Type: New
Title: "Nuclear structure and nuclear reactions"

Principal Investigator: James Vary, Iowa State University
Co-Investigators: Joseph Carlson, Los Alamos National Laboratory
Pieter Maris, Iowa State University
Hai Ah Nam, Oak Ridge National Laboratory
Petr Navratil, Lawrence Livermore National Laboratory
Witold Nazarewicz, University of Tennessee
Steven Pieper, Argonne National Laboratory

Scientific Discipline: Physics: Nuclear Physics

INCITE Allocation: **43,000,000 processor hours**
Site: Oak Ridge National Laboratory
Machine (Allocation): Cray XT (28,000,000 processor hours)
Site: Argonne National Laboratory
Machine (Allocation): IBM Blue Gene/P (15,000,000 processor hours)

Research Summary:
Developing a comprehensive description of all nuclei (stable and unstable) and their reactions requires investigations of rare and exotic isotopes with unusual proton-to-neutron ratios that are difficult to produce and study experimentally because of their short lifetimes. We perform state-of-the-art simulations to provide needed predictions where direct experiment is not possible or is subject to large uncertainties.

Predictions for the structure and reactions of nuclei, with assessed uncertainties, are important for the future of the nation's energy and security needs. Such calculations are relevant to many applications in nuclear energy, nuclear security and nuclear astrophysics, where rare nuclei lie at the heart of nucleosynthesis and energy generation in stars.