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Dark matter in split supersymmetry: thermal wino dark matter and beyond

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(Mini) split supersymmetry explains the observed Higgs mass and evades stringent constraints, while keeps good features of TeV-scale supersymmetry other than the little hierarchy problem. A compelling dark matter candidate in split supersymmetric scenarios is thermal wino dark matter whose mass is around 3 TeV. Even if wino is lighter and its thermal relic is a sub-dominant component of dark matter, non-thermal production of wino, e.g., late-time decay of gravitino, can account for the rest of dark matter. It is also possible that the rest of dark matter consists of hidden baryon whose asymmetry is produced by thermal leptogenesis at the same time as asymmetry of visible baryon. Such composite asymmetric dark matter scenarios require some entropy transfer mechanism below the composite scale. A tiny kinetic mixing term between a dark photon and the visible photon is a promising example. Split supersymmetry plays an important role to explain the origin of such a tiny kinetic mixing by realizing grand unifications in the dark and the visible sectors. We see a broad spectrum of dark matter candidates and phenomenology in split supersymmetry.

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