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Anomalous Thermalization[1]

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It is commonly believed that quantum isolated systems satisfying the eigenstate thermalization hypothesis (ETH) are diffusive. We show that this assumption is too restrictive since there are systems that are asymptotically in a thermal state, yet exhibit anomalous, subdiffusive thermalization. Such systems satisfy a modified version of the ETH ansatz and we derive a general connection between the scaling of the variance of the off-diagonal matrix elements of local operators, written in the eigenbasis of the Hamiltonian, and the dynamical exponent. We find that for subdiffusively thermalizing systems the variance scales more slowly with system size than expected for diffusive systems. We corroborate our findings by numerically studying the distribution of the coefficients of the eigenfunctions and the diagonal and off-diagonal matrix elements of local operators of the random field Heisenberg chain, which has anomalous transport in its thermal phase. Surprisingly, this system also has non-Gaussian distributions of the eigenfunctions, thus, directly violating Berrys conjecture. [1] David J. Luitz and Yevgeny Bar Lev, Phys. Rev. Lett. 117, 170404 (2016) [2] David J. Luitz, Phys. Rev. B 93, 134201 (2016)

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