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High-density QCD: a paradigm for PT symmetry in field theory

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The physics of QCD at nonzero density and temperature is rich, accessible via theory and experiment, and important for several areas of physics. The path integral is complex at nonzero density, and difficult to evaluate: there is a sign problem which reflects an underlying PT symmetry. We show that novel new phases associated with PT symmetry breaking, including liquid-like phases and inhomogeneous phases, are likely in finite-density QCD and related models. A diverse set of analytic and computational methods give a consistent, if incomplete, picture of possible phase structure and other features. We propose experimental signatures which may give a direct indication of PT symmetry breaking at the next generation of heavy-ion experiments.

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