Anomalously hindered $E2$ strengths in ^{16,18}C *

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The reduced $E2$ transition probability from the first excited 2^+ (2^+_1) state to the ground ($0^+_{\rm gs}$) state, $B(E2)$, of an even-even nucleus is an important observable that reflects proton collectivity. Recently, an anomalously small $B(E2)$ was reported for the neutron-rich ^{16}C nucleus [1]. The result points to a suppressed proton contribution to the transition strength. This finding raises an intriguing question as to whether or not the neutron contribution is similarly small for the relevant quadrupole excitation. Results from two subsequent experiments [2,3] suggest that the neutron contribution is "normal". When combined with the $B(E2)$ value, the results indicate a neutron-dominant quadrupole excitation in ^{16}C. To shed light on the exotic phenomenon exhibited by ^{16}C and to explore the structural evolution of the carbon isotopes towards the neutron dripline, we have carried out an experiment to determine the $B(E2)$ value for the neighboring ^{18}C nucleus.

The $B(E2)$ value for ^{18}C was determined by measuring the mean lifetime of the 2^+_1 state in ^{18}C using an upgraded recoil shadow method (RSM) [1]. The experiment was performed at the RIKEN Nishina Center using the RIPS beamline [4]. Besides ^{18}C, we have also remeasured the mean lifetime of the 2^+_1 state in ^{16}C. The $B(E2)$ values for ^{16,18}C thus determined were about seven and five times smaller than the empirical values, indicating that the anomalously hindered $E2$ transition observed in ^{16}C persists in ^{18}C. Details of the experiment which includes the upgrading of the RSM will be presented and the results will be discussed.

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