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# Numerical studies of Hawking Radiation via hyperboloidal slices

Hawking Radiation, proposed by physicist Stephen Hawking in 1974, is a theoretical result stating that black holes emit particles in accordance to Planck's Distribution of Thermal Radiation. This outcome arises by coupling classical spacetime to quantum fields. The emission of particles is not a standalone characteristic of black holes, rather it's a consequence of gravitational collapse. By dividing the dynamic scenario into an initial flat, stationary region, an intermediate dynamic collapsing region, and a final stationary Schwarzschild region, one finds that the vacuum state of the initial region differs from that of the final region. This leads to particle creation from an initial vacuum state for an observer in the future.

The project focuses on a classical and numerical study of Hawking Radiation by propagating a massless scalar field from past null infinity to future null infinity. The field is subsequently extracted and Fourier Analysis is performed to identify negative energy mode contributions and thus accertain particle creation. A distinct feature of this setup is the evolution of the field on hyperboloidal slices - spacelike surfaces extending towards null infinity –obtained by using a compactified radial coordinate and redefining the time coordinate. This approach allows the exploration of asymptotic regions of spacetime in the computational domain and correct radiation extraction.

The final objective of the research is to evolve the field on a dynamical background corresponding to gravitational collapse. Initial steps involve testing the code on stationary backgrounds such as Minkowski, Minskowski with a potential, and Schwarzschild spacetimes, where particle creation is not expected.

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