

Ph.D. Defense

Andrew A. Phillips

DATE: Wednesday, August 19, 2009

TIME: 1:30 p.m.

PLACE: MacNaughton Room 222

University of Guelph

THESIS TITLE:

STRUCTURE OF $^{186,188}\text{Os}$ STUDIED WITH ($^3\text{He},d$) REACTIONS

ABSTRACT:

The vibrational nuclear structure in Os isotopes has been the subject of debate for decades. In particular, the nature of the 4_3^+ level was contested to be double quadrupole phonon ($\gamma\gamma$) or a single hexadecapole phonon. The $\gamma\gamma$ view is based on collective B(E2) values from Coulomb excitation and lifetime studies. The single hexadecapole phonon interpretation is supported by a population of the state in single-proton (t,α) transfer reaction work and an enhanced E4 matrix element from inelastic scattering of α particles and protons. The proponents of each point of view offer criticisms to the other, but no new experimental work had been performed recently to aid in a resolution. We set out to add more data to this debate by performing a single-proton ($^3\text{He},d$) transfer reaction experiment.

The experiment was performed at the Maier-Leibnitz Laboratory in Garching, Germany. The 30 MeV ^3He beams provided by the tandem Van de Graaff accelerator bombarded $^{185,187}\text{Re}$ targets while the Q3D spectrometer analyzed the momenta of light ions and focused them onto a focal plane detector for identification and energy measurements. The spectrometer was rotated to angles between 5° and 50° for the transfer reaction work and cross sections were deduced for the population of excited states in $^{186,188}\text{Os}$. Results show a significant $\frac{5}{2}^+[402]_\pi + \frac{3}{2}^+[402]_\pi$ two quasi-particle component for the 4_3^+ level which is consistent with a hexadecapole interpretation of vibrational structure.

EXAMINING COMMITTEE:

Chair: D.E. Sullivan

Advisors: P.E. Garrett and C.E. Svensson

Internal Examiner: G. Karl

External Examiner: W.N. Catford, University of Surrey, United Kingdom