📈 Poster-P2 | OpenReadings Conf2021

This is a page for writing the content of the poster for the conference.

Title:

> ***DESCRIBING THE WOBBLING MOTION IN ^{163}Lu THROUGH A SEMI-CLASSICAL APPROACH***

https://s3-us-west-2.amazonaws.com/secure.notion-static.com/2d11b1da-e896-43c5-869e-a94699a4c545/abstract-presentation.pdf

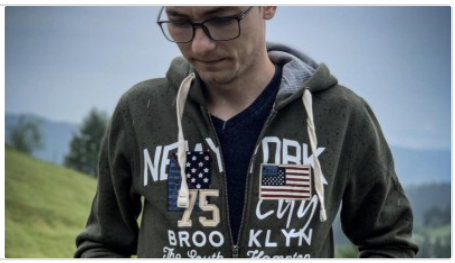
📖 [TOC] 📖

This GitHub project contains the development source-code (mainly as Mathematica documents)

basavyr/163Lu-New-TSD4-Formalism

Project dedicated to the wobbling motion in ^{163}Lu aimed at describing the energy spectra of the four triaxially deformed bands, nuclear stability (e.g. shape

https://github.com/basavyr/163Lu-New-TSD4-Formalism



The GitHub project dedicated to the wobbling analysis of ^{163}Lu.

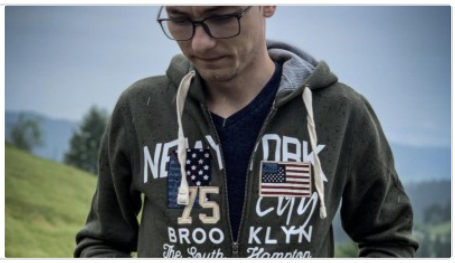
Introduction

Text can be found in the GitHub repository dedicated to the poster development.

basavyr/Poster-OpenReadings2021

This project represents the development of a scientific poster that will take part on the poster session during the 64th International Conference for Students of

https://github.com/basavyr/Poster-OpenReadings2021



The main project of the poster development process.

Wobbling Motion in odd-A Nuclei

Add formula for the Hamiltonian

Add classical expression of the Variational Principle

Add formula of the classical energy function

$$\mathcal{H} = \mathcal{H}_{min} + h_1 + h_2$$

Results

- [x] ~~Show the excitation energies for Lu-163~~

Use energy levels representation

- [x] ~~Show the wobbling frequencies~~

Use the classic `Plot` function

- [x] ~~Show the Signature Energies~~

Find energy formula for the staggering energies

Conclusions

- The excitation spectrum of the wobbling states in ^{163}Lu is accurately described by a classical set of equations.
- The excitation spectrum of the wobbling states in ^{163}Lu is accurately described by a classical set of equations.
- The excitation spectrum of the wobbling states in ^{163}Lu is accurately described by a classical set of equations.

Final poster

Here

http://www.openreadings.eu/thesismanager/posters21/499Poenaru.pdf

Speech

The Variational Principle which is applied in this method helps to make a dequantization procedure of the initial Hamiltonian:

- to each set of angular momentum component, a classical counterpart will be created
- After the classical quantities have been established, a set of parameters is established for the wave-function and as well as the energy will have.

The semi-classical approach is convenient since it simplifies the workflow, avoiding the different quantities that have rather complex expressions and complex algebra.

In the present study, an analysis on the wobbling spectrum of an odd-A nucleus has been done (i.e., ^{163}Lu).

This nucleus has four known wobbling bands (confirmed experimentally), and their energy increases with spin (total angular momentum)

For an odd nucleus, one can imagine the total system as being made up of a core with even number of protons and neutrons and also a single-particle (known as *intruder* or valence nucleon)

The valence nucleon is moving in a deformed field, generated by the core.

Due to the interaction between these two sub-systems, a deformed structure with stability is obtained, thus, one can assert that:

- coupling of an odd-single nucleon to a triaxial core, will drive the system up to very large deformations (asymmetry across all three axes)
- the asymmetry in the axes is related to the large values of the moments of inertia, which they are also increasing functions with spin

In this study, the wobbling frequencies have a two-fold character.

- when compared to a classical wobbler, where only one frequency causes the oscillator movement, here, there are two oscillations, one associated with the movement of the core, and one associated with the movement of the single-particle

The staggering-behavior is also a specific feature of heavy nuclei with large deformations.

One can imagine a single sequence of spins, that form a state, however, that collection of rotational bands is changing with a rotation of the wave-function with π

In fact, these states are described by wave-functions lacking rotational invariance.

From the loss of rotational invariance of the wave-function from the change $lab \rightarrow body - fixed$ coordinate system, a set of two bands with opposite signature quantum numbers and $\Delta I = 2\hbar$

These two bands are called signature partners.

They have similar properties, especially with regards to the increase of energy with angular momentum, large static quadrupole moment and also large quadrupole deformation.

From the current analysis, we can draw the following conclusions:

the wobbling energies (or the excitation spectrum) of the four wobbling triaxial super-deformed bands in ^{163}Lu were accurately described.

behavior of the wobbling frequencies was obtained with respect to the increase in angular momentum

A calculation of the staggering parameter, which is given by the different in energies of a given spin state, and also the adjacent energy levels from its signature partner.