素粒子論セミナー

Excited bound states and their role in dark matter production

Stefan Lederer (Tokyo U of Science)

概要

I will discuss the impact of highly excited bound states on the evolution of number densities of new physics particles, focusing on dark matter, in the early Universe. In case of non-Abelian gauge interactions, which source dipole interactions between fundamental particles, highly excited states can prevent the particles from freezing, supporting a continuous depletion in the regime consistent with perturbativity and unitarity. Unitarity violation does in fact arise systematically, that is even for arbitrary small interaction strengths, once sufficiently highly excited states become relevant at low velocities. Novel analytic expressions for bound state formation, which we found recently, allow to accurately compute the freeze-out dynamics down to very low temperatures. I will highlight the importance of bound states to dark SU(N) sectors. For a more concrete dark matter model, I will focus on a colored and charged t-channel mediator model in the regime of superWIMP production. Here, excited states render the mediator depletion efficient all the way until its decay, introducing a dependence of the dark matter density on the mediator lifetime as a novel feature. [arXiv: 2308.01336, 2411.08737]

1月16日（木）10:30〜　4号館4階　会議室

問い合わせ：阿部研究室 (abe.tomohiro@rs.tus.ac.jp)