

Two-proton radioactivity - a new nuclear decay mode

B. Blank

CENBG, Le Haut Vigneau, F-33175 Gradignan Cedex, France

For nuclei beyond the proton drip line, where the strong force can no longer bind all protons, one- and two-proton radioactivity was predicted more than 40 years ago by Goldanskii [1]. For odd- Z nuclei, one-proton radioactivity was proposed to occur, whereas for medium- and heavy-mass even- Z nuclei two-proton emission is to be expected.

Two-proton radioactivity was sought for many years without success. This research field experienced a strong boost with the advent of high-intensity projectile-fragmentation facilities. According to recent theoretical predictions, proton drip-line nuclei in the $A=40-55$ region were identified as the most promising candidates [2, 3, 4]. The recent observation of two-proton radioactivity of ^{45}Fe [5, 6] confirmed these predictions nicely. Beyond ^{45}Fe , ^{48}Ni and ^{54}Zn were regarded as possible candidates to exhibit two-proton radioactivity.

In the present paper, we will summarize experimental results for the decay of ^{45}Fe , which include data from the 2002 discovery of this radioactivity, but also new, yet unpublished data [7]. In addition, we will report on the first observation of ^{54}Zn and its decay by two-proton radioactivity [8], the second case of this new decay mode. Finally, we will discuss tentative evidence for a small two-proton radioactivity branch for ^{48}Ni .

These experimental results will be confronted to modern theories which succeed in describing reasonably well this decay mode. Finally, future studies will be presented.

References

- [1] V. I. Goldanskii, Nucl. Phys. **19**, 482 (1960).
- [2] B. A. Brown *et al.*, Phys. Rev. C **65**, 045802 (2002).
- [3] W. E. Ormand, Phys. Rev. C **55**, 2407 (1997).
- [4] B. J. Cole, Phys. Rev. C **54**, 1240 (1996).
- [5] J. Giovinazzo *et al.*, Phys. Rev. Lett. **89**, 102501 (2002).
- [6] M. Pfützner *et al.*, Eur. Phys. J. **A14**, 279 (2002).
- [7] C. Dossat *et al.*, to be published.
- [8] B. Blank *et al.*, accepted for publication in PRL.