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Matrix Product State Simulations of Quantum Fields in Curved 1+1 Spacetime

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While the dynamics of black hole evaporation and closed-timelike-curve physics in the presence of quantum fields are to some extent understood in principle, the computations necessary to produce concrete predictions from them are often intractable in practice. Here we show how tensor-network based numerics, which assign a manageably sparse representation to certain quantum states, can be used to perform them. As a first step wecompute the Hadamard-regularized stress-energy tensor of a 1+1-D massive Dirac field in various quantum states, demonstrating the Unruh effect in flat and curved spacetime.

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