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Constraining Interacting Dark Radiation with Lyman-alpha

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Models of dark sectors with a mass threshold exhibit significant cosmological signatures. When a relativistic species becomes non-relativistic before recombination and subsequently depletes in equilibrium, measurable effects on the cosmic microwave background (CMB) arise as entropy is transferred to lighter relativistic particles. Notably, if this transition occurs near z ~ 20,000, the model can naturally support higher values of H0. Additionally, if this stepped radiation interacts with dark matter, it significantly influences the matter power spectrum. Dark matter, coupled through a species that becomes non-relativistic and depleted, leads to suppressed power at scales within the sound horizon prior to the transition, while preserving conventional cold dark matter signatures beyond the sound horizon.
This presentation will explore the cosmological implications of such models and evaluate their potential to resolve the 5σ Hubble tension alongside discrepancies in Large Scale Structure (LSS) data, including the eBOSS Lyα forest measurement.

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