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Multicomponent Dark Matter signatures in supersymmetric models

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An intriguing possibility is that multiple dark matter (DM) candidates can coexist and contribute significantly to its measured relic abundance. In R-parity conserving supersymmetric models, the MSSM and the next-to-MSSM extended with RH neutrino superfields, we study a two-component scenario with right-handed sneutrino NLSP and gravitino LSP as DM candidates. Interestingly, the right-handed sneutrino decay is dominated by two-body processes to the LSP plus neutrinos, producing a potentially detectable signal in the ballpark of current and planned neutrino telescopes, in addition to the usual WIMP signatures. Since the interaction is suppressed by the Planck mass, and if the LH-RH sneutrino mixing parameter is small, $\ll O(10^{-2})$, a long-lived RH sneutrino NLSP is possible. On the other hand, in R-parity breaking models we consider axino and gravitino as DM candidates. Both can decay into a neutrino-photon pair with a lifetime much longer than the age of the Universe yielding a potentially detectable signal by gamma-ray telescopes. Moreover, if one is the NLSP and the other the LSP, the former can live enough as to contribute to the relic density in important regions of the parameter space. We study this multicomponent scenario in the context of the $\mu\nu$ SVM in which a double-line signal can arise as a smoking gun.

Primary author: PEREZ, Andres Daniel (UAM-IFT)

Presenter: PEREZ, Andres Daniel (UAM-IFT)

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