Relativistic Quantum Information Mirror

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We present a new solution of quantum particle creation from vacuum by a relativistic accelerating mirror, which preserves information. It solves the soft particle production problem and radiates thermally. The Bogolyubov coefficients and particle spectrum, with an appropriate Planckian limit, can be computed analytically. We detail the correspondence to black hole particle creation (Hawking radiation) and complete evaporation (no remnant).

The conformal diagrams in Fig. (1) illustrate the usual correspondence [1] between the moving mirror in (1+1) and the black hole in (3+1). The strict v-horizon at v_H, results in divergent entanglement entropy, but signals exact late-time Planckian distribution (as is eternal in the Unruh effect [2]). The thermal solution we will present, in contrast, preserves information and conserves energy.

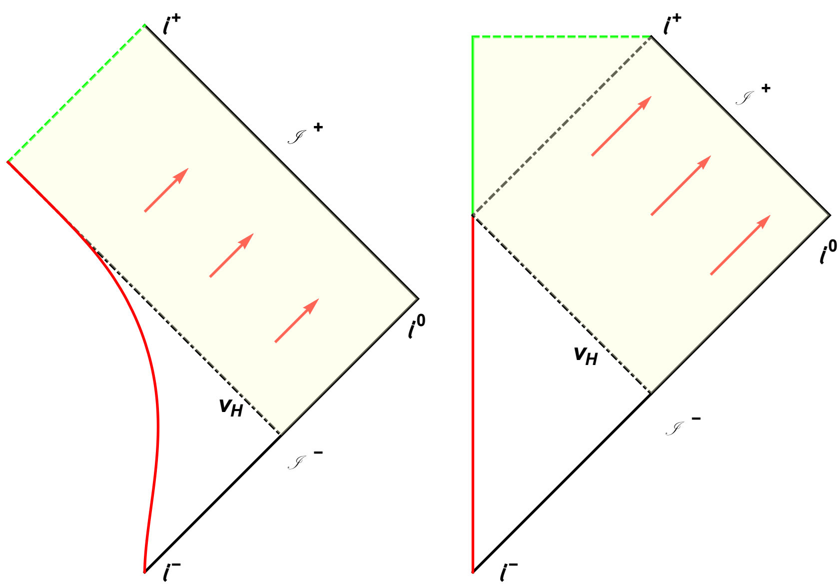

FIG. 1: **Left**: The 1+1 dimensional Penrose diagram for the black hole collapse analog mirror, 'black mirror', [1] or BHC trajectory [3]. The red line is the mirror, computed with $\kappa = 4$ for illustration. The dot-dashed black line is the horizon, $v_H = 0$. The green dashed line is $\mathscr{I}_L^+$ (unlabeled), and acts as a singularity analog. Notice the light yellow shaded region is where left-moving modes never reflect off the mirror and get 'trapped', never to become right-movers. The red arrows are Hawking radiation emitted by the mirror. **Right**: The usual 3+1 dimensional Schwarzschild causal structure for a black hole, captured in a Penrose diagram. The green dashed line is the space-like singularity while the green solid line is $r = 0$ where modes pass through ('reflect') but still hit the singularity (no mirror counterpart).

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