



DEPARTAMENTO DE
ANÁLISIS MATEMÁTICO

Curso introductorio

Periodo de concentración:

Quantum information and
Quantum Many Body Systems

Programa Criptografía e Información Cuántica



Instituto de
Matemática
Interdisciplinar

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El mes de octubre habrá un período de concentración en el IMI en torno a Quantum Information and Quantum Many Body Systems. Durante dicho período nos visitarán muchos de los mayores expertos mundiales en esta área. Para facilitar el seguimiento de las actividades de dicho período, o simplemente como introducción para aquellas personas interesadas, se oferta este minicurso de 8 horas.

QUANTUM INFORMATION AND QUANTUM MANY BODY SYSTEMS

MOTIVATION: Having a quantum information point of view has been proven extremely successful when it comes to understand the behavior of Quantum Many Body Systems. This has been done mainly through the different variants of Tensor Network States: MPS, PEPS, MERA, ... These states are characterized by the fact that the relevant quantities one is interested in: amplitudes, expectation values of local observables, correlation functions, ... can be computed through the contraction of a suitable graph of tensors, usually related to the interactions between the parties. Tensor Network States has given us a deeper insight in the behavior of Quantum Many Body Systems from both a numerical and an analytical point of view. In numerics, they provide with variational algorithms, like DMRG, which are in practice extremely precise. But they also allow us to understand in a clearer way many intriguing phenomena, as for instance: One-way Quantum Computation, Quantum Phase Transitions, Topological Order or Entanglement.

From a mathematical point of view, the variety of techniques used up to now to treat them is extremely rich: Graph Theory, Stochastic Processes, Functional Analysis, Complexity Theory, Group Theory, ... but the most interesting thing is that, perhaps, this area could motivate the introduction of completely new mathematics, specially adapted to it.

CONTENTS: Día 6: An Introduction to Quantum Computation and Cryptography.
Día 7: One-dimensional quantum systems. Matrix Product States.
Día 13: The case of 2 and more spatial dimensions. PEPS.
Día 14: MERA states and current lines of research.



6-14 de octubre de 2008, 15:30 - 17:30 h

Seminario 222, Facultad de CC. Matemáticas, UCM