VANDERBILT UNIVERSITY

Department of Physics and Astronomy

Nuclear and Particle Physics Seminar

Monday, April 4
12:30pm-1:30pm
Stevenson Center, Room 6333

Dennis Fong

Vanderbilt University

FISSION STUDIES WITH ^{252}CF: HALF-LIVES OF EXCITED STATES, ISOMERIC STRUCTURES IN ^{113,115,117}PD, AND NEUTRON MULTIPLICITIES

Several experiments were performed with a spontaneous fission source of ^{252}Cf with Gammasphere. Triple coincidence γ-γ-γ data were recorded in each of these experiments. The most recent experiment in 2000 provided the highest statistics data set. These new high statistics data were analyzed to measure detailed nuclear structure information from the neutron-rich nuclei produced in the fission. In addition to binary fission γ-ray spectroscopy, ternary fission data were also collected in a light charged particle-γ-γ coincidence experiment.

The half-lives of several excited states were measured with a new technique. It was necessary to develop a procedure to correct the measurement for low energy transitions and short half-lives. The corrected results are in agreement with previous measurements. The half-lives of excited states in ^{104}Zr and ^{152}Ce are reported for the first time, and the results indicate super deformed ground-states in these nuclei. Theoretical calculations support these deformations. This is interpreted as evidence for the existence of shell gaps at large deformation in this region.

The level structures of ^{113,115,117}Pd are re-examined with higher statistics. New transitions are found at low energy (39.0, 49.0, 63.7, and 85.1 keV), in addition to higher energy transitions. These are placed in the negative parity bands that feed the isomeric states. The spin and parity of the ground states and some of the low spin states are re-assigned by using these new data. In addition, new levels are assigned to a high spin side band in each nucleus.

The existence of a "hot" second fission mode has been reported in the Ba-Mo binary split for ^{252}Cf. Our high statistics data confirm the existence of this mode, with an intensity of 5% of the regular mode. In α-ternary fission, the "hot" mode is present for the Ba-α-Zr split, but not Xe-α-Mo or Ru-α-Te. The second "hot" mode is stronger than in binary fission, but with larger uncertainty. Possible explanations are discussed.