

## Rapid thermal co-annihilation through bound states

*Thursday, July 14, 2016 1:30 PM (30 minutes)*

The coannihilation rate of kinetically equilibrated non-relativistic particles plays an essential role in the classic WIMP dark matter scenario. If the dark matter particles interact attractively, for instance through  $Z^0$  exchange, the coannihilation rate could be substantially increased with respect to a tree-level estimate, a phenomenon known as the Sommerfeld effect. We study this physics in an analogous QCD situation, replacing WIMPs by charm or bottom quarks at a temperature of a few hundred MeV. Through resummed perturbative estimates and lattice simulations, we demonstrate that the coannihilation rate can increase much more than predicted by the standard Sommerfeld enhancement, by up to two orders of magnitude. The boost originates from the formation of (thermally broadened) bound states, which subsequently decay.

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**Session Classification:** Parallel Track 1