

JOINT TUFTS/MIT COSMOLOGY SEMINAR

Reflections on Bubble Walls

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Cosmological phase transitions that proceed via nucleation of bubbles are a well-motivated possibility both in minimal extensions of the Standard Model as well as in more general hidden sectors with their own dynamics. In this talk, I will discuss the dynamics of expanding vacuum bubbles in the presence of massive dark photons that gain mass across the interface — with a special focus on the well-motivated benchmark where the dark photons furnish the dark matter. I will argue the existence of a transient kinematic regime during which the wall behaves as an (imperfect) mirror of longitudinal — but not transverse — modes. This leads to a new source of pressure on the expanding interface that can prevent the accelerated expansion of the bubble walls. Instead, the difference in vacuum energy densities goes into making a fraction of the dark photons relativistic, turning them into dark radiation. If the dark radiation remains relativistic until late times, an observable contribution to ΔN_{eff} is possible for strong phase transitions with observable gravitational wave signals. Our results highlight the potential interplay between the dark matter and the dynamics of phase transitions in the early universe, as well as the complementarity between gravitational wave detectors and CMB Stage-4 observatories.

Tuesday, April 25, 2023, 2:30 pm
Cosman Seminar Room
Center for Theoretical Physics
Building 6C, Room 6C-442
Massachusetts Institute of Technology