Contribution ID: **324** Type: **Oral Presentation**

Octupole Correlations in the neutron-deficient ^{110}Xe nucleus

Octupole correlations near $N = Z = 56$ are unique in the sense that they occur between particles in the same orbitals for both neutrons and protons. In this region just above ^{100}Sn, it is expected that enhanced octupole correlations will take place at low and medium spins in the light Te ($Z = 52$), I ($Z = 53$), and Xe ($Z = 54$) nuclei [1]. In this region of the nuclear chart, the Fermi surface for both neutrons and protons lies close to orbitals from the $d_{5/2}$ and $h_{11/2}$ subshells; octupole correlations emerge from the interactions of particles in these orbitals with valence neutrons and protons outside the ^{100}Sn core [2, 3]. As a result of the octupole correlations, an enhancement of octupole collectivity is expected to appear. Close to N = Z = 56, a level structure characteristic of octupole correlations, consisting of negative-parity states and enhanced E1 transitions, has been observed in several cases, including ^{112}Xe [4], ^{114}Xe [5, 6, 7], and ^{118}Ba [8].
With the aim to observe for the first time the octupole band in the neutron-deficient ($N = Z + 2$) ^{110}Xe nucleus, an in-beam experiment was performed at the Accelerator Laboratory of the University of Jyväskylä, Finland. The ^{110}Xe nuclei were produced via the ^{54}Fe(^{58}Ni,2n) fusion-evaporation reaction. The emitted γ rays were detected using the JUROGAM3 γ-ray spectrometer [9], while the fusion-evaporation residues were separated with the MARA separator [10]. In this experiment, we were able to prove the existence of the octupole band via the identification of the low-lying 3^- and 5^- states and their inter-band E1 transitions between the ground-state band and the octupole band [11]. Hence, these new experimental findings will be presented combined with a detailed study of the systematics of the energy levels and the B(E2)/B(E1) ratios in $^{110-114}$Xe and a comparison with state-of-the-art theoretical calculations.

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Session Classification: Parallel session

Track Classification: Nuclear Structure, Spectroscopy and Dynamics