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Eigenstate Thermalization and the fate of off-diagonal matrix elements in the two-dimensional transverse field Ising model[1] RUBEM MONDAINI, Beijing Computational Science Res Ctr, MARCOS RIGOL, The Pennsylvania State University — The Eigenstate Thermalization Hypothesis (ETH) provides a framework that explain how thermalization happens in generic isolated quantum systems. The two-dimensional transverse field Ising model is one of the models that one can numerically verify its predictions and infer under which circumstances it is valid. To probe thermalization and its relationship with the onset of quantum chaos, we use full exact diagonalization in moderately sized lattices using symmetries. We examine the behavior of quantum chaos indicators and of the diagonal matrix elements of operators of interest in the eigenstates of the Hamiltonian. An analysis of finite size effects reveals that quantum chaos and eigenstate thermalization occur in those systems whenever the transverse field is nonvanishing and not too large, that is, away from the integrable limits. Going beyond this analysis, we investigate the behavior of off-diagonal matrix elements of few-body operators in the eigenstate basis of the Hamiltonian. With this we can infer its relationship with the predictions of equivalent quantities in random matrix theory. Reference: R. Mondaini, K. R. Fratus, M. Srednicki, and M. Rigol, "Eigenstate thermalization in the two-dimensional transverse field Ising model", Phys. Rev E, **93**, 032104 (2016).

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Rubem Mondaini
Beijing Computational Science Res Ctr

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