JOINT TUFTS/MIT COSMOLOGY SEMINAR

The Quantum Nature of Gravity Waves from Inflation

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Previous work on the prediction of gravity waves from inflation will be reviewed, and a key unsolved problem will be addressed. Gravitons are expected to arise at the end of inflation from gravitational particle creation. These will be created into a non-classical, squeezed vacuum state. Yet the prediction of B-modes assumes a classical gravity wave, leaving the question of how this classical behavior emerges. One answer is through decoherence from interactions, but it is not clear if the extremely weak coupling of gravitons to their environment is sufficient. In this talk, an alternative proposal will be offered based on a measurement selection effect. The squeezed vacuum state contains correlated pairs of gravitons, but only one member of each pair is accessible to a given observer. This motivates the definition of a "reduced quantum state", which contains only the observable gravitons. It will be shown that this state exhibits classical-like behavior. The expectation value of the metric perturbation or of the linearized Riemann tensor satisfies the classical equation of motion. However, there are relatively large quantum fluctuations around this mean value, whose magnitude may be quantified. The possibility of observing the fluctuations in these CMB will be discussed. There is an analog model in quantum optics which may be accessible to experimental study.

Tuesday, October 24, 2023, 2:30 pm

574 Boston Ave, Room 402

Tufts University

Refreshments at 2:00 outside the building, at the corner of Harvard St. and Boston Ave.