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# Physikalisches Kolloquium

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None

Achim Schwenk  
Technische Universität Darmstadt

## Frontiers in Nuclear Theory

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.

New facilities for rare isotopes 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 combined with powerful many-body methods. In this colloquium, we will discuss the advances, status and challenges in strongly interacting matter, with a focus on how the nuclear chart emerges from nuclear forces and on the physics of neutron stars and neutron star mergers.

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