Contribution ID: **261** Type: **Poster**

Probing Non-classicality of Primordial Gravitational Waves and Magnetic Field Through Quantum Poincare Sphere

Tuesday 13 December 2022 14:00 (1 hour)

The universe is believed to be originated from a quantum state. However, defining measurable quantities for the quantum properties in the present universe has gained interest recently. In this work, we propose a quantum Poincare sphere as an observable quantity that can hint at the quantumness of primordial gravitational waves and large-scale magnetic fields. The Poincare sphere is defined in terms of quantum stokes operators associated with the polarization of those fields, which can be measured directly. We have further studied the effects of the initial non-BD vacuum on the power spectrum and squeezing parameter of the primordial gravitational waves and magnetic field. We have found that the initial non-BD vacuum increases the value of the squeezing parameter at the end of inflation, which further enhances the possibility of measuring the quantumness of the fields under consideration. To support our results, we further explored the possible Bell violation test for a set of generalized pseudo spin operators defined in the polarization space of those fields.

Session

Astroparticle Physics and Cosmology

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Session Classification: Poster - 2