

Quantum Physics and Geometry

Program and Abstracts

JULY 11

17h00-17h30

Nuno C Dias, Escola Superior Náutica Infante D. Henrique and GFM UL
Schrodinger operators with singular potentials

I will present some recent results about Schrodinger operators with singular potentials. In the one-dimensional case these operators can be intrinsically defined using a suitable multiplicative product of distributions. They yield exactly solvable models, providing approximations to large classes of Schrodinger operators with sharply localized potentials. Moreover, they can be used to obtain global formulations of quantum systems with boundary interactions, confining conditions or arbitrary (local) boundary conditions. The relevance of these results for the deformation quantization of systems defined on bounded domains will be succinctly discussed.

17h30-18h00

Nenad Manojlović, Universidade do Algarve
The XYZ Heisenberg spin chain and the corresponding Gaudin model

Our study of the inhomogeneous XYZ Heisenberg spin-s chain is based on the most general boundary reflection matrices. A realization of the reflection equation algebra corresponds to N sites with spin-s representations of the Sklyanin algebra. The corresponding vacuum elliptic curve is discussed. Following Sklyanin's proposal in the periodic case, we derive the generating function of the Gaudin Hamiltonians with boundary terms. Our derivation is based on the quasi-classical expansion of the linear combination of the transfer matrix of the XYZ Heisenberg spin chain and the central element, the so-called Sklyanin determinant.

18h00-18h30

Bruno Mera, Instituto Superior Técnico
A theorem regarding families of topologically non-trivial fermionic systems

We introduce a Hamiltonian for fermions on a lattice and prove a theorem regarding its topological properties. We identify the topological criterion as a \mathbf{Z}_2 -topological invariant $p(\mathbf{k})$ (the Pfaffian polynomial). The topological invariant is not only the first Chern number, but also the sign of the Pfaffian polynomial coming from a notion of duality. Such a Hamiltonian can describe non-trivial Chern insulators, single band superconductors or multiorbital superconductors. The topological features of these families are completely determined as a consequence of our theorem. Some specific model examples are explicitly worked out, with the computation of different possible topological invariants.

JULY 13

14h00-14h30

Aleksandar Mikovic, Universidade Lusófona

Piecewise linear Quantum Gravity

We describe a path-integral quantization of General Relativity which is based on the assumption that the spacetime is a piecewise-linear manifold corresponding to a triangulation of a smooth 4-manifold. We show how to define an effective action with the correct classical limit and describe the relationship to the corresponding quantum field theory effective action.

14h30-15h00

João Pimentel Nunes, Instituto Superior Técnico

Complexified symplectomorphisms in geometry and quantization

We will describe how Hamiltonian flows analytically continued to complex time relate to geodesic families of Kahler metrics and to interesting families of polarizations in geometric quantization.

15h00-15h30

Miguel Tierz, Faculdade de Ciências, Universidade de Lisboa

Random matrices in gauge theory problems

We give an overview of the application of random matrix theory in the computation of observables in topological and supersymmetric gauge theories.