UNIVERSITY OF BUCHAREST

[Wobbling Title]

Robert Poenaru

Faculty of Physics

July 2021

Abstract

Nova.

Keywords: *nuclear shape, nuclear deformation, collective parameters, triaxiality, wobbling.*

Acknowledgements

Nova.

Keywords: Thank you!

Contents

Abstract **i**

Acknowledgements **ii**

1 Introduction **1**

2 Deformed Nuclei **2**
2.1 Nuclear deformation 2

Chapter 1

Introduction

Ground-state nuclear shapes with spherical symmetry or axial symmetry are predominant across the char of nuclides. Near closed shells, the deformation is indeed sufficient that models based on spherical symmetries can be used to describe nuclear properties (e.g., energies, quadrupole moments, and so on). Besides the spherical and axially-symmetric shapes, the existence of triaxial nuclear deformation was theoretically predicted a long time ago [1]. The rigid triaxiality of nuclei is defined by the asymmetry parameter γ, giving rise to unique quantum phenomena. The quantum mechanical properties of the rigid triaxial shapes drew a lot of attention within the nuclear community, since the description of nuclear properties for the deformed nuclei turns out to be a great challenge.

Chapter 2

Deformed Nuclei

2.1 Nuclear deformation

Most of the nuclei across the nuclide chart are spherical or symmetric in their ground state. Moreover, for the axially symmetric nuclei (i.e, either *oblate* or *prolate*), there is a prolate over oblate dominance. In Figure 2.1, the nuclear shapes are shown.

FIGURE 2.1: Nuclear Shapes.

The spherical shell model only describes nuclei near the closed shells. On the other side, the nuclei that lie far from closed shells, a deformed potential must be employed. Indeed, for even-even nuclei, unique band structures resulting from the vibrations and rotations of the nuclear surface (as proposed by Bohr and Mottelson [1] in *Geometric Collective Model* - GCM) appear in the energy range 0-2 MeV.

Within the GCM, the nucleus is described as a classical charged liquid drop.

Bibliography

[1] Aage Niels Bohr and Ben R Mottelson. *Nuclear Structure (In 2 Volumes)*. World Scientific Publishing Company, 1998.