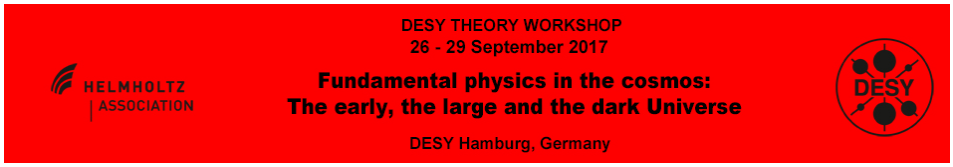

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Early Kinetic Decoupling —a case when the standard thermal dark matter relic density calculation fails

Wednesday 27 September 2017 14:51 (17 minutes)

Today's standard formalism to calculate the abundance of thermally produced dark matter particles relies on the underlying assumption that annihilating dark matter particles are in kinetic equilibrium throughout the freeze-out period. I will point out that this assumption does not have to be fulfilled in general and then present two methods on how to generalize the formalism in order to deal with the situation when kinetic decoupling happening so early that it interferes with the chemical decoupling process. One is an approximate method, where two coupled differential equations describe the leading momentum moments of the dark matter distribution, and one is a numerical procedure that enables to solve the Boltzmann equation at the full phase-space level. To illustration the implications, the methods are applied to the renown Scalar Singlet dark matter candidate where it's shown that even in such a simple model the dark matter abundance predictions can be affected by up to one order of magnitude.

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