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Cosmological signatures of electromagnetically decaying dark matter

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Although the existence of Dark Matter (DM) is by now well-established thanks to a variety of observations on many different scales, its nature is still unknown and so are many of its most basic properties, such as its lifetime. Moreover, even if obvious arguments require that most of the DM is stable on timescales of (at least) the lifetime of the universe, a fraction of it could be in the form of unstable exotic particles that are free to decay at much shorter times. In the literature, numerous relics from the early universe have been proposed in many extensions of the standard model of particle physics, in some cases unstable to processes injecting electromagnetic (e.m.) forms of energy (e.g. 'superWIMP', R-parity breaking SUSY models, Sterile neutrinos, Primordial black holes ...).

In this talk, I would like to review how the study of CMB temperature and polarization anisotropies can be used to put stringent constraints on the abundance of such electromagnetically decaying exotic particles, as a function of their lifetime. I will then emphasize the synergy with CMB spectral distortions and Big Bang Nucleosynthesis studies and illustrate how the 21cm signal, one of the main target of future experiments, could be used in order to improve (but not always !) over these bounds.

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