Dottorato di Ricerca in Fisica – PhD in Physics
(XLII Ciclo)

Research Project:

Title: Tailored quantum evolution

Abstract: Decoherence is detrimental to any form of quantum evolution. Our goal is to model perturbations as realistically as possible and to find ways either to counteract or to use them to steer the system's evolution, e.g. a quantum computer, toward the following and creation of interesting states. Existing methods include coherent control, dissipation engineering, and active error compensation, usually applied to specific situations. This PhD project will design general strategies combing those methods. Our longterm experience in counterdiabatic control [1] and Floquet/spectral engineering [2] is our starting point. The methodology developed will be applied to modern experimental platforms, such as superconducting circuits (Nobel prize 2025), magnetic or cold molecules, Rydberg and ultracold atoms, in close collaboration with our experimental partners. Commercialization of the research output is possible with industrial partners, e.g. Q-CTRL [3].

[1] Review paper: F. Petiziol, F. Mintert, S. Wimberger, Quantum control by effective counterdiabatic driving, EPL **145**, 15001 (2024)
[2] F. Petiziol, S. Wimberger, A. Eckardt, F. Mintert, Non-perturbative Floquet engineering of the toric-code Hamiltonian and its ground state, Phys. Rev. B **109**, 075126 (2024)
[3] L. S. Yagüe Bosch, S. Wimberger, Comparison of Two Optimization Methods for a Rydberg Quantum Gate, Ann. Phys. **537**, e00163 (2025)

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