

Investigating neutron-proton pairing in sd-shell nuclei via $(p,3\text{He})$ and $(3\text{He},p)$ transfer reactions

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Pairing correlations, influencing almost every feature of ground and low-lying states in nuclei, lie at the heart of nuclear physics. Understanding the mechanism of neutron-proton (np) pairing in $N=Z$ nuclei has been a long-sought goal in nuclear structure since the early sixties. Despite large efforts in both theoretical and experimental studies, the fundamental nature and the interplay between $T=0$ and $T=1$ pairs are still the subject of debate. Cross section measurement of np-pair transfer is considered as a sensitive probe for the insight into $T=0$ and $T=1$ np pairing collectivity and its mechanism [1-3].

We therefore carried out systematic np-transfer measurements spanning $N=Z$ sd-shell nuclei using $(p,3\text{He})$ and $(3\text{He},p)$ reactions at RCNP Osaka University. In particular, we study the cross-section ratio of the lowest $0+$ and $1+$ states as an observable to quantify the interplay between $T=0$ (isoscalar) and $T=1$ (isovector) pairing strengths. The experimental results are compared to second-order distorted-wave Born approximation calculations with proton-neutron amplitudes obtained in the shell-model formalism using the universal sd-shell interaction B . Our results suggest underestimation of the nonnegligible isoscalar pairing strength in the shell-model descriptions at the expense of the isovector channel. In this talk, we will present this work [4].

References:

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