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Advances and prospects in the theoretical studies of few-body decays

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Genuine (or "true") few-body decays take place due to specific energy conditions making the sequential emission of particles energetically prohibited. The systems exhibiting phenomena of this class are actually widespread in the proximity of nucleon driplines, see Figure 1. The genuine few-body emitters demonstrate different lifetime systematics compared to two-body decays, unusual excitation functions for population in reactions, and complicated correlations among the decay products. Among the phenomena connected with few-body dynamics the following are attracting nowadays the most attention.
(i) *Two-proton radioactivity*. This is the most recently (2002) discovered mode of radioactive decay. Within the decade since the discovery several examples were found (^{45}Fe, ^{19}Mg, ^{48}Ni, ^{54}Zn) and some of them well studied. The status of the research in this field is summarized in the recent review [1].
(ii) *Democratic decay*. This is the form of true three-body decay connected with availability of broad states in the two-body subsystems. The light two-proton (^{6}Be, ^{12}O, ^{16}Ne) and presumably majority of true two-neutron emitters (like ^{5}H, ^{10}He, ^{13}Li, etc.) belongs to this class. Interesting features of democratic decays are uncovered by the recent studies of ^{6}Be [2,3] and ^{10}He [4] isotopes.
(iii) *Soft dipole excitation modes* are expected in continuum of halo systems. Well understood for the two-body haloes these excitations could be quite complicated for studies and understanding in the three-body systems, such as ^{6}He, ^{8}He [5], ^{6}Be [6], and ^{17}Ne.
(iv) Existence of the *ground state neutron radioactivity* is highly improbable. However, possibility of $2n$ and even $4n$ radioactivity was demonstrated and prospects of experimental studies were discussed in [7].

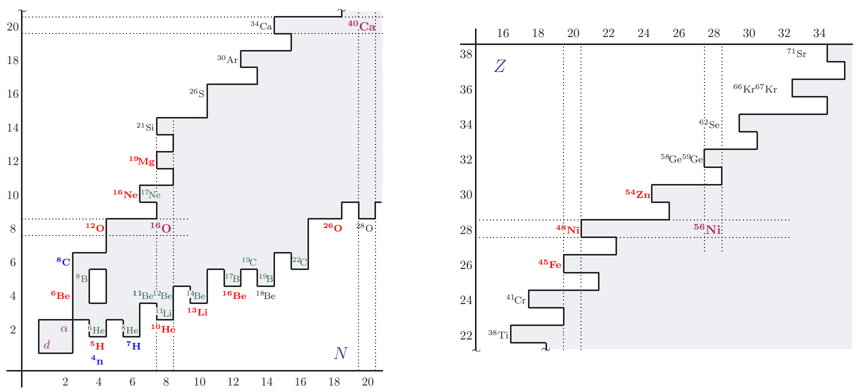

Figure 1: *Driplines in the region of light nuclei achieved for today experimentally. Known isotopes with exotic properties are indicated by coloured labels: green for halo nuclei, red for $2p/2n$ emitters, blue for $4p/4n$ emitters. The gray colour indicates the predicted but not yet discovered nuclei of the above kinds.*

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