Static and dynamical properties of isolated many-body quantum systems

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We study static and dynamical properties of isolated many-body quantum systems and compare them with the results for full random matrices. In doing so, we link concepts from quantum information theory with those from quantum chaos. We argue that similar information about the system can be obtained either with the von Neumann entanglement entropy or with the Shannon information entropy, the latter being computationally less expensive. We also analyze the evolution of the survival probability. It reveals details about the system that the two entropies cannot capture. These include the correlation hole, which is a way to directly detect level repulsion from dynamics, and a slower evolution at long times caused by the unavoidable energy bounds of the spectrum.