Study of the ^{20}O+p interaction

Changbo Fu, V. Z. Goldberg, G. G. Chubarian, M. McCleskey, Y. Zhai,
T. Al-Abdullah, G. Tabacaru, and R. E. Tribble

Data on ^{21}O level scheme are scarce and all spin parity assignments for the excited states were made just by comparison of the excitation energies with shell model calculations. The detailed data on the structure of the ^{21}O levels are important to understand the way single-particle energies evolve when one goes away from stable nuclei to neutron and proton drip lines, specifically for the new N=14 magic number[1], and for astrophysics [2]. The study of the ^{20}O+p→ ^{21}F(T=5/2) → ^{20}O+p reaction should provide a test of a possibility of investigating neutron rich nuclei through their analog states, which are populated in the resonance reactions of neutron rich nuclei with protons [3]. Our estimations show that in spite of the high binding energy of ^{21}O, ~3.8 MeV, all isobar analogs of the ^{21}O excited states can be populated in the resonance scattering in question. In a test experiment, we obtained the ^{20}O beam with intensity about 10^4 pps, using the ^{4}He(^{18}O,^{20}O) reaction and MARS facilities [4]. The main contaminants were $^{20}F^{8+}$, and $^{15}N^{6+}$(Fig. 1) with the same q/m values as $^{20}O^{8+}$. These contaminants could be identified and separated by an ionization chamber (Fig. 2). The working gas of the ionization chamber was the target material, methane gas. In a short test experiment we also could observe recoil protons from the interaction of ^{20}O with hydrogen.

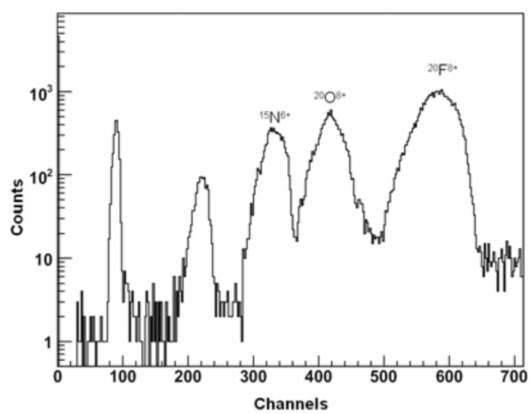

Figure 1. Composition of the beam by energy loss in the ionization chamber.

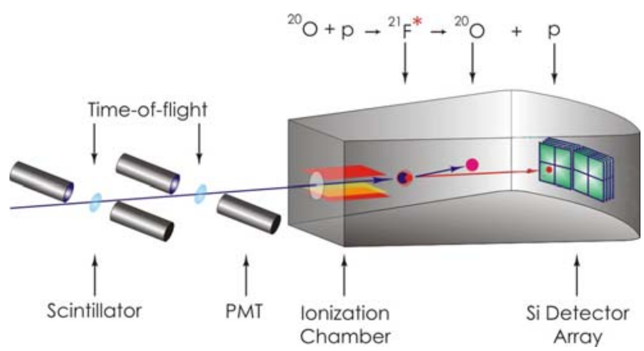

Figure 2. The setup of the experiment.

[1] M.Stanoiu *et al.*, Phys.Rev. **C 69**, 034312 (2004).
[2] H.Herndl *et al.*, Phys. Rev. **C 60**, 064614 (1999).
[3] V.Z. Goldberg, Exotic Nuclei and Atomic Masses, edited by B. M. Sherrill, *et al.*, (AIP, Woodbury, NY, 1998).
[4] R. E. Tribble *et al.*, Nucl. Instrum. Methods Phys. Res. **A285**, 441 (1989).