

Gauge-Invariant Analysis of Phase Transitions in Dark $U(1)$ Sectors

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$U(1)$ dark and darker sectors accommodating viable dark matter candidate(s) will be discussed. When the additional $U(1)$ symmetry undergoes spontaneous breaking, the dark sector often exhibits a characteristic phase transition pattern capable of producing detectable gravitational wave signals. A gauge-invariant formulation of the scalar potential associated with this phase transition will be discussed in detail.

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