



BELL

FUNDAMENTAL PROBLEMS IN QUANTUM PHYSICS

GENOVA, PAVIA, MILANO, TRIESTE, COSENZA, TRENTO

National Coordinator: Nino Zanghì

Abstract

The network BELL aims to strengthen cooperation and promote theoretical research among Italian groups working on the foundations of quantum physics within INFN that have gained over the years reputation of excellence at the international level, thanks also to their involvement in several international collaborations, most with foreign institutions of great prestige.

The goal of the network is to meet the challenges of the research in the foundations of quantum mechanics which are of primary interest both theoretically and experimentally, with particular focus on the interplay between gravity and quantum physics.

Main themes of research

- the quantum aspects of gravity, both in the semiclassical regime and in perturbative quantum field theories,
- the relational formulations of classical and quantum gravity,
- the quantum cellular automata with applications to quantum field theory and quantum gravity,
- the relativistic extension of the models of collapse and applications to the post-Newtonian regime,
- the models of decoherence and quantum non-Markovian dynamics,
- the theory of open quantum systems,
- the mathematical investigation of the various aspects of quantum mechanics and its extension to quantum field theory.

Activity in Genova

Staff members:

- Nino Zanghì (PO)
- Nicola Pinamonti (PO)
- Pierre Martinetti (R B)

Other participants

- Federico Faldino (PhD student)

Research in Genova

1. Cosmological perturbations, cosmological models, arrow of time and weak values.
2. Operator product expansions for time ordered products on curved spaces (master thesis: Paolo Meda)
3. Stability of solutions of Semiclassical Einstein Equations in Cosmology (master thesis: Stefano Bertolotto)
4. Development of relational formulations of classical and quantum theories.
5. Noncommutative Geometry with applications to quantum field theory.

Most significant collaborations of the Genova unit

X. Oriols, Universitat Autònoma de Barcelona (Spain)

J.L. Lebowitz, S. Goldstein, and R. Tumulka, Rutgers University (USA)

D. Duerr, L.M. University, Munich (Germany)

K. Fredenhagen University Hamburg (Germany)

K. Rejzner University of York (UK)

R. Verch and T.-P. Hack ITP, University of Leipzig (Germany)

S. Doplicher Università La Sapeinza Roma (IT)

G. Morsella Università Tor Vergata Roma (IT)