

# A Novel Approach to Observing Nuclear Excitation by Electron Capture

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Nuclear excitation by electron capture (NEEC) is an exotic mode of nuclear excitation which has yet to be unambiguously observed. An observation of NEEC was reported in Nature in 2018, and has been subsequently significantly challenged, where the inferred NEEC probability exceeds the best theoretical estimates by nine orders of magnitude.

Corresponding to the inverse of internal conversion, an unbound electron is captured into an atomic orbital leading to excitation of the nucleus to a higher-lying excited state. NEEC is highly resonant, requiring precise energy matching between the sum of the electron's kinetic energy and the binding energy of the corresponding orbital with the nuclear transition energy, making observation really challenging. Recent theoretical work has shown that the best case for NEEC observation in an ion-beam setting is  $^{83}\text{Kr}$ , with a low-lying first excited state which can be excited to via NEEC. Presented is an entirely new experimental approach to observing NEEC based on detecting changes in the charge-state distribution following decay of the excited nucleus by internal conversion. This method provides a distinct and potentially more sensitive signature, offering a promising pathway toward its unambiguous experimental identification.