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Bridging nuclear ab-initio and Energy Density Functional Theories

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A density functional is proposed for Fermi systems with anomalously large s-wave scattering length that has no free parameters. The functional is designed to correctly reproduce the unitary limit in Fermi gases together with the leading-order contributions in the s-wave channel at low density. The functional reproduces well static properties of Fermi gas at or close to the unitary limit. By including the effect of the s-wave effective range it can also be applied to neutron systems. For neutron infinite matter, it is shown to be predictive up to densities $\sim$ 0.01 fm^{-3} that is much higher densities compared to the Lee-Yang functional, valid for $\rho < 10^{-5}$ fm^{-3}.

In this talk, we will explain how the functional was built up and apply it both to unitary gas and neutron matter. The functional is used to obtain in a simple way thermodynamical quantities: pressure, sound velocity, compressibility. For unitary gas, it is in good agreement with experimental observations. Using the functional, we will also discuss the response of Fermi systems with large scattering length to an external field.

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Auteur principal: M. BOULET, Antoine (IPNO)

Orateur: M. BOULET, Antoine (IPNO)

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