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Particle-theory input for neutron-star physics

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Different parts of neutron stars (NSs) probe all fundemantal interactions of particle physics: the strong nuclear force is behind the bulk thermodynamic properties of their constituent matter, electroweak interactions are needed to describe equilibration and transport phenomena during binary NS mergers, and information on QED scattering processes at ultrastrong magnetic fields is required to properly understand the NS magnetosphere. Corresponding to these three topics, I will discuss three topical problems within NS physics: inferring a model-independent equation of state for NS matter, determining the bulk viscosity of quark matter, and accounting for the full effects of background magnetic fields in QED scattering processes using Schwinger's proper time formalism. A common denominator in all cases is the need to perform high-precision calculations using resummed (thermal) field theory, the recent results of which I will showcase within each of the three categories.

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