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Measurement of the B(E2; $4^+ \rightarrow 2^+$)/ B(E2; $2^+ \rightarrow 0^+$) ratio in 164W

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Recent lifetime measurements revealed that the $B(E2)_{4^+/2^+}$ ratio is far less than unity in several nuclei in the mass region 160 ≤ A ≤ 170 namely ^{166}W [1], ^{168}Os [2], ^{170}Os [3], and ^{172}Pt [4]. From a theoretical point of view, the origin and the underlying structure of this anomalous behavior remains unexplained. On the other hand, a quantum phase transition from seniority-conserving structure to a collective regime as a function of neutron number around N ≈ 90 - 94 has been proposed for these nuclei from phenomenological point of view [4]. In the present work, we aimed to extend our investigation of the anomalous B(E2; $4^+ \rightarrow 2^+$)/ B(E2; $2^+ \rightarrow 0^+$) ratio phenomenon this mass region in order to provide more data for the future theoretical calculations. We chose ^{164}W as a good candidate to investigate because, it has a pivotal position with N = 90 to test the hypothesis of a quantum phase transition as the mechanism for the $B(E2)_{4^+/2^+}$ anomaly. We used the DPUNS [5] plunger device in conjunction with the RITU gas-filled separator [6] and the JUROGAM II and GREAT [7] spectrometers for the measurement of mean lifetimes of excited states in ^{164}W. The fusion evaporation reaction ^{106}Cd(^{60}Ni,2p2n)^{164}W* at a beam energy of 270 MeV provided an initial recoil velocity v/c of 3.3%. The analysis of the data revealed that 164W has a similar $B(E2)_{4^+/2^+}$ = 0.56(13) < 1 anomaly as in the ^{166}W, ^{168}Os, ^{170}Os, and ^{172}Pt nuclei. Experimental B(E2) values have been compared to the state-of-the-art beyond-mean-field calculations. However, the theoretical predictions disagree with experimental findings. In the present work, details of the experimental procedure and analysis steps will be explained and the results for the lifetime measurements of first excited 2^+ and 4^+ states will be presented.

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