The Core of ^{25}F in the rotational model*

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In a recent experiment, carried out at RIBF/RIKEN, the ^{25}F(p, 2p) ^{24}O reaction was studied at 270 MeV/A in inverse kinematics [1]. Derived spectroscopic factors suggest that the effective core of ^{25}F significantly differs from a free ^{24}O nucleus.

In this talk, we will discuss these results within the framework of the particle-rotor model and show that the experimental level scheme of ^{25}F can be understood in the rotation-aligned coupling scheme with its $5/2^+$ ground state as the bandhead of a decoupled band [2]. The excitation energies of the observed $1/2^+$ and $9/2^+$ states correlate strongly with the rotational energy of the effective core, seen by the odd proton, and allow us to estimate its 2^+ energy. The Nilsson plus PRM picture suggests that the extra proton, with a dominant component in the down-sloping [220] ½ level polarizes ^{24}O and stabilizes its dynamic deformation. Thus, the effective core in ^{25}F can be interpreted as a slightly deformed rotor with E_{2+} (core) ≈ 3.2 MeV and $\varepsilon_2 \approx 0.15$, compared to the real doubly magic ^{24}O with $E_{2+} \approx 4.7$ MeV and weak vibrational quadrupole collectivity.

The measured fragmentation of the $\pi d_{5/2}$ single-particle strength is in agreement with the experimental data [1], and understood by the fragmentation of the $d_{5/2}$ strength due to both deformation and core overlap.

We will also present preliminary results of our study of the ^{25}F(-1p)^{24}O knockout reaction at NSCL with GRETINA and the S800, and discuss some further experiments that can shed further light on the validity of our interpretation.

*This material is based upon work supported by the U.S. DOE, Office of Science, Office of Nuclear Physics, under Contract No. DEAC0205CH11231.

[1] T. L. Tang *et al*., Phys. Rev. Lett. **124**, 212502 (2020).
[2] A. O. Macchiavelli *et al*., Phys. Rev. **C102** , 041301(R) (2020).