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Neutron-rich nuclei, neutron matter and constraints on neutron star structure from chiral effective field theory interactions

Donnerstag, 15. Juli 2010 16:30 (30 Minuten)

This talk will discuss the impact of chiral three-nucleon forces on neutron-rich nuclei and on neutron-rich matter. I will show that three-nucleon forces lead to repulsive contributions to the interactions among valence neutrons that change the location of the neutron drip line from ^{28}O to the experimentally observed ^{24}O . This three-nucleon mechanism provides the first microscopic explanation of the oxygen anomaly in the neutron drip line and can impact the prediction of the most neutron-rich nuclei and the synthesis of heavy elements in neutron-rich environments. In addition, our microscopic calculations based on the same interactions constrain the properties of dense matter below nuclear densities to a much higher degree than is reflected in current neutron star modeling. Combined with observed neutron star masses, our results lead to a radius $R = 11.8 \pm 2.1$ km for a $M = 1.4 M_{\text{sun}}$ neutron star, where the theoretical error is due, in about equal amounts, to uncertainties in many-body forces and to the extrapolation to high densities.

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Sitzung Einordnung: Session 2: Neutron stars, properties and EoS I