

SES19-2019-000147

Abstract for an Invited Paper  
for the SES19 Meeting of  
the American Physical Society

### **Neutron-neutron quasifree scattering in neutron-deuteron breakup<sup>1</sup>**

RONALD MALONE, Duke University and Triangle Universities Nuclear Laboratory

The neutron-deuteron (nd) system is a rich environment for testing models of the nucleon-nucleon interaction and three-nucleon (3N) forces. Rigorous ab-initio calculations of 3N scattering observables accurately describe most experimental data. However, some exceptions remain, including the cross section for neutron-neutron (nn) quasifree scattering (QFS) in nd breakup. Recent measurements of this cross section reveal that theory underpredicts the data by more than 15%. These results imply charge-symmetry breaking at a level higher than expected. We are conducting new measurements of the nn QFS cross section in the tandem accelerator laboratory at the Triangle Universities Nuclear Laboratory. Our measurements are carried out using two substantially different experimental setups to assess systematic uncertainties. The first measurement, which is performed at an incident laboratory neutron energy of 10.0 MeV, uses heavily shielded detectors with an open neutron source. The second measurement utilizes unshielded detectors with a collimated 16.0 MeV neutron beam. Time-of-flight techniques are used to determine the energies of the breakup neutrons detected in coincidence. Our measurements differ from previous experiments in that the beam-target luminosity is determined from the nd elastic scattering yields measured simultaneously with the nd breakup yields. A description of experimental methods and results will be presented.

<sup>1</sup>This work is supported in part by the U.S. Department of Energy under grant Nos. DE-FG02-97ER41033 and DE-SC0005367 and by the Polish National Science Center under grant No. DEC- 2016/22/M/ST2/00173.