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Studying dark sector imprints in cosmology

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Relativistic degrees of freedom or N_eff is one of the crucial cosmological parameters and is sensitive to extra radiation energy density at the time of neutrino decoupling. The precise measurement of N_{eff} at the time of CMB formation by Planck 2018 can be used to understand fundamental interactions and to shed light on beyond standard model (BSM) scenarios. In this talk I will explain how N_eff can probe light (MeV) freeze in dark matter models which contain additional neutrino injection at late time. We propose a scenario where a long lived scalar decays to a dark matter and active neutrinos after BBN. Despite the feeble coupling of DM the parameter space can be probed via N_eff. I will also talk about how N_eff at CMB can constrain light Z' gauge boson realized in generic BSM U(1)_X scenarios.

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