Project 16/2014: "**MSSM parameter scans for Sommerfeld enhanced WIMP relic densities**"

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Abstract:
The neutralino LSP in the MSSM is one of the most promising candidates for particle dark matter (DM), explaining the experimentally observed DM abundance in terms of a thermal relic. The requirement that the neutralino relic density matches the observed value leads to particularly severe constraints on the MSSM parameter space. A central ingredient in the relic abundance calculation are the (co-)annihilation cross sections of all particles nearly mass-degenerate with the neutralino DM candidate. While publicly available codes calculating neutralino relic abundances take Born- level cross sections into account, Sommerfeld enhancements of the relevant annihilation rates due to long range potential interactions prior to the annihilation reaction are generic for TeV scale neutralino DM and can lead to up to a few orders of magnitude enhancements of the rates compared to the tree-level expectation. This can translate into a significant reduction of the calculated abundance for a given parameter space point. Scanning the MSSM parameter space we identify regions consistent with the neutralino DM hypothesis when Sommerfeld corrections are correctly taken into account.