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Phase Transition of Conformal Freeze-In Dark Matter

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We study the cosmological phase transition in the Conformal Freeze-In (COFI) dark matter model. The dark sector is a 4D conformal field theory (CFT) at high energy scales, but its conformal symmetry is broken in the IR through a small coupling of a relevant CFT operator \mathcal{O}_{CFT} to a Standard Model (SM) portal operator. The dark sector confines below a gap scale M_{gap} of order keV—MeV, forming bound states amongst which is the dark matter candidate. We consider the holographic dual in 5D given by a Randall-Sundrum-like model, where the SM fields and the dark matter candidate are placed on the UV and IR branes respectively. The separation between the UV and IR branes is stabilized by a bulk scalar field dual to \mathcal{O}_{CFT} , naturally generating a hierarchy between the electroweak scale and M_{gap} . The confinement of the CFT is then dual to the spontaneous symmetry breaking by the 5D radion potential. We find the viable parameter space of the theory which allows the phase transition to complete promptly without significant supercooling.

Mini Symposia (Invited Talks Only)

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