Contribution ID: **52** Type: **Invited Presentation**

Ab Initio Studies of Nucleonic Matter

Wednesday, 31 May 2017 10:15 (25 minutes)

Nucleonic matter has important implications on many branches of nuclear science: from the bulk properties of exotic nuclei to the equation of state of neutron star matter. After we have extended the self-consistent Green's function (SCGF) theory to account for three-nucleon forces, it is now possible to make reliable predictions of nucleonic matter at both zero and finite temperatures and with full chiral interactions, a task that was not possible until a few years a ago.
The talk will present the SCGF approach as a very convenient way to investigate microscopic and thermodynamical properties of nucleonic matter. Among recent results, the prediction of the liquid-gas phase transition critical temperature in symmetric matter appears to be in reasonable agreement with experimental outcomes. Also studies of both saturation properties and finite temperature behaviors in infinite matter are pointing towards the necessity to refine the fitting procedure of low-energy constants. Moreover, I will show how first-principle tests of thermal approximations used in equations of state to study stellar environments questions the validity of such simulations.

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