Beitrag ID: **6** Typ: **Talk Main Workshop**

The Crust Of Accreting Neutron Stars: Role Of Nuclear Binding Energies

Mittwoch, 20. August 2025 11:50 (20 Minuten)

The crust of neutron stars in soft X-ray transients is heated up by nuclear reactions induced by hydrostatic compression during periods of active accretion. These periods alternate with quiescent phases, during which X-ray telescopes in space have monitored a gradual decrease in the thermal emission from the surface of a dozen neutron stars [1]. The exact location of heating sources and the crustal composition represent crucial parameters for the detailed modeling of the neutron star crust cooling and the correct interpretation of observational data [2]. They depend on the nuclear reaction flows which extend up to the neutron-drip line and beyond and are mainly governed by the binding energies of extremely neutron-rich nuclei. A large part of these nuclides is not yet accessible to terrestrial nuclear facilities. Hence, the reaction networks are forced to rely on theoretical predictions for nuclear masses. In this talk, I will show to what extent the nuclear evolution is sensitive to the applied nuclear mass model [3-5] and identify the key neutron-rich isotopes that are of particular interest for future laboratory measurements. In addition, I will present our latest efforts in building nuclear mass tables along with the relevant nuclear physics input for the wide range of astrophysical applications.

References

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