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Topological aspects of particle production, and it's applications to early universe cosmology

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We study topological aspects of particle production using Stokes phenomenon. An explicit map between the standard β-coefficient computation, and Stokes constants from the perspective of the F-matrix formalism is presented. In scenarios where the particle dispersion relation reduces, in the long wavelength limit ($k \to 0$), to the form z^n ($n \in \mathbb{Z}_{>0}$) in complexified time coordinate z, the corresponding mode equation satisfies a Z_{n+2} symmetry. This symmetry, combined with the F-matrix formalism fixes the Stokes constants and the β coefficient as a simple trigonometric function of n. In our on-going work we are attempt to extend the above computation to small non-zero values of k by computing the lowest order correction to the Stokes constant for scenarios where the mode equation retains a Z_{n+2} symmetry. These corrections are then used to estimate the topological contribution, corresponding to $k \approx 0$, to the total particle production in two scalar field models of interest for early universe cosmology.

Presenter: KANDATHPATINHARUVEETIL, Nidhi (University of Wisconsin)

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