First data on lifetimes of the 2_1^+ and 4_1^+ states of ^{200}Pt*

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The region of the nuclear chart, where the W, Os, Pt and Hg isotopes are found, exhibit phase transitions between oblate, prolate and spherical shapes [1, 2]. The $R_{4/2}$ ratio of the energies of the 2_1^+ and 4_1^+ states indicates a transition from γ-softness towards sphericity for the Pt isotopic chain when approaching the neutron-shell closure at $N = 126$. In the vicinity of shell closures, quadrupole collectivity is expected to decrease, which is characterized by a declining trend of the $E2$ transition strength of the $2_1^+ \rightarrow 0_1^+$ transition. Further, the $B_{4/2}$ value, which is the ratio of the $B(E2)\downarrow$ values of the $4_1^+ \rightarrow 2_1^+$ and $2_1^+ \rightarrow 0_1^+$ transitions, serves as an additional indicator for nuclear structure.

^{200}Pt is the lightest, neutron-rich, unstable Pt isotope without known $B(E2; 2_1^+ \rightarrow 0_1^+)$ and $B(E2; 4_1^+ \rightarrow 2_1^+)$ values, that are inversely proportional to the lifetimes of the 2_1^+ and 4_1^+ states, respectively. As ^{200}Pt could mark the transitional point for the structural evolution from γ-softness to sphericity in the Pt isotopic chain, the information on the lifetimes of its 2_1^+ and 4_1^+ states are highly desirable.

Therefore, the ^{198}Pt(^{18}O,^{16}O)^{200}Pt* two-neutron transfer reaction was studied at the tandem accelerator of the IFIN-HH in Bucharest-Măgurele in a recoil-distance Doppler-shift [3] experiment. The ROSPHERE array [4] equipped with 25 high purity germanium detectors and the SORCERER silicon particle detector [5] were used to detect the γ-rays from de-excitations and back-scattered particles from the reaction, respectively.

After corrections for contaminants and for the de-orientation effect, the lifetime of the 2_1^+ state of ^{200}Pt could be determined by applying the differential decay curve method [3]. Due to limited statistics, the lifetime of the 4_1^+ state was obtained from an alternative approach described in Ref. [6], where the summed peak areas of the shifted and unshifted components of the $4_1^+ \rightarrow 2_1^+$ transition determined in the sum spectrum of all plunger distance settings are considered. The normalization factors and solutions of the Bateman equations are used to disentangle the distance-wise contributions to both components and extract the lifetime of the 4_1^+ state.

The $B_{4/2}$ ratio calculated from the newly measured $B(E2)\downarrow$ values is in good agreement with the theoretical limit of a vibrational nucleus, thus, indicating the structural evolution towards sphericity as the Pt isotopic chain approaches the $N = 126$ neutron shell closure.

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