Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Entanglement dynamics in quantum many-body systems[1] WEN WEI HO, DMITRY ABANIN, Department of Theoretical Physics, University of Geneva — The dynamics of quantum entanglement $S(t)$ has proven useful to distinguishing different quantum many-body phases. In particular, the growth of entanglement following a quantum quench can be used to distinguish between many-body localized($S(t) \sim \log t$) and ergodic($S(t) \sim t$) phases. Here, we provide a theoretical description of the growth of entanglement in a quantum many-body system, and propose a method to experimentally measure it. We show that entanglement growth is related to the spreading of local operators. In ergodic systems, the linear spreading of operators results in a universal, linear in time growth of entanglement. Furthermore, we show that entanglement growth is directly related to the decay of the Loschmidt echo in a composite system comprised of many copies of the original system, subject to a perturbation that reconnects different parts of the system. Using this picture, we propose an experimental set-up to measure entanglement growth by using a quantum switch (two-level system) which controls connections in the composite system. Our work provides a way to directly probe dynamical properties of many-body systems, in particular, allowing for a direct observation of many-body localization.

[1]This work was partially supported by Sloan Foundation, Ontario Early Researcher Award and NSERC Discovery Grant.

Wen Wei Ho
Department of Theoretical Physics, University of Geneva

Date submitted: 06 Nov 2015 Electronic form version 1.4