



The Galileo Galilei Institute for Theoretical Physics
Arcetri, Florence



Galileo Galilei

From Static to Dynamical Gauge Fields with Ultracold Atoms

May 22, 2017 - Jun 23, 2017

Topics:

- Spin-orbit-coupled Bose and Fermi gases
- Synthetic gauge fields in optical lattices
- Dynamical gauge fields and lattice gauge theories with ultracold atoms
- Matrix-product states and tensor network methods for lattice gauge theories
- Quantum gases with $SU(N)$ symmetry
- Quantum magnetism and long-range interactions

Gauge fields play a fundamental role in our understanding of complex natural phenomena. Static gauge fields, such as magnetic fields and spin orbit coupling, are responsible for most of the topological effects found in solid state materials, while dynamical gauge fields are the backbone of the standard model in particle physics, and are instrumental in describing quantum magnetism.

In recent years, quantum technologies have emerged as a novel, complementary approach to investigate paradigms of strongly correlated quantum matter related to gauge fields. On the one hand, cold atoms systems, owing to their unparalleled degree of control and versatility, represent an ideal experimental platform for the investigation of both static and dynamical gauge fields. From the other hand, novel numerical quantum information tools have been put forward as complementary methods to access regimes where Monte Carlo simulations are affected by the sign problem.

The purpose of this workshop is to bring together researches in the fields of cold atoms, high-energy, and condensed matter physics, to discuss state-of-the-art perspectives and challenges in the field of synthetic gauge fields and related areas. Within this activity, we expect that the growing interdisciplinary field involving the aforementioned fields will be given a strong boost, paving the way toward the realization of quantum simulation platforms for gauge theories and exotic superfluid and insulating states of matter.

Organizing Committee:

Marcello Dalmonte (ICTP)
Leonardo Fallani (University of Florence)
Massimo Inguscio (University of Florence & CNR)
Guido Martinelli (University of Rome, La Sapienza)
Simone Montangero (University of Ulm)
Ian Spielman (NIST & JQI)
Sandro Stringari (University of Trento)
Uwe-Jens Wiese (University of Bern)

Local organizer: Andrea Cappelli