MOQS – MOlecular Quantum Simulations

Topic title	Realization of programmable quantum registers via stroboscopic Rydberg excitation
Main host institution	University of Strasbourg, France http://en.unistra.fr/index.php?id=english
Supervisor	**Shannon Whitlock / eqm.unistra.fr** Whitlock@unistra.fr
Co-Supervisor	**Oliver Morsch** CNR-INO Pisa, Italy oliver.morsch@df.unipi.it
Mentor[1]	**Thomas Eckl,** BOSCH, Germany Thomas.Eckl@de.bosch.com
Secondment institutions	CNR-INO Pisa, Italy (3 Months) TU Munich / Walther-Meißner-Institute, Germany (3 months)
Preferred starting date	Before May 2021

Topic description

This experimental project will help advance the state-of-the-art in Rydberg-atom based quantum processors and establish a novel platform for solving molecular physics problems. This will involve controlling the quantum states of trapped arrays of several hundred laser cooled atoms or atomic ensembles using precisely controlled laser fields. Expected results include minimizing technical noise sources leading to decoherence in Rydberg quantum processors, speeding up quantum gates and increasing robustness against particle loss using collective qubit encoding; and the realization of new multiqubit quantum gate protocols exploiting long-range interactions between Rydberg states. Together this will enable a new generation of quantum simulations and quantum computations involving high quality atomic qubits, enabled by fast and highly programmable Rydberg-mediated interactions. About the Exotic Quantum Matter group: We offer the possibility to do exciting experiments embedded in a culturally and scientifically rich research environment, situated alongside the Rhine river on the French-German border. We host a state-of-the-art quantum simulator based on optically trapped Rydberg atom qubits. These systems are uniquely suited for studying quantum many-body problems, and applications towards quantum computing. For more information and recent publications, visit: eqm.unistra.fr

Recommended applicant's profile

Candidates should have a master degree in physics with a strong academic background in quantum physics and atomic, molecular and optical physics, as well as experimental research experience in the field of ultracold atoms.

[1] Mentor: The primary role of the mentors will be to identify and facilitate specific training objectives, advise on any problems faced by the ESR, including career matters with an external perspective and provide mediation in the case of disputes.

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