Contribution ID: **265** Type: **not specified**

Particle Production by Gravitational Fields and Black Hole Evaporation

Tuesday, October 31, 2023 4:00 PM (1h 20m)

based on Phys. Rev. Lett. 130 (2023) 221502 (arXiv:2305.18521 [gr-qc])

This talk presents a new avenue to black hole evaporation using a heat-kernel approach in the context of effective field theory analogous to deriving the Schwinger effect. Applying this method to an uncharged massless scalar field in a Schwarzschild spacetime, we show that spacetime curvature takes a similar role as the electric field strength in the Schwinger effect. We interpret our results as local pair production in a gravitational field and derive a radial production profile. The resulting emission peaks near the unstable photon orbit. Comparing the particle number and energy flux to the Hawking case, we find both effects to be of similar order. However, our pair production mechanism itself does not explicitly make use of the presence of a black hole event horizon and might have cosmological implications.

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