Contribution ID: **51** Type: **not specified**

Cosmological Collider Searches beyond the Hubble Scale with Planck Data

Monday, 20 April 2026 14:30 (15 minutes)

Searches for primordial non-Gaussianity (NG) has the potential to not only reveal the physics of cosmic inflation, but also the structure of fundamental interactions at the highest energies. The cosmological collider (CC) physics program exemplifies this possibility and demonstrates how searches for oscillatory NG can lead to mass-spin spectroscopy of extremely heavy states. Adopting an effective field theory approach, we find the class of Feynman diagrams that can give the largest NG mediated by a heavy scalar particle with mass $M \sim H$, the inflationary Hubble scale. We compute the full shape of the NG and perform the first search for this shape using Planck data, finding no evidence for NG. This search loses its sensitivity as $M \gg H$ since quantum vacuum fluctuations cannot efficiently produce such heavier particles. We then focus on a mechanism where a chemical potential excites on-shell scalar particles with mass $M \gg H$. Computing the full shapes, we perform the first CC search for particles parametrically heavier than H using Planck data. For a range of chemical potential ω and M satisfying $\omega - M \simeq 3H$, we find a global 1.7σ evidence for non-zero NG, after taking into account the look-elsewhere effect.

Primary authors: Ms LU, Qianshu (Institute for Advanced Study, Princeton); Mr KUMAR, Soubhik (Tufts University); ZHANG, Yisong (Tsinghua University); XIANYU, Zhong-Zhi (Tsinghua University)

Presenter: ZHANG, Yisong (Tsinghua University)

Session Classification: Parallel Theory-BSM: BSM Probes (Room 368, Chair Ke-Ping Xie)