Neutron-rich nuclei and matter in neutron stars*

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The ab initio description of nuclei has seen major advances combining innovative many-body developments with nuclear forces and electroweak currents based on chiral effective field theory. This has led to ab initio calculations up to heavy nuclei, and highlighted the importance of uncertainty quantification as well as the development of accurate interactions for medium-mass to heavy nuclei. This talk will discuss the status and challenges for nuclear forces and uncertainty quantification in describing medium-heavy nuclei. Moreover, we will explore ab initio calculations of nuclear masses around the $N = 82$ shell closure and their impact on r-process nucleosynthesis, and the role of two-body currents on beta-decay half-lives at $N = 50$. The same strong interactions at work in nuclei also determine the equation of state and thus the properties of neutron stars at least for the outer regions. We will discuss how present and future astrophysical observations can constrain the properties of matter and interactions at intermediate densities.

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