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Halo nuclei breaup studies on a proton target around QFS conditions

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Halo nuclei are novel nuclear quantum systems which appear at the neutron drip line for light nuclei. They are well described by a core and one or two loosely bound valence neutrons orbiting around the core outside the range of the nuclear interaction. Therefore these structures are characterized by low separation energies and consequently very narrow momentum distributions of the core from nucleon knockout.

15C is a one-neutron halo nucleus with a neutron separation energy of S_n=1.218 MeV. Ground state and spectroscopic information have been extracted experimentally from Coulomb dissociation studies [1], resulting in a consistent picture with a dominant (14C(0+) x 2s_{1/2}) configuration. Momentum distributions of the core extracted from single-neutron knockout reactions [2] exhibit in this case a broader width of 67 MeV/c, consistent with a larger separation energy and the same dominant configuration. However, calculations failed in reproducing the tail of the measured momentum distribution. The momentum distributions are inclusive measurements and thus it is desirable to measure also exclusive observables which incorporate more physics information.

It was shown in the work of refs. [3,4] that semi-inclusive breakup cross sections around Quasi-Free Scattering (QFS) conditions provide a very clear signature of the orbital angular momentum of the valence neutron. With increasing projectile energy the reaction formalism becomes more simplified and less terms from the Faddeev multiple scattering expansion are needed. For neutron in a S-wave the single scattering (SS) term becomes dominant as the energy increases.

In this contribution we review the curent experimental status for QFS experiments and present the expected outcome from the breakup of 15C on a proton target at QFS conditions to be measured at the R3B experimental setup.

[1] U. Datta Pramanik et al, Phys. Lett. B 551 (2003) 63

[2] D. Bazin et al, Phys. Rev. Lett. 74 (1995) 3569

[3] R. Crespo et al, Phys. Rev. C 79 (2009) 014609

[4] R. Crespo et al, "One-neutron knockout reaction of halo nuclei", to be published in Eur. Phys. Journal A

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