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The equation of state from chiral forces in the Green's functions approach

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The equation of state of neutron matter is a basic ingredient in the theoretical understanding of neutron stars. From a nuclear theory perspective, the problem has two major sources of uncertainty: the nuclear hamiltonian and the treatment of quantum many-body correlations. I will review a series of recent theoretical advances within the many-body Green's functions approach that help tackle both sources. First, I will discuss how chiral effective field theory two-body forces can be incorporated into the Green's functions approach, to obtain single-particle and bulk properties [1]. Chiral forces represent a step forward in having a direct connection to QCD and a quantifiable uncertainty. Second, I will introduce a new diagrammatic approach to include three-body forces consistently in the many-body formalism [2]. This improves saturation properties, but also the available equation of state [3]. The errors coming from many-body theory can be obtained by looking at different many-body approaches. Finally, I will mention potential future improvements to both chiral theory and many-body techniques.

[1] A. Rios, A. Polls and W. H. Dickhoff, arXiv:1312.7307.
[2] A. Carbone, A. Cipollone, C. Barbieri, A. Rios and A. Polls, Phys. Rev. C 88, 054326 (2013).
[3] A. Carbone, A. Polls and A. Rios, Phys. Rev. C 88, 044302 (2013).

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