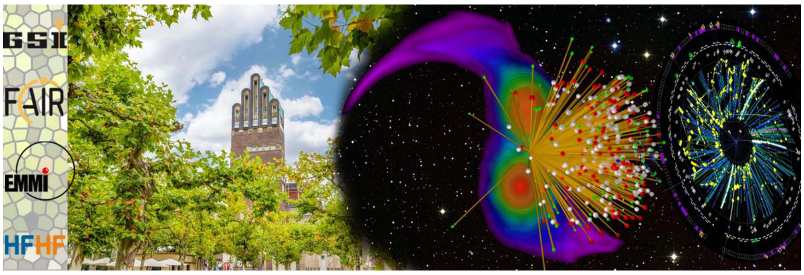


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# Nuclear matter and neutron stars from the relativistic Brueckner-Hartree-Fock theory in the full Dirac space

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It is still a challenging task to derive the symmetry energy and equation of state for neutron stars from the underlying realistic nucleon-nucleon interaction. The relativistic Brueckner-Hartree-Fock (RBHF) theory provides a relativistic ab-initio approach, which is able to reproduce saturation properties of symmetric nuclear matter without three-body forces. However, most of the past work have considered only the positive-energy states, with different additional approximations on the neglected negative-energy states. Recently, the self-consistent solution of the RBHF equations in the full Dirac space was achieved for the first time. The symmetry energy and its slope parameter at the saturation density are 33.1 MeV and 65.2 MeV, in good agreement with empirical and experimental values. Further applications predict the radius of the neutron star with 1.4 times solar mass 12 km and the maximum mass of a neutron star less than 2.4 times solar mass. These applications reveal clearly the importance of the full Dirac space. We anticipate that our work can be suitably gauged against other theoretical approaches which are based on phenomenological and non-relativistic ab-initio methods, thus leading to a concerted effort to pin down the properties of nuclear matter and neutron star matter.

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