

# “*Ab initio* nuclear reactions” – LLNL

## ASCR- Nuclear Theory Highlight

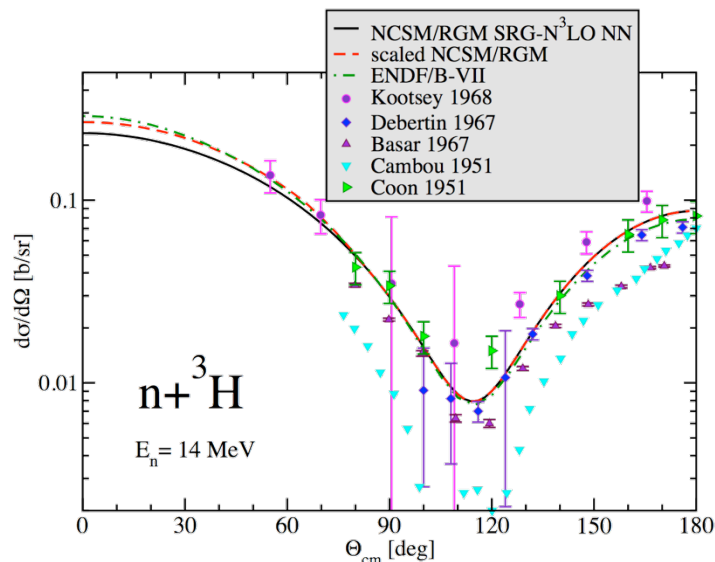
### Objectives

- Arrive at a fundamental understanding of nuclear properties from a unified theoretical standpoint rooted in the fundamental forces among nucleons
- Develop theoretical foundations for an accurate description of reactions between light ions in a thermonuclear environment

### Impact

- Computational tools for addressing fusion reactions that power stars and Earth-based fusion facilities such as the National Ignition Facility (NIF)
- Provide research community with accurate evaluations and uncertainties for nuclear astrophysics and fusion diagnostic

*Ab initio* theory reduces uncertainty due to conflicting data (•, ♦, ▲, ▼, ▽)



### Progress / Accomplishments FY10

- The elastic  $n$ - $t$  cross section for 14 MeV neutrons, important for understanding how the fuel is assembled in an implosion at NIF, was not known precisely enough. Nuclear theory was asked to help.
- Delivered evaluated data with required 5% uncertainty and successfully compared to measurements using an Inertial Confinement Facility
- “*Ab initio* theory of light-ion reactions”, by P. Navrátil, S. Quaglioni, and R. Roth, arXiv:1009.3965
- “First measurements of the differential cross sections for the elastic  $n$ - $^2\text{H}$  and  $n$ - $^3\text{H}$  scattering at 14.1 MeV using an Inertial Confinement Facility”, by J.A. Frenje *et al.*, to be submitted



U.S. DEPARTMENT OF  
**ENERGY**

Office of  
Science



UNEDF SciDAC Collaboration  
Universal Nuclear Energy Density Functional