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## Lifetimes of nuclear states in proton-emitting nuclei from Differential Plunger measurements.

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Over the last few years, a programme of research at the University of Jyvaskyla, Finland has established the first measurements of the nuclear state lifetimes built above proton emitting states [1-5]. Lifetimes have been deduced in several nuclei; 109I [1], 151Lu [2,3] and 113Cs [4] for the first time using a specially constructed Differential Plunger for Unbound Nuclear States (DPUNS) plunger [5]. The new experimental results have led to the development of a non-adiabatic quasi-particle code which has been required to explain proton emission based on the experimentally deduced deformations extracted from the lifetime measurements. This talk will show how the new lifetime values for the ground- and isomeric-state proton decays in 151Lu are best interpreted by a mildly oblate deformation, settling a long-standing theoretical debate about the shape of 151Lu. The very recent lifetime results for the more deformed proton emitter 113Cs will also be discussed. In this case the wavefunctions extracted from the non-adiabatic quasi-particle code were used separately to evaluate both proton emission and gamma-ray transition rates as a function of deformation. In this study, a consistent quadrupole deformation was found to match both the experimental proton emission half-life and the lifetime of the electromagnetic state in 113Cs. This deformation is in agreement with the earlier proton emission studies, but is now more firmly supported based on the measured electromagnetic transition rates.

- [1] M. Procter, D.M. Cullen et al. Phys. Lett. B704 (2011) 118-122.
- [2] M. Procter, D.M. Cullen et al. Phys. Lett. B 725 (2013) 79-84.
- [3] M. Taylor, D.M. Cullen et al. Phys. Rev. C 91, 044322 (2015).
- [4] D. Hodge, D.M. Cullen et al. To be submitted to Phys. Rev. C. May 2016.
- [5] M. Taylor, D.M. Cullen et al. Nuclear Instr. and Methods in Phys. Res. A 707 (2013) 143-148.

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