

Abstract

The investigation of exotic isotopes is one of the main topics in nuclear research. Neutron-deficient isotopes in the lead region ($Z=82$) manifest various interesting phenomena of nuclear structure and radioactive decay, such as shape coexistence, isomeric states and β -delayed fission. The main topic of this Dissertation Thesis is the γ -ray spectroscopy of ^{182}Pt after β decay of ^{182}Au ($Z=79$, $N=103$), and α -decay spectroscopy of ^{182}Au . The parent isotope was studied during the IS665 experiment performed at the radioactive ion beam facility ISOLDE at CERN in Switzerland. The nuclei were produced in spallation of a thick uranium target by proton beam, and their decays were measured at the detection system ISOLDE Decay Station. The analysis of γ rays emitted after electron capture/ β^+ decay of ^{182}Au was performed, and the level scheme of isotope ^{182}Pt was established based on γ - γ coincidences. Transitions known from previous β -decay studies were confirmed, and 125 new levels and 336 new γ -ray transitions were placed in the level scheme of ^{182}Pt , expanding it up to ~ 3.7 MeV in the excitation energy. Internal conversion coefficients for three transitions were determined from measurements of conversion electrons. Moreover, γ rays from the 455-keV transition previously observed only via conversion electrons were detected for the first time. Unusually high β -decay feeding intensity of 4^+ levels was observed, considering the decay of the currently known (2^+) ground state in ^{182}Au into such states corresponds to the second forbidden non-unique β decays, which are typically highly suppressed. Several possible explanations are discussed, namely the 3^+ assignment for the ^{182}Au ground state, a new 5^+ isomeric state in this nucleus, and the pandemonium effect. The α -decay scheme of ^{182}Au was extended by two new fine structure α decays and branching ratio of $b_\alpha(^{182}\text{Au}) = 0.129(11)\%$ was derived. Relative intensities were determined, and hindrance factors for α -decay branches were calculated relative to unhindered decays in neighbouring isotopes. The $I^\pi = (1^+, 2^+, 3^+)$ assignment was proposed for the ground state of ^{178}Ir based on the conversion coefficient of the 55-keV transition.

Key words: beta decay, alpha decay, gamma ray, excited states, decay properties