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Spin-orbit splitting in oxygen isotopes

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A level splitting between a spin doublet, spin-orbit splitting, can be a good measure of spin- orbit coupling in nuclei. Ando-Bando and Pieper-Pandharipande investigated microscopic origins of the 1p spin-orbit splitting in ˆ{16}O and showed that about half of the splitting originates from the NN spin-orbit interaction and the remaining part from the NN tensor and three- nucleon interactions. According to recent works by Otsuka et al., the tensor force is responsible for the change of proton (neutron) spin-orbit splitting depending on the neutron (proton) number.

We are planning to perform (p(pol), 2p) knockout experiments at RIBF to determine the proton spin-orbit splitting in unstable oxygen isotopes, ˆ{14,22–24}O. At RIBF energies, quasi-free knockout (p, pN) reactions can be a good spectroscopic tool to study single hole states. Experiments with spin polarized proton target make it possible to determine spin-parity of the single-hole state with less ambiguity. Thus the experiment will clearly exhibit how the proton spin-orbit split- ting changes from the values of about 6 MeV for ˆ{16}O when neutrons are added (removed) to d5/2 s1/2 and s1/2 orbits (from a p1/2 orbit). This neutron-number dependence of the spin-orbit splitting is expected to provide a unique opportunity to pin down the relevance of tensor and three-body interactions to nuclear structure clearly.

Prior to the RIBF experiment, we have carried out a ˆ{18}O(p(pol),2p) experiment at the ring cyclotron facility of RCNP, Osaka University and found that the proton spin-orbit splitting in ˆ{18}O is smaller by about 0.5 MeV than that in ˆ{16}O.

In the symposium, results from the ˆ{18}O(p(pol),2p) experiment at RCNP and the future plan of the ˆ{14,22–24}O(p(pol),2p) experiment at RIBF will be discussed.

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