

Dark Chiral Phase Transition Driven by Chemical Potential

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In this article, for the first time, we explore the scenario that the dark-QCD sector has a large chemical potential μ (on the order of magnitude of temperature) of dark quarks. It leads to a complex-valued Polyakov loop and tilts the partial confinement effect, driving the dark-QCD phase transition to a first-order one in the early universe. We present a toy model via the Affleck-Dine mechanism that could generate degenerate dark quarks. Our study, in the framework of PNJL, focuses on the dynamical impacts of a large chemical potential on the chiral phase transition without turning on the KMT instanton term. We plot the phase diagram of the dark-QCD in the chiral limit. Following the phase diagram, we find that increasing μ can considerably prolong the duration of the phase transition and also the release of latent heat.

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