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FAIR and strong interaction matter in the universe (35+10)

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The strong interaction described by quantum chromodynamics gives rise to the formation of hadrons and nuclei that constitute the baryonic matter in the Universe and governs the densest matter in neutron stars and highest temperatures reached in compact object mergers. Combined with the electroweak interaction, it determines the structure and properties of all nuclei in the nuclear chart in a similar way as quantum electrodynamics shapes the periodic table of elements. However, big science problems of the strong interaction remain unsolved, especially regarding the structure of extreme neutron-rich matter in the laboratory and stars.

FAIR and other new facilities will discover over a thousand new isotopes, getting as close as possible to the nuclei in the Universe's heavy-element nucleosynthesis pathway. On the theoretical side, there are impressive advances towards a unified description of all nuclei and matter based on effective field theories of the strong interaction. This talk will discuss the advances and challenges in understanding strongly interacting matter, with a focus on the physics and astrophysics of NUSTAR at FAIR.

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