Abstract Submitted
for the HAW05 Meeting of
The American Physical Society

The Nuclear Born–Oppenheimer Method and Nuclear Rotations

NOUREDINE ZETTILI, Jacksonville State University, AL — We want to discuss the application of the nuclear Born–Oppenheirmer (NBO) method to the study of nuclear rotations and collective motion. This application is illustrated on permanently deformed (non-spherical) nuclei that are axially-symmetric and even, but non-closed shell nuclei. We will focus, in particular, on the derivation of expressions for the energy and for the moment of inertia. Using trial functions in which the intrinsic structure is described in a mean-field approximation, we then show that the NBO formalism–a truly quantum mechanical description–yields the Thouless-Valantin formula for the moment of inertia and that this moment of inertia increases with angular momentum, in agreement with experimental data. We show that the NBO formalism is well equipped to describe low-lying as well as high lying rotational states. In addition, we establish a connection between the NBO method and the self-consistent Cranking (SCC) model, which is known to be successful in reproducing vast amounts of experimental data ranging from low-lying rotational states to high angular momentum states.

Nouredine Zettili
Department of Physical & Earth Sciences
Jacksonville State University, Jacksonville, AL 36265

Date submitted: 13 May 2005 Electronic form version 1.4