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First Experimental Test of the Ratio Method

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The ratio [1,2] is a new reaction observable suggested to extract accurately structural information on halo nuclei. It is based on the Recoil Excitation Breakup (REB) model [3], which predicts that taking the ratio of angular distributions for breakup and scattering, the uncertainty related to the reaction dynamics is strongly reduced [1,2]. It exhibits a much better accuracy than traditional methods, such as Coulomb breakup. We present here the first experimental test of the method for the ^{11}Be + ^{12}C collision at Elab=20 MeV/u. The experiment was performed at Texas A&M University cyclotron. Angular differential cross sections for scattering and inclusive one-neutron breakup cross sections have been measured with the new Si + phoswich detector array, BlueSTEAl [4], at θcm =10°–30°. The ratio of the inclusive breakup to elastic cross sections is, as predicted, very smooth and independent of the projectile-target interaction. This demonstrates the validity of the new method. We have extended our analysis to ^{11}Be + ^{208}Pb data [5], confirming that the method works well both for nuclear- and Coulomb-dominated reactions. This augurs well for our plan to extract accurate structure information of further exotic halo nuclei at FRIB.

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