Contribution ID: **12** Type: **not specified**

On the impact of perturbative counterterms on black holes

Monday, 9 September 2024 10:30 (25 minutes)

Motivated by considerations in Quantum Gravity, I will discuss black hole-like spacetimes obtained from higher derivative theories of gravity, focusing particularly on the Goroff-Sagnotti counterterm. We find that static, asymptotically flat, and spherically symmetric geometries are completely characterized by their asymptotic mass and the coupling associated with the counterterm. This coupling induces distinct corrections at the sixth order of the parametrized post-Newtonian expansion. The resulting spacetime geometries still exhibit an event horizon. I will discuss various thermodynamic aspects using the Wald formalism to derive the entropy and compute the first law of thermodynamics for the static black holes in this theory. From a phenomenological perspective, I will show how corrections to the shadow size can be determined analytically and used to provide an initial bound on the new coupling. Finally, I will present some recent developments regarding the geometry inside the event horizon.

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