton drip line was addressed in a number of recent experimental and theoretical studies of the light- and intermediate- mass nuclei, see the recent review [1]. The present research status can be summarized as follows:

i) All known 1p and 2p emitters are located by 1–2 atomic mass units (amu) beyond the proton drip line. The 2p emitters exhibit three main decay mechanisms (direct, sequential and democratic) and their transition modes [2].

ii) The most exotic nuclei located in the very remote outskirts of the nuclear landscape become unbound in respect of new decay channels. Such exotic decay modes play an increasingly important role as the precursor' s decay energy grows. The most-remote isotopes are identified as far as 4 amu beyond the proton drip line and decay by emission of 3 or 4 protons.

iii) The studied 3p- and 4p- decays show sequential decay mechanisms like 1p–2p and 2p-2p emissions, respectively. In particular, there are several isotopes whose ground states (g.s.) are established as 3p emitters, i.e. 7B, 17Na, 31K, 13F, and the recently-observed 20Al [3]. The measured 3p-decay patterns in all cases include 2p emission as part of a sequential p–2p decay mechanism. This may strongly influence the predictions for unobserved-yet isotopes. More multi-proton decay modes are reported, i.e. 5p emission from 9N, and even 6p emission is foreseen from unobserved yet 20Si.

iv) Predictions for proton-unbound isotopes by using their neutron-rich mirrors and isospin symmetry indicate area of 5–6 amu beyond the proton drip line [4].

For the most remote nuclear systems, no g.s. of isotopes (and thus no new isotope identification) are expected. Therefore a new borderline indicating the limits of existence of isotopes in the nuclear chart and the transition to chaotic-nucleon matter may be discussed [5].

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Primary author: MUKHA, Ivan (Helmholzzentrum GSI, Darmstadt, Germany)

Presenter: MUKHA, Ivan (Helmholzzentrum GSI, Darmstadt, Germany)

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