Quantum Information Channels in Curved Spacetime

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Abstract. Quantum field theory in curved spacetime reveals a fundamental ambiguity in the quantization procedure: the notion of vacuum, and hence of particles, is observer dependent. A state that an inertial observer in Minkowski space perceives to be the vacuum will appear to an accelerating observer to be a thermal bath of radiation. The impact of this Davies-Fulling-Unruh noise on quantum communication has been explored in a recent paper by Bradler, Hayden and the author.

I will review the results of that paper. The problem of quantum communication from an inertial sender to an accelerating observer and private communication between two inertial observers in the presence of an accelerating eavesdropper was studied there. In both cases, they were able to establish compact, tractable formulas for the associated communication capacities assuming encodings that allow a single excitation in one of a fixed number of modes per use of the communications channel. Group theoretical ideas play a key role in the calculation.

I close with a discussion of some issues of quantum communication in curved spacetime that have yet to be understood.