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Quantum memory and BMS symmetries

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Asymptotically flat spacetimes are known to possess an infinite number of symmetries known as the Bondi-Metzner-Sachs (BMS) supertranslations. These BMS symmetries were shown to be related, both, to the gravitational memory effect and Weinberg's soft theorems, the significance of which was recently realised by Hawking et. al. who conjectured that applying these relations to an asymptotically flat spacetime with a black hole in the interior would imply the existence of an infinite number of soft hairs for the black hole. We discuss the effect of BMS symmetries on quantum entanglement and its implications in the context of the black hole information paradox. In particular, we illustrate the gravitational memory effect for linear uniformly accelerated observers in a physical process involving a BMS shock-wave without planar/spherical symmetry. This classical memory is accompanied by a quantum memory that modulates the quantum entanglement between the opposing Rindler wedges in quantum field theory. A corresponding phenomenon across the Schwarzschild black hole horizon suggests that the Negativity measure of entanglement between infalling and outgoing Hawking pair should be degraded due to an infalling BMS shockwave while there should be linear order generation of Negativity between two outgoing Hawking particles. Implications are discussed.

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