Exotic Nuclei Studied with Transfer Reactions using the TIARA Array

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An area of fundamental interest in modern nuclear physics is the evolution of the single particle structure with isospin. Detailed studies are now becoming possible largely as a result of the recent development of beams of exotic nuclei with energies that allow the use of techniques based on direct reactions. Transfer reactions that add or remove single nucleons from the valence orbitals have traditionally been a powerful tool in exploring such questions and were highly influential in demonstrating the single particle picture of stable nuclei. Studying exotic nuclei using transfer reactions is technically very challenging primarily for two reasons: firstly, the reactions are in inverse kinematics and secondly, the beams of exotic nuclei are very weak. This necessitates the use of detection systems that are highly segmented, have high efficiency and allow the complete kinematics of the reaction to be measured.

We have recently installed the TIARA/VAMOS/EXOGAM detection systems at the GANIL/SPIRAL facility to perform such experiments [1,2]. This setup, which is pioneering the use of particle-gamma coincidence techniques to study transfer reactions with exotic nuclei, will be described. In the first campaign, the changing single particle structure in the region around the N=16 shell closure has been investigated using the ^{24}Ne beam from SPIRAL [3-8] and results will be presented. The next experimental campaign will extend these studies using the ^{26}Ne and ^{20}O beams from SPIRAL. These future measurements will be outlined, together with ongoing upgrades of the detection systems.

References

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