LPMMC

LABORATOIRE DE PHYSIQUE ET MODELISATION DES MILIEUX CONDENSES

Research axes

The mission of LPMMC is to

- develop innovative theory and models to predict and to describe complex phenomena in condensed matter physics – in close collaboration with experimentalists - and to make quantitative predictions for ongoing and future experiments, supported by advanced analytical and numerical tools.
- train graduate and undergraduate students in the theoretical and computational skills needed for condensed matter research.
- favor and foster national and international collaborations in condensed matter research, including its many interdisciplinary interfaces (applied mathematics, atomic physics, geophysics…)

LPMMC plays a pioneering role in three national research groups, in the local network on theoretical and mathematical physics (Centre de Théorie en Physique de Grenoble), and is an active partner of the national project on advanced computing. Many international collaborations exist, supported by bi-lateral and European grants, and roughly 40 % of the LPMMC scientific output has been co-authored with foreign partners.

Actions within LANEF

The challenge for LPMMC is to be part of one well-organized and visible transverse alliance covering all activities in theoretical and computational condensed matter physics inside LANEF.

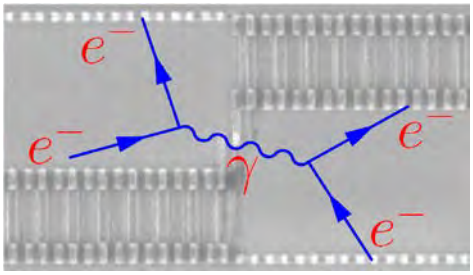

Fig. 1: Cooper pairs in mesoscopic superconductors.

Mesoscopic superconductivity. We study thermal and electronic properties of superconductors at the mesoscopic level (grains, Josephson junctions) and investigate their use for quantum computing (qubits).

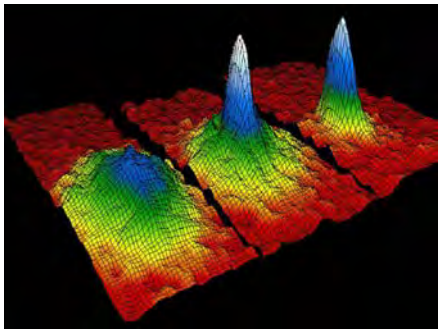

Fig. 2. Condensed matter physics with cold atomic gases.

Quantum gases. Cold atomic gases have become model systems to investigate many new theoretical ideas in condensed matter physics, such as the realization of Bosonic Josephson Junctions, Anderson localization of matter waves or the prediction of anomalous correlations in low dimensions.

Magnetism in low dimensions. Microscopic theory of quantum Hall effect, spin magnetism in different systems, renormalization group theory.

Quantum optics. Optics of the quantum vacuum in the presence of external magnetic fields, quantum entanglement of photons in disordered media, random laser.

Mesoscopic wave propagation. Development of sophisticated theory to support ongoing experiments with electromagnetic, elastic and seismic waves, and its application to imaging.

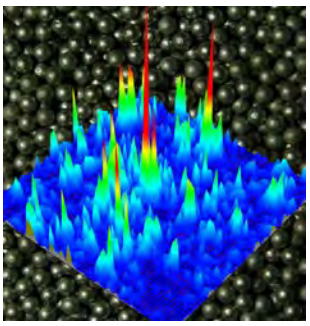

Fig. 3. Three-dimensional Anderson localization of elastic waves.

Advanced computing. The LPMMC is an active partner in the local facility for super-computation, that has recently been relaunched.

Fig. 4: Meso-cluster PHYNUM – CIMENT (100 knots).

Key figures:

3 faculty members (Université de Grenoble)
11 CNRS scientists, 3 engineers & technicians
4 postdocs, 4 PhD

CONTACT
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