The Abdus Salam International Centre for Theoretical Physics

**Conference on Frustration, Disorder and Localization: Statics and Dynamics**

**28 September - 2 October 2015**
**Trieste, Italy**

# NON-LOCAL RESPONSE IN LOCALIZED SYSTEMS

**Rahul M. NANDKISHORE**
**Condensed Matter Physics, Princeton Center for Theoretical Science, Princeton University, NJ-08544 Princeton, U.S.A.**

Abstract:

I discuss the response of a system localized by disorder to a time dependent local perturbation which varies smoothly with a characteristic timescale Ï„ . I show that such a perturbation induces a non-local response, involving a rearrangement of conserved quantities over a length scale â^¼ ln Ï„ . This effect lies beyond linear response, is absent in undisordered insulators and highlights the remarkable subtlety of localized phases. The effect is common to both single particle and many body localized phases. This result has implications for numerous fields, including topological quantum computation in quantum Hall systems, quantum control in disordered environments, and time dependent localized systems. For example, it indicates that attempts to braid quasiparticles in quantum Hall systems or Majorana nanowires will surely fail if the manipulations are performed asymptotically slowly, and thus using such platforms for topological quantum computation will require considerable engineering. This result also establishes that disorder localized insulators suffer from a statistical orthogonality catastrophe.