



Contribution ID: 30

Type: **Talk in a parallel session**

The role of gravitational energy in the quantum gravity phenomenology

Tuesday, 9 July 2024 16:00 (15 minutes)

Since the seminal work of Jacobson, it has been known that the equations governing gravitational dynamics can be reconstructed from thermodynamics of local causal horizon. Remarkably, it is even possible to recover low energy quantum phenomenological corrections to gravitational dynamics from thermodynamics. In vacuum, the only possible such corrections are quadratic in Weyl tensor. These contributions take the form of the time component of the Bel-Robinson tensor, which satisfies many of the properties expected from a measure of the quasi-local gravitational energy. In my talk, I show how this candidate expression for the gravitational energy enters the thermodynamics of local causal horizons and whether one should ultimately expect it to affect the gravitational dynamics. Notably, such effects would provide a quantum signature in the vacuum gravitational dynamics.

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Session Classification: Quantum gravity phenomenology

Track Classification: Quantum Gravity (QG): Quantum gravity phenomenology