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Investigation into the effects of deformation on proton emission rates via lifetime measurments

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Proton emission rates are highly sensitive to nuclear deformation but in all known cases the deformation has never been experimentally determined. Currently, tunnelling calculations have to rely on theoretical estimates of quadrupole deformation, a key input parameter, due to the lack of experimentally determined values. In order to address this logical weakness, A new plunger device, DPUNS, has been designed and built at the University of Manchester to measure the lifetimes of unbound states in exotic nuclei approaching the proton drip-line. The measurement of excited-state lifetimes above proton-decaying states yields information on the reduced transition probabilities which in turn can be used, albeit in a model dependent way, to ascertain the degree of deformation in the nuclear system.

The DPUNS device is designed to work in both vacuum and gas environments but will primarily be used in conjunction with the gas filled separator RITU at the University of Jyv¨askyl¨a. Combining DPUNS with JUROGAMII, RITU and the GREAT spectrometer allows the accurate measurement of excited-state lifetimes in exotic nuclei identified via charged-particle tagging.

The presentation will focus on the measurement of excited state lifetimes in the proton-emitting nucleus 151Lu (70 μb) and the impact the results have had on state-of-the-art calculations. Spectroscopic information gained from the observation of isomeric proton decays in this nucleus will also be discussed.

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