Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

Local quenches and quantum chaos from higher spin perturbations

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We study local quenches in 1+1 dimensional conformal field theories at large-c by operators carrying higher spin charge. Viewing such states as solutions in Chern-Simons theory, representing infalling massive particles with spin-three charge in the BTZ background, we use the Wilson line prescription to compute the single-interval entanglement entropy (EE) and scrambling time following the quench. We find that the change in EE is finite (and real) only if the spin-three charge q is bounded by the energy of the perturbation E, as |q|/c < E^2/c^2. We show that the Wilson line/EE correlator deep in the quenched regime and its expansion for small quench widths overlaps with the Regge limit for chaos of the out-of-time-ordered correlator. We further find that the scrambling time for the two-sided mutual information between two intervals in the thermofield double state increases with increasing spin-three charge, diverging when the bound is saturated. For larger values of the charge, the scrambling time is shorter than for pure gravity and controlled by the spin-three Lyapunov exponent 4\pi/\beta. In a CFT with higher spin chemical potential, dual to a higher spin black hole, we find that the chemical potential must be bounded to ensure that the mutual information is a concave function of time and entanglement speed is less than the speed of light. In this case, a quench with zero higher spin charge yields the same Lyapunov exponent as pure Einstein gravity.

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