Quantum signs of chaos: eigenvector thermalization vs. lyapunov exponent

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A symptom of chaoticity for quantum models is the so-called ”Eigenvector thermalization Hypothesis” (ETH), which consists in assuming that even single eigenvectors of the Hamiltonian yield the good averages coinciding with the Canonical in the thermodynamic limit. This hypothesis led to a form of the matrix elements of smooth operators, in the basis of the Hamiltonian. A different, more traditional measure of chaoticity is the Lyapunov exponent, promoted to a quantum quantity. a) This second approach convinces us that the matrix elements cannot be assumed to have random, uncorrelated signs, as was previously thought was a consequence of ETH. b) Unlike the classical case, the quantum Lyapunov exponents cannot be arbitrarily large, there is a bound of quantum nature. I will explain how it acts, in a simple example.