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**Experimental finding of the anomalous quadrupole collectivity in unstable nucleus $^{16}$C**

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The electric quadrupole transition from the first $2^+$ state to the ground $0^+$ state in $^{16}$C is studied through measurements of the lifetime. The measured mean lifetime $\tau$ is $77 \pm 14$ (stat) $\pm 19$ (syst) ps. The central value of $\tau$ corresponds to a $B(E2; 2_1^+ \to 0^+)$ value of $0.63 e^2 \mathrm{fm}^4$, or 0.26 Weisskopf units [1]. The transition strength is found to be smaller than the empirically predicted value by one order of magnitude. This is the first application of recoil shadow method (RSM) to the lifetime measurement using an intermediate-energy RI beam. For nuclei located far from the stability line, the method of the intermediate energy Coulomb excitation has widely been used for their $B(E2)$ measurements. In the case of small $Z$ nuclei, however, a cross section of the nuclear excitation is comparable with that of the Coulomb excitation. To avoid difficult treatment of the nuclear excitation, we adopted the RSM for measurements of $\tau$, which is inversely proportional to $B(E2)$.
To account for the quenched $B(E2)$ value, two theoretical pictures have been proposed. One is based on the shell model calculation. The other is on the antisymmetrized molecular dynamics (AMD) calculation. The shell model treatment has mainly ascribed the quenching to the combined effects of increased proton sub-shell gap between $1p_{3/2}$ and $1p_{1/2}$ and reduced $E2$ effective charges for neutrons, while the AMD treatment has ascribed it mainly to the difference between favored deformed shapes for protons and neutrons. Both calculations reproduce the sudden decrease of $B(E2)$ in carbon isotopes.
I will show the detailed experimental setup and the experimental result together with the theoretical works.

**Ref.** [1] N. Imai et al., Phys. Rev. Lett. **92**, 06251(2004).