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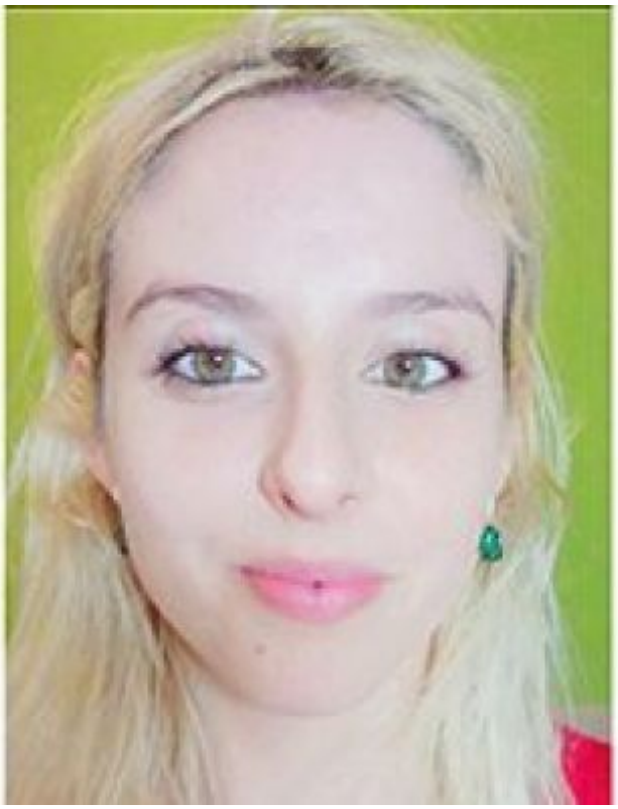

PhD THESIS DEFENSE: Quantum Information in Lattices

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This Ph.D. manuscript is divided into two chapters, related to two different scientific scopes, but with the common point of exploring entanglement phenomena in complex matter or lattices. In the first part of my Ph.D., I did exploratory research studying the origin and formation of intra-particle entanglement, specifically spin-pseudospin bipartite degree of freedoms, in some graphene-based platforms. The intra-particle entanglement is one of the signatures of the quantum spin transport in Dirac matter in the presence of Rashba spin-orbit coupling (pseudo-magnetic field) term and other spin-orbit terms, in the case of the graphene on substract of heterostructures.
The second part is a study about effective ways to perform partial quantum state tomography for many-body physics. We adapted an original method of quantum overlapping tomography for qubits and fermions for finite lattices. The main goal of our adaptation is to provide

k-particles reduced density matrix to recover the physical observables via local measurements for being applied to quantum simulation in real quantum devices. Consequently, we bridged two research areas usually studied separated, graphene physics and quantum tomography in lattices. Each chapter derives from already published or preprint papers and can be considered self-contained.

Thesis Director: Prof Dr. Antonio Acin dal Maschio and Prof. Dr. Stephan Roche
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