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PROBING THE QUANTUM MECHANICS OF MANY-BODY CHAOS

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The notions of chaos and order are central to understanding the statistical physics of many-body systems. In this context the spread of quantum information in dynamical many-body systems is presently attracting a lot of attention across various fields, ranging from cold atom physics via condensed quantum matter to high energy physics and quantum gravity. Starting from the concept of a "quantum butterfly effect", this includes questions of how a quantum system thermalizes and phenomena like many-body interference and localization, more generally non-classicality in many-particle quantum physics.

To this end concepts based on echoes, i.e. rewinding time, provide a useful way to monitor far-out-of-equilibrium quantum dynamics and its stability. Central to these developments are so-called out-of-time-order correlators (OTOCs) as sensitive probes for chaos in interacting systems. We will address such phenomena using semiclassical methods based on interfering Feynman paths, thereby bridging the classical and quantum chaotic many-body world.