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Observation of unique radioactivity in spinning silver

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Radioactivity or spontaneous decay of atomic nuclei has been much studied ever since Becquerel discovered natural radioactivity in 1896. For proton-rich nuclei, one- and two-proton radioactivity were predicted in 1960 [1], with the former observed in 1982 [2]. Two-proton radioactivity has also recently been detected, e. g. by experimentally studying the decay of Fe-45 [3, 4], but identification of two protons is missing from these experiments. We have measured proton-proton correlations in two-proton radioactivity of the high-spin isomer (21+) in Ag-94 [5] which is also known to undergo one-proton decay [6] thus making the unique nuclear decay case. Striking 2p decay features are the proton-proton energy correlations and the unexpectedly large decay probability. These data can only be interpreted in a meaningful way by assuming simultaneous two-proton emission. Our results exclude sequential emission of protons via the intermediate nucleus Pd-93. The two-proton decay pattern can be explained by assuming that the parent nucleus is strongly cigar-like (prolate) deformed emitting the protons either from the same or from opposite ends of the cigar. This first measurement of correlations in 2p radioactivity, the nuclear-structure implications and plans for further experimental and theoretical studies of the properties of this truly exotic isomer will be presented. [1] Goldansky, V.I., Nucl. Phys. 19, 482 (1960). [2] Hofmann, S. et al., Z. Phys. A 305, 111 (1982). [3] Pfutzner, M. et al,. Eur. Phys. J. A 14, 279 (2002). [4] Giovinazzo, J. et al., Phys. Rev. Lett. 89, 102501 (2002). [5] I. Mukha et al., Nature 479, 298 (2006). [6] I. Mukha et al., Phys. Rev. Lett. 95, 022501 (2005).