

Seminar

Identifying and Extracting Signatures of Gravitational Fluctuations

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In this talk, I discuss two complementary approaches to identifying observable signatures of gravitational fluctuations.

First, I discuss the dynamics of two massive particles in the presence of quantum fluctuations of the gravitational field. I find observable consequences of choosing two different position observables: (i) a frame-dependent coordinate separation and (ii) a frame-independent geodesic separation.

Second, I discuss my work that forges a bridge between ultra-high-precision interferometer output signals and a fundamental aspect of gravity theories – the two-point correlation function of spacetime fluctuations. I consider three classes of spacetime fluctuations, characterised by the decay behaviour and symmetries of their two-point correlation functions. For each, I identify low- and high-frequency behaviour of the interferometric outputs and their dependence on the interferometer's arm length. Capturing these requires sensitivity over a broad frequency range that spans the light-round-trip frequency, as provided by laboratory-scale setups, whereas detecting the presence or absence of the fluctuations can be done with high narrowband sensitivity at the light-round-trip frequency. My approach applies to interferometers with arm cavities, such as the km-long LIGO detectors, and those without, like laboratory-scale setups QUEST and GQuEST. I also assess if introducing active optical elements in the interferometric setup can enhance the sensitivity.

Thursday, Oct 15th 2026

11:30 Hrs (Tea / Coffee 11:15 Hrs)

Auditorium, TIFRH