Colloquium del Departamento

de Análisis Matemático

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U. C. M.

"Entanglement and correlations in quantum many-body systems"
(Presentación de Tesis Doctoral)

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a las 13:00 horas en el seminario 222

Abstract:

This thesis deals with the study of correlations, locality and entanglement in quantum many-body systems. It relies on mathematical tools such a tensor network representations, Lieb-Robinson bounds and quantum algorithms in order to obtain original results, both analytical and numerical, with practical applications to quantum information theory, condensed matter and quantum metrology. We prove the existence of Lieb-Robinson bounds for spin-boson models and we propose an experimental test to measure these bounds in a system of trapped ions. Afterwards, we use matrix product states (MPS) to prove analytical results and to perform numerical simulations. We prove that a large fractionalization in the magnetization or the need of long-range interactions implies a large amount of entanglement in a quantum spin chain. Then, we put forward numerical methods to find purifications of multipartite states using the sum of squares polynomial method. Finally, we suggest novel quantum algorithms to measure time correlations which accumulate in a quantum system during its interaction with laser pulses and we apply this idea to the characterization and stabilization of a frequency comb, obtaining a polynomial improvement on the sensitivity over classical protocols.

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