

Massachusetts Institute of Technology  
Department of Physics

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Condensed Matter Theory Seminar

"Renyi entanglement entropy in quantum many-body systems"

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**Abstract:** We present two concrete examples where the Renyi rather than just the von Neumann entanglement entropy is necessary in order to obtain certain insights into quantum many-body systems.

In the first example, we consider systems supporting ballistic information propagation and diffusive transport. It is well known that the linear-in-time growth of the von Neumann entanglement entropy (starting from a product state) is a probe of the former. Perhaps surprisingly, we show that the Renyi entanglement entropy (with Renyi index greater than 1) grows diffusively (i.e., as a square root of time) and is consequently a probe of the latter.

In the second example, we study the problem of approximating local properties of a quantum many-body state using matrix product and projected entangled pair representations in one and two dimensions, respectively. We prove that area laws for the Renyi entanglement entropy (with Renyi index less than 1) lead to nontrivial upper bounds on the bond dimension. The bounds only depend on the accuracy of the desired approximation but not the system size.

References:

<https://arxiv.org/abs/1902.00977>

<https://arxiv.org/abs/1903.10048>

**12:00pm noon**  
**Tuesday, October 22, 2019**  
**Duboc Room (4-331)**