Out-of-time-ordered correlators in weakly interacting chaotic systems

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Strongly chaotic and weakly interacting subsystems display two distinct phases in the growth of the out-of-time-ordered correlators (OTOC), a diagnostic of quantum chaos intensely under study in many areas. The first is dominated by intra-subsystem scrambling, when an exponential growth with a positive Lyapunov exponent is observed till the Ehrenfest time. This phase is essentially independent of the interaction, while the second phase is an interaction dominated exponential approach to saturation that is universal and described by a random matrix model. The example of two coupled kicked rotors is used to demonstrate the two phases. That the two phases correspond to delocalization in the subsystems followed by inter-subsystem mixing is seen via the participation ratio in phase-space. We also point out that the second, universal, phase alone exists when the observables are in a sense locally pre-scrambled.

References

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