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Dark Matter prospects for heavy neutralinos (12' + 3')

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The relic density of TeV-scale wino-like neutralino dark matter in the MSSM is subject to potentially large corrections as a result of the Sommerfeld effect. A recently developed framework enables us to calculate the Sommerfeld-enhanced relic density in general MSSM scenarios, properly treating mixed states and multiple co-annihilating channels as well as including off-diagonal contributions. Using this framework, including on-shell one-loop mass splittings and running couplings and taking into account the latest experimental constraints, we perform a thorough study of the regions of parameter space surrounding the well known pure-wino scenario: namely the effect of sfermion masses being non-decoupled and of allowing non-negligible Higgsino or bino components in the lightest neutralino. We further perform an investigation into the effect of thermal corrections and show that these can safely be neglected. The results reveal a number of phenomenologically interesting but so far unexplored regions where the Sommerfeld effect is sizeable. We find, in particular, that the relic density can agree with experiment for dominantly wino neutralino dark matter with masses ranging from 1.7 to beyond 4 TeV. In light of these results the bounds from Indirect Detection on wino-like dark matter are revisited: indirect signals from charged cosmic rays and diffuse gamma rays are also computed within our framework, and we show the impact o the corresponding experimental limits in the new wino-like regions.

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