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Cosmology of composite dynamics: dark matter, phase transitions and gravitational waves

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Abstract:In this talk, I briefly overview recent progress in strong coupling dynamics at finite temperatures and its cosmological implications in SU(N) gauge theories, with and without fermions. In a confining pure Yang-Mills theory of dark sector, the scalar glueballs are considered as possible candidates for Dark Matter. To predict the relic abundance of glueballs for the various gauge groups and scenarios of thermalisation of the dark gluon gas, we employ a thermal effective theory that accounts for the strong-coupling dynamics in agreement with lattice simulations. In a QCD-like theory with N_f flavours, the Polyakov-loop Improved Linear Sigma Model in the Cornwall-Jackiw-Tomboulis formulation is employed to investigate the chiral phase transition in regimes that can mimic QCD-like theories incorporating in addition composite dynamics associated with the effects of confinement-deconfinement phase transition. We show that strong first-order phase transitions occur for weak effective couplings of the composite sector leading to gravitational-wave signals potentially detectable at future experimental facilities.

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