

Ab initio Nuclear Physics: The bridge between “Heaven and Earth”

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Abstract. The road map to a reliable description of neutron-rich systems starts from microscopic few-nucleon forces. Those are best constructed within the framework of chiral effective field theory (EFT), which maintains consistency with the symmetries of quantum chromodynamics (QCD) and provides a counting scheme where all required contributions can be arranged order by order. Having a limited domain of validity, chiral EFT cannot be applied throughout the profile of a neutron star, which probes a very large range of densities, up to several times the density of saturated nuclear matter. This presentation will focus on how *ab initio* theory can be of guidance for the development of the stellar matter equation of state in those regions. I will discuss how the microscopic predictions, on the one end, with causality and maximum-mass constraints, on the other, set strong boundaries to the mass vs. radius relation in neutron stars. The conformal limit for the speed of sound in dense matter will also be addressed.