Anomally Hindered E2 Strengths in $^{16,18}C$

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**Question:**

*Ejectiles*

**Recoil Shadow Method**

**Upgraded Recoil Shadow Method**

**Experimental Setup** @ RIPS (RIKEN)

**Determination of mean lifetime**

To determine the mean lifetime, we performed Monte Carlo simulations using the GEANT3 and
(1) to determine D(exp), and
(2) to generate response functions for use in fitting to deduce D(exp).

**Procedures for simulations:**

1. Beam info position, target, energy

   a. Scattered particle info scattered beam energy

2. Generation and detection of γ rays

   a. generated isotropically in CM frame

   b. Lorentz boost "detected" by NaI(Tl)

**Results**

Small $B(E2)$ values!! (See Fig.1)

- $B(E2)$ for $^{16}C$
- $B(E2)$ for $^{18}C$

**Comparison with microscopic theoretical predictions:**

- Shell Model predicts proton-closed shell in $^{16}C$
- No-core Shell Model reproduces $B(E2)$ values for the neutron-rich $^{14,16}C$ quite well, when a small neutron effective charge $e_{n} = 0.16/z$ is assumed.

Both SM and AMD look promising in explaining the small $B(E2)$ values; but which picture is correct? More experimental data is necessary.

For the immediate future, it will be interesting to see whether the $B(E2)$ value for $^{18}C$ increases as predicted.

**Figure 1**

Lifetime measurement of the $2^+$ state in $^{16}C$

- Anomalously hindered E2 strength in $^{16}C$

- Combined with the results from the inelastic proton scattering

**Figure 2**

- Neutron-dominant quadrupole collectivity in $^{16}C$ (see Fig. 2)

**Figure 3**

- Determination of mean lifetime

**Figure 4**

- Simulation

**Figure 5**

- Previous data

Besides $^{16}C$, the mean lifetime $\tau(2^+)$ for $^{18}C$ was also remeasured with two reaction channels. Moreover, angular distribution of γ rays, which was not determined in the previous work (PRL 92, 062501(2004)), was also measured and incorporated into an improved reanalysis of the previous data. (See Fig.5)