SEMINARIO DE OPERADORES Y FÍSICA-MATEMÁTICA

Organizers: *Doctors: Rafael del Río, Luis O. Silva y Ricardo Weder*

COOLING THE MOTION OF A QUANTUM OBJECT WITH A CAVITY

Prof. Marc Bienert
Saarland University

Abstract

I will present the cooling dynamics of a single atom, trapped in a harmonic potential, which interacts by dipole coupling with the electromagnetic field inside an optical high-finesse resonator. Cooling in such a system is achieved by suitably tailoring scattering processes such that transitions which reduce the motional energy of the atom preferentially take place compared to transitions where the motion is heated. The asymmetry in the scattering can be realized by exploiting the modifications on the mode structure of the electromagnetic field imposed by the cavity, or by taking advantage of quantum interferences in the atom-cavity system. The latter cooling schemes will be exemplified for a two- and three level atomic system, and compared to recent experiments in cavity quantum electrodynamics with single atoms.

Cooling with cavities is not restricted to atoms: I will also present a scheme where light scattering at a cavity with a pendular end-mirror, which is coupled to a single atom, can be used to cool down the motion of the mirror to its quantum ground state by exploiting quantum interferences to suppress unwanted heating transitions.

6 de septiembre de 2012

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MOVING CAVITIES AND DETECTORS FOR RELATIVISTIC QUANTUM INFORMATION PROCESSING

Dra. Ivette Fuentes
School of Mathematical Sciences
University of Nottingham, UK.

Abstract

Research in the field of relativistic quantum information aims at finding ways to process information using quantum systems taking into account the relativistic nature of spacetime. Cutting edge experiments in quantum information are already reaching regimes where relativistic effects can no longer be neglected. Ultimately, we would like to be able to exploit relativistic effects to improve quantum information tasks. In this talk, we propose the use of moving cavities and finite-size detectors for relativistic quantum information processing. Using these systems, we will show that non-uniform motion can change entanglement affecting quantum information protocols between moving parties. We will show that it is possible to preform quantum gates by moving. Via the equivalence principle, our results also provide a model of entanglement generation by gravitational effects.

30 de agosto de 2012

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APPLICATIONS OF MICROLOCAL ANALYSIS TO QUANTUM FIELD THEORY ON CURVED SPACE-TIMES I, II Y III

Prof. Christian Gérard
Université Paris-Sud

Abstract

In this espository lectures, I will describe some results obtained several years ago by Radzikowski and his followers about the so-called Hadamard states, one of the central notions in quantum field theory on curved space times. I will also present a recent result obtained by Michal Wrochna and myself about the construction of a large set of Hadamard states on a class of curved space-times.

3, 4 y 8 de mayo de 2012

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GEOMETRIC METHODS FOR NONLINEAR MANY-BODY QUANTUM SYSTEMS I Y II

Prof. Mathieu Lewin
Université de Cergy-Pontoise

Abstract

Geometric techniques have played an important role in the seventies, for the study of the spectrum of many-body Schrödinger operators. In this talk I will present a formalism which also allows to study nonlinear systems.

I will in particular define a weak topology on many-body states, which appropriately describes the physical behavior of the system in the case of lack of compactness, that is when some particles are lost at infinity.

As an application I prove the existence of multi-polaron systems in the Pekar-Tomasevich approximation, in a certain regime for the coupling constant.

15 y 16 de marzo de 2012

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BOUNDARY BEHAVIOR OF OPERATOR-VALUED HERGLOTZ FUNCTIONS AND APPLICATIONS

Prof. Sergey Naboko
Department of Mathematical Physics
St. Petersburg State University

Abstract

Operator valued Herglotz functions are analytic functions on the upper-half plane taking values in the class of dissipative operators in Hilbert space. This class appears in many problems of discrete and continuous spectral analysis of operators in Hilbert space. In particular such functions are generalized Weyl-Titchmarsh functions (M-functions), Krein Q-functions, bordered resolvents of self-adjoint operators, etc. The existence of boundary values of an operator valued Herglotz functions in various Schaten-von Neumann classes will be discussed. This is important in scattering theory among other applications.

Based on the joint paper with M. Marletta and R. Weikard.

24, 26 y 27 de enero de 2012