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Particles correlations in 2-proton radioactivity

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The ground-state 2-proton radioactivity is a rare decay mode that can occur for few nuclei, beyond the proton drip-line and with an even number of protons. The phenomenon is possible due to the pairing interaction that lowers the mass and to the Coulomb and centrifugal barrier, which keeps the last proton pair inside the nucleus, until its tunneling through this barrier. The emission of a single proton being forbidden from energy conservation, the nucleus can only decay only decay by a direct emission of the 2 protons. While the *p*-*p* sub-system is necessarily correlated in the nucleus, it is unbound after the emission, which makes this decay mode a unique case of quantum 3-body process.
In order to reach a theoretical description of such a process, several aspects must be considered: the nuclear structure, the emission dynamics, and the asymptotic behavior. This decay mode has been observed experimentally for 4 nuclei: ^{45}Fe, ^{48}Ni, ^{54}Zn and ^{67}Kr. The results obtained with Time Projection Chamber devices, that allow to measure the angular and energy correlations between the emitted protons, are compared to recent theoretical descriptions. This work indicates that the process is not fully understood.

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