STRUCTURE OF THE STABLE XENON ISOTOPES AND THE SEARCH FOR AN E(5) CRITICAL-POINT NUCLEUS

Prof Steven Yates[1], Dr Erin Peters[1], Dr Timothy Ross[1], Dr Anagha Chakraborty[1], Dr Benjamin Crider[1], Dr Francisco Prados-Estevez[1], Dr Sharmistha Mukhopadhyay[1], Dr Stephen Ashley[1], Prof Marcus McEllistrem[1]

[1]University of Kentucky

Transitional nuclei have proven difficult to describe by conventional nuclear structure models; however, a possible interpretation is to depict such nuclei as undergoing a phase transition. A critical point has been proposed to exist within the shape/phase transition of the U(5), spherical, and O(6), gamma-soft rotor, limits of the Interacting Boson Model. The xenon isotopes exhibit such a transition and have, therefore, been proposed as a chain in which to search for the E(5) critical-point symmetry. The candidacy for an E(5) nucleus has been largely based on the decays of the excited 0^+ states, which for some of the xenon isotopes were not yet known. Inelastic neutron scattering reactions followed by γ-ray detection were performed at the University of Kentucky Accelerator Laboratory using highly enriched (>99.9%) ^{130}Xe, ^{132}Xe, ^{134}Xe and ^{136}Xe gases converted to solid xenon difluorides as scattering samples. From these measurements, low-lying excited states in these nuclei were characterized, new excited 0^+ states and their decays were identified, level lifetimes were measured with the Doppler-shift attenuation method, multipole mixing ratios were established, and transition probabilities were determined. This new information allows conclusions to be drawn about the occurrence of the E(5) symmetry within the stable xenon isotopes. ^{132}Xe was excluded as a representation of the E(5) critical-point symmetry; however, ^{130}Xe has emerged as an excellent candidate. This material is based upon work supported by the U.S. National Science Foundation under grant no. PHY-1305801.