Dottorato di Ricerca in Fisica (XLI Ciclo)
Proposta di Progetto di Ricerca

Titolo:

Control of many-body quantum systems for quantum technologies
Controllo di sistemi quantistici a molti corpi per le tecnologie quantistiche

Argomento della ricerca:

A quantum computing device builds on advanced techniques for initializing, coherent manipulation and readout of quantum states. A bottleneck is noise and decoherence in all these three stages [1]. We are investigating and improving adiabatic quantum computing protocols for the realization of state transfer and quantum gates. In this Ph.D. project we want to design counter-diabatic protocols [2] for the robust and coherent control of existing experimental platforms (e.g. superconducting qubits, Rydberg atoms, NV centers and nano-spin systems). For this purpose, the current state-of-the art must be extended to **open** and **many-body** quantum systems [1,3]. Quantum states and their coherent evolution will be stabilized and controlled by a proper combination of driving, error compensation and dissipation.

[1] F. Impens, D. Guéry-Odelin, Fast quantum control in dissipative systems using dissipationless solutions, Sci. Rep. **9**, 1 (2019)
[2] Review paper: F. Petiziol, F. Mintert, S. Wimberger, Quantum control by effective counterdiabatic driving, EPL **145**, 15001 (2024)
[3] S. Dengis, S. Wimberger, P. Schlagheck, Accelerated creation of NOON states with ultracold atoms via counterdiabatic driving, Phys. Rev. A **111**, L031301 (2025)

Contatto E-mail:
sandromarcel.wimberger@unipr.it