NUSTAR Seminar

Helena May Albers

GSI Darmstadt, Germany

https://indico.gsi.de/event/17232/manage/

Monday, April 03 2023 at 03:00 PM CEST,
GSI / SB1 Main Lecture Room

https://gsi-fair.zoom.us/j/61918223744

Meeting-ID: 619 1822 3744
Kenncode: 309978

Structure of exotic nuclei at high collectivity: deformed subshell effects in neutron-rich rare-earth isotopes

Exotic isotopes with large neutron excess can exhibit behaviour strikingly different to those near to the traditional closed spherical shells. Indeed, both the breakdown of the classic magic numbers and the emergence of new ones have been observed. In deformed nuclei, the macroscopic properties are expected to be influenced by the appearance of subshell gaps in the single-particle spectra, which can stablise the shape at large deformation.

Rare-earth nuclei lying mid-way between the proton closed shells at Z=50 and 82 and the neutron closed shells at N=82 and 126 have large numbers of valence protons (N_π) and neutrons (N_ν) and display some of the most collective behaviour on the nuclear chart. In contrast to the expected picture of smoothly-increasing deformation peaking at the mid-mid-shell nucleus ^{170}Dy (which has the largest $N_\pi N_\nu$ value of any isotope with A<208), discontinuities in the E(2^+) energies in this region have indicated the presence of one or more deformed subshell gaps. Despite many experimental and theoretical investigations with the aim of understanding the nature, location and size of deformed shell gaps close to N~100, the results are conflicting and no clear conclusions have been made. Spectroscopic information for neutron-rich rare-earth isotopes is also highly-sought in order to constrain modelling of r-process nucleosynthesis to provide a robust description of the formation of the abundance peak at A~160.

An overview of work addressing these topics carried out at radioactive and stable beam facilities and within contemporary theoretical frameworks will be given in this talk. Future opportunities using a combination of high-intensity beams, the ion-by-ion identification provided by the GSI FRagment Separator (FRS) and the state-of-the-art DEcay SPECtroscopy (DESPEC) detector suite, which affords a unique environment within which to investigate exotic neutron-rich nuclei in FAIR Phase-0, will be presented. In addition, recent results from the application of machine-learning algorithms to fast scintillator detectors with the potential to significantly increase the physics output of DESPEC experiments will be shown.

Convener: M. Gorska
Secretary: R. Krause / D. Press
Organized by: T. Dickel