Title: “Link representation of entanglement entropy”

Abstract: In this seminar, I will present the “link representation formalism” that we introduced in our recent works [1-2], where we assume entanglement entropy of any bipartition of a quantum state can be approximated as the sum of certain link strengths connecting internal and external sites. The representation is useful to unveil the geometry associated with the entanglement structure of a quantum many-body state which may occasionally differ from the one suggested by the Hamiltonian of the system. In the cases where the representation is exact, the elements of the link matrix coincide with the mutual information between pairs of sites. In others, it provides a very good approximation, and in all cases, it yields a natural entanglement contour that is similar to earlier proposals [3]. We will present examples where the representation is exact and then discuss several non-exact cases where we can apply certain approximation techniques, including matrix product states, free fermionic states, or cases in which contiguous blocks are especially relevant. The accuracy of the representation for different types of states and partitions will also be discussed. Finally, we show that the representation helps us extend the application of the quasi-particle picture useful in explaining the growth of entanglement entropy of short-range initial states when quenched under critical Hamiltonian, to the initial states presenting long-range correlations [4-5].

References:

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[4] Sudipto Singha Roy, Giovanni Ramírez, Silvia N. Santalla, Germán Sierra, and Javier Rodríguez-Laguna, “Exotic correlation spread in free-fermionic states with initial patterns”, Physical Review B **105,** 214306 (2022).

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