

博士論文公聴会の公示 (物理学専攻)

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論文題目：Nuclear structures in neutron-rich nuclei ^{141}Xe and ^{143}Xe
investigated by β - γ spectroscopy
 β - γ 核分光法による中性子過剰な ^{141}Xe と ^{143}Xe の原子核構造の研究

日時：2024年3月12日(火) 11:00~12:30

場所：理学研究科H棟7階セミナー室 (H701号室)

主査：川畑 貴裕

副査：青井 考、吉田 齊、吉田 賢市、小田原 厚子

論文要旨：

Study of nuclear shape change from spherical to prolate deformation as increase of neutron and/or proton numbers is one of the most important subjects to understand nuclear interaction. Neutron-rich nuclei with $A \sim 140$ in the north-east transitional mass region beyond the doubly magic nucleus $^{132}\text{Sn}_{82}$ are expected to exhibit various nuclear structures with prolate collectivity and with mixing of small octupole collectivity. In present work, low-lying states in $^{141}\text{Xe}_{87}$ and $^{143}\text{Xe}_{89}$ are investigated by the β decay of $^{141}\text{I}_{88}$ and $^{143}\text{I}_{90}$, respectively.

Experiment was performed as a part of Euroball RIKEN Cluster Array (EURICA) project at RI beam factory (RIBF), RIKEN, based on β - γ spectroscopy. Neutron-rich nuclei were produced by in-flight fission of ^{238}U beam with energy of 345 MeV/nucleon and intensity of ~ 5 pnA bombarding on a Be target. Fragments were separated and identified through BigRIPS separator and ZeroDegree spectrometer. Particles and β rays were detected by 5 double-sided silicon-strip detectors and γ rays were detected by EURICA.

Two γ rays and two levels in ^{141}Xe , and 11 γ rays and seven levels in ^{143}Xe are newly found by analysis of β - γ and β - γ - γ coincidence data. Decay schemes of the β decays of ^{141}I to ^{141}Xe and of ^{143}I to ^{143}Xe are constructed for the first time. Branching ratio of the β -delayed-neutron decay of ^{143}I to ^{143}Xe is newly determined to be 49(6)%.

Based on the β -decay scheme, spins and parities of the ground states in parent isotopes ^{141}I and ^{143}I are proposed. From this spin-parity assignment, nuclear shape is supposed to change from spherical shape in nuclei ^{141}I and ^{143}I to prolate deformation in neutron-rich Xe isotopes.

Nuclear structure of the low-lying states in ^{141}Xe and ^{143}Xe is discussed with comparison of the calculation by large-scale shell-model and with comparison of those in $N = 89$ isotone ^{145}Ba , respectively. From these information, gradual change of nuclear structure in ^{141}Xe and ^{143}Xe is suggested to appear with increase of prolate collectivity.