JOINT TUFTS/MIT COSMOLOGY SEMINAR

Uncovering Physics Beyond the Standard Model in the Primary and Secondary CMB Anisotropies

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The cosmic microwave background (CMB) remains the cleanest, most powerful probe of fundamental physics in the cosmos. Measurements of the small-scale CMB temperature and polarization fields have recently undergone transformative improvements with Data Release 6 (DR6) of the Atacama Cosmology Telescope (ACT) and will soon improve further with the Simons Observatory, which will open new windows into physics beyond the standard models (BSM) of particle physics and cosmology. I will first review key findings from our ACT DR6 CMB power spectrum analysis, with a particular emphasis on implications for inflationary models and constraints on BSM physics operating at the recombination epoch, including new relativistic particles and new pseudo-scalar fields. I will then discuss novel searches for signatures of inflationary particle production in Planck CMB temperature and polarization maps, which we have used to place new bounds on multi-field inflationary scenarios. Finally, I will discuss signals of BSM physics in CMB secondary anisotropies, as could be imprinted by the conversion of CMB photons into massive dark photons (DPs) or axion-like particles. I will show the first results of searches for these signals in CMB data, enabled by our state-of-the-art needlet internal linear combination code, yielding leading bounds on kinetically mixed DPs and axion-photon couplings over two decades in DP or axion mass. I will conclude with a look ahead to the prospects for BSM physics from the now-operating Simons Observatory.

Tuesday, December 9, 2025, 2:30 pm
Cosman Seminar Room
Center for Theoretical Physics
Building 6C, Room 6C-442
Massachusetts Institute of Technology