*International Nuclear Physics Conference INPC2013: 2-7 June 2013, Firenze, Italy*

# The Structure of the Proton-Dripline Nucleus $^{17}$Ne Studied in Knockout Reactions at Relativistic Beam Energies

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$^{17}$Ne is a proton-dripline nucleus that has raised interest in nuclear-structure physics in recent years. As a ($^{15}$O+2p) Borromean 3-body system, it is often considered to be a 2-proton-halo nucleus, yet lacking concluding quantification of its structure; this is appearent in the form of different results on the s-/d-wave mixing of the valence-proton pair in the $^{17}$Ne ground state in recent years [1-4].

In order to clarify its structure, we have studied breakup reactions of 500 AMeV $^{17}$Ne secondary beams in inverse kinematics using the R3B-LAND setup at GSI in 2007. The reactions investigated were Coulomb breakup on a lead target, quasi-free scattering on a proton-rich polyethylene ($CH_2$) target, and one-proton-knockout reactions on a carbon target.

In this contribution, we focus on knockout and proton-removal reactions on the carbon target: Projectile-like forward protons after one-proton knockout from $^{17}$Ne have been measured in coincidence with the $^{15}$O residual core, leading to the relative-energy spectrum of the unbound $^{16}$F. The selection of the low-energy region in this spectrum enables us to exclusively select events stemming from the knockout of halo (not core) protons.

Monte-Carlo simulations including the detailed geometry of the experimental setup have been carried out, allowing for the determination of the relative-energy-differential acceptance and efficiency for the identification of the various proton-breakup channels leading to $^{15}$O in the final state. In consequence, the partial cross sections for 2p-knockout, 1p-knockout, and diffraction (0p-knockout) on $^{17}$Ne have been determined, as well as the inclusive 2p-removal cross section. Those, and the also obtained transverse-momentum distributions of residual $^{16}$F fragments stemming from 1p knockout on $^{17}$Ne, have been interpreted using Glauber-type calculations in terms of a superposition of components of s- or d-proton knockout from the groundstate of $^{17}$Ne. In this analysis framework, the relative weights as well as spectroscopic factors for the s- or d-wave valence-proton pair in $^{17}$Ne have been determined.

Additionally, the s-/d-weight in the $^{17}$Ne ground state has been determined by describing the low-energy region of the $^{16}$F relative energy spectrum by a superposition of the four lowest known continuum resonances in $^{16}$F, broadened by the experimental resolution determined via the Monte-Carlo simulation. Those two independently obtained results will be compared, and the implications regarding the structure of $^{17}$Ne will be discussed.

This work was supported by BMBF (project 05P12RDFN8), by HIC for FAIR, and by GSI.

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