ID de la contribución : **847** Tipo : **no especificado**

First beta-decay spectroscopy of 132Cd

miércoles, 20 de noviembre de 2024 9:45 (15)

Isotopes close to the doubly-magic nuclei ^{132}Sn are of strong interest from the point of view of nuclear structure. Spectroscopic studies are performed with the aim of obtaining a better understanding of the evolution of shell orbits in nuclei with large N/Z ratios, and providing critical tests of theoretical models. The information on the nuclear structure and decay properties of n-rich nuclei in this region may also provide input to calculations for astrophysical r-process.

A new experimental camping was carried out at the ISOLDE facility to study the β-decay of neutron-rich cadmium isotopes. High intensity Cd (Z = 48) beams were produced after the fission of a thick UC_x target, selectively ionized by the ISOLDE Resonance Ionization Laser Ion Source (RILIS) and separated in mass using the General Purpose Separator (GPS) ISOLDE mass separator. A temperature-controlled quartz transfer line was used to ensure purity of the cadmiun beams [1].The experiment exploited the excellent spectroscopic capabilities of the ISOLDE Decay Station (IDS). The fast-timing configuration was employed, which included 6 highly efficient clover-type HPGe detectors, altogether with 2 $LaBr_3$(Ce) and 3 ultra-fast β-plastic detectors arranged in close geometry.

Direct observation of γ-ray de-excitations and γ-γ coincidences in ^{132}In has been achieved following the β-decay of the ^{132}Cd 0^+ ground state (g.s.). The ^{132}In nuclear structure information is complemented by the β-n decay of ^{133}Cd, providing enhanced statistics. These results expand those from experiments at RIKEN facility [2,3].

The significantly higher statistics and the possibility of using coincident γ-γ measurements enable an expanded level scheme and more detailed comparison with shell-model calculations. An interpretation of the level structure is given based on the experimental findings and the particle-hole configurations arising from core excitations both from the N < 82 and Z < 50 shells, leading to positive- and negative-parity particle-hole multiplets [2,3].

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[3] A. Jungclaus \textit{et al.}, (2016). Physical Review C, 93(4), 041301.

Abstract

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Clasificación de la sesión : Red FNUC (Red Temática de Física Nuclear)

Clasificación de temáticas : Red Temática de Física Nuclear (FNUC)