Contribution ID: **24** Type: **not specified**

Superheavy Kaluza-Klein particle production in the early universe

Thursday, 30 October 2025 11:20 (40 minutes)

Extra dimensions appear in the theory beyond the standard model, such as superstring theory. Kaluza-Klein modes associated with the compact extra spaces are usually never excited in the low energy effective theory below the compactification scale, and we are able to use the 4D effective theory by integrating them out. However, it might not be the case. In case that gauge fields along the compact spaces acquire time-dependent field values, which may occur in the very early universe, the time-dependence of the gauge field leads to "electric fields" along compact spaces. KK momenta can be accelerated/decelerated by the electric fields, and when KK momenta vanish, the "KK modes" are produced from vacuum in the exactly the same way as Schwinger effect in strong field QED. I will show that the KK particles are indeed produced with concrete models of 5D QED with gravity. Remarkably, KK particles are produced even if the Hubble scale is hierarchically smaller than the compactification scale. I also briefly discuss the possibility that the produced KK particles become super heavy dark matter.

Presenter: YAMADA, Yusuke (IBS CTPU-CGA)

Session Classification: Session 2