Quantum memory for Rindler supertranslations

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Abstract

Recently, Hawking, Perry and Strominger described a physical process that implants supertranslational hair on a Schwarzschild black hole by an infalling matter shock wave without spherical symmetry. Using the BMS-type symmetries of the Rindler horizon, we present an analogous process that implants supertranslational hair on a Rindler horizon by a matter shock wave without planar symmetry, and we investigate the corresponding memory effect on the Rindler family of uniformly linearly accelerated observers. Starting with a family of observers who follow the orbits of a single boost Killing vector before the wave, we find that after the wave has passed, each observer still follows the orbit of a boost Killing vector but this boost differs from trajectory to trajectory, and the trajectory-dependence carries a memory of the planar inhomogeneity of the wave. We further show that this classical memory is accompanied by a supertranslation quantum memory that modulates the entanglement between the opposing Rindler wedges in quantum field theory. A corresponding phenomenon across the Schwarzschild black hole horizon indicates that the Negativity measure of entanglement between infalling and outgoing Hawking pair should be degraded due to an infalling soft hair implanting shockwave while there should be linear order generation of Negativity between two outgoing Hawking particles. These observations may play a role in Hawking, Perry and Strominger's proposal for supertranslations to provide a solution to the black hole information paradox.

References

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