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Exotic properties of strongly interacting matter under rotation

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Recent first-principles lattice simulations of SU(N) Yang-Mills theory in 3+1 dimensions have revealed that the gluon plasma exhibits several unexpected equilibrium properties in a rotating state: (i) a negative moment of inertia within a certain temperature range; (ii) the formation of a thermodynamically stable inhomogeneous mixed phase that does not align with the conventional Tolman–Ehrenfest relation in static gravitational backgrounds; and (iii) a rotation-induced enhancement of the critical deconfinement temperature. We briefly review these surprising numerical observations and argue that they may share a common origin rooted in enhancement of the gluonic coupling in a non-inertial rotating frame. We suggest that such phenomena may be probed experimentally in synthetic non-Abelian gauge fields engineered in condensed matter systems.

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