

## NITheCS WEBINAR:

# Gaussian Entanglement in Noncommutative Space

Prof Pinaki Patra (Brahmananda Keshab Chandra College, India)

Friday, 21 June 2024 | 14h00 – 15h00 SAST

Attend online or in the NITheCS Seminar Room, Stellenbosch University

### ABSTRACT

We investigate the separability of noncommutative (NC) space coordinate degrees of freedom using the generalized Peres-Horodecki separability criterion (Simon's condition) for bipartite Gaussian states. The non-symplectic transformation between commutative and NC spaces limits the direct application of Simon's condition in NC space. By employing the Bopp shift, we transform the NC system to an equivalent Hamiltonian in commutative space, preserving the intrinsic symplectic structure ( $\mathbb{Sp}(4, \mathbb{R})$ ). We find that NC parameters influence the separability of states, particularly for isotropic oscillators, where the separability condition depends on NC parameters. Anisotropic oscillator parameters also affect separability, making both the deformation parameters ( $\theta, \eta$ ) and oscillator parameters crucial for bipartite state separability. Adjusting these parameters can destroy or restore state separability. We illustrate the practical implications by examining extractable work from a quantum heat engine in NC space for entangled states.

### BIOGRAPHY



Dr Pinaki Patra earned his PhD in Physics from the University of Kalyani in 2018, under the guidance of Dr Jyoti Prasad Saha. His PhD focused on "Non-local deformation and aspects of CPT violation in lower dimensional field theory."

Currently, he serves as an Assistant Professor in the Department of Physics at Brahmananda Keshab Chandra College, Kolkata, a position he has held since March 2015. Dr Patra has over nine years of teaching experience, including six years of post-PhD teaching. His research interests include Mathematical Physics, High Energy Physics, and Quantum Information.

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