Theoretical Predictions for Two-Proton Radioactivity

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Abstract

The nuclear shell model is used for predictions of isospin mixing of the isobaric analog states in light nuclei. Spectroscopic factors and half-lives for beta-delayed one- and two-proton emission, both isospin allowed and isospin forbidden, were calculated for ^{19,23}Mg and ^{35}Ca. Beta-decay feedings and gamma-emission branching ratios were taken into account.

The isospin mixing in the sd-shell nuclei was obtained with the isospin-nonconserving interaction of Ormand and Brown [1], based on the well-tested USD interaction by Wildenthal [2]. Woods–Saxon type single-particle wave functions were used for the radial overlaps. The spectra of the nuclei were well reproduced. The resulting wave functions were then used for the overlaps needed for the spectroscopic amplitudes. The barrier penetrabilities were calculated using regular and irregular Coulomb wave functions. The recent measurement of the beta-delayed proton spectrum of ^{23}Al by the Jyvskyl group [3] shows good agreement with our theoretical predictions. In other cases experimental data are not yet available.

In addition, isospin mixing of the isobaric analog state is calculated for ^{31,32,33}Cl, ^{36,37}K, and ^{40,41}Sc. These results are also compared with experimental data.

References

[1] W.E. Ormand and B.A. Brown, Nucl. Phys. A 491 (1989) 1.

[2] B.H. Wildenthal, Prog. Part. Nucl. Phys. 11 (1984) 5.

[3] K. Perjrvi *et al.*, in preparation.