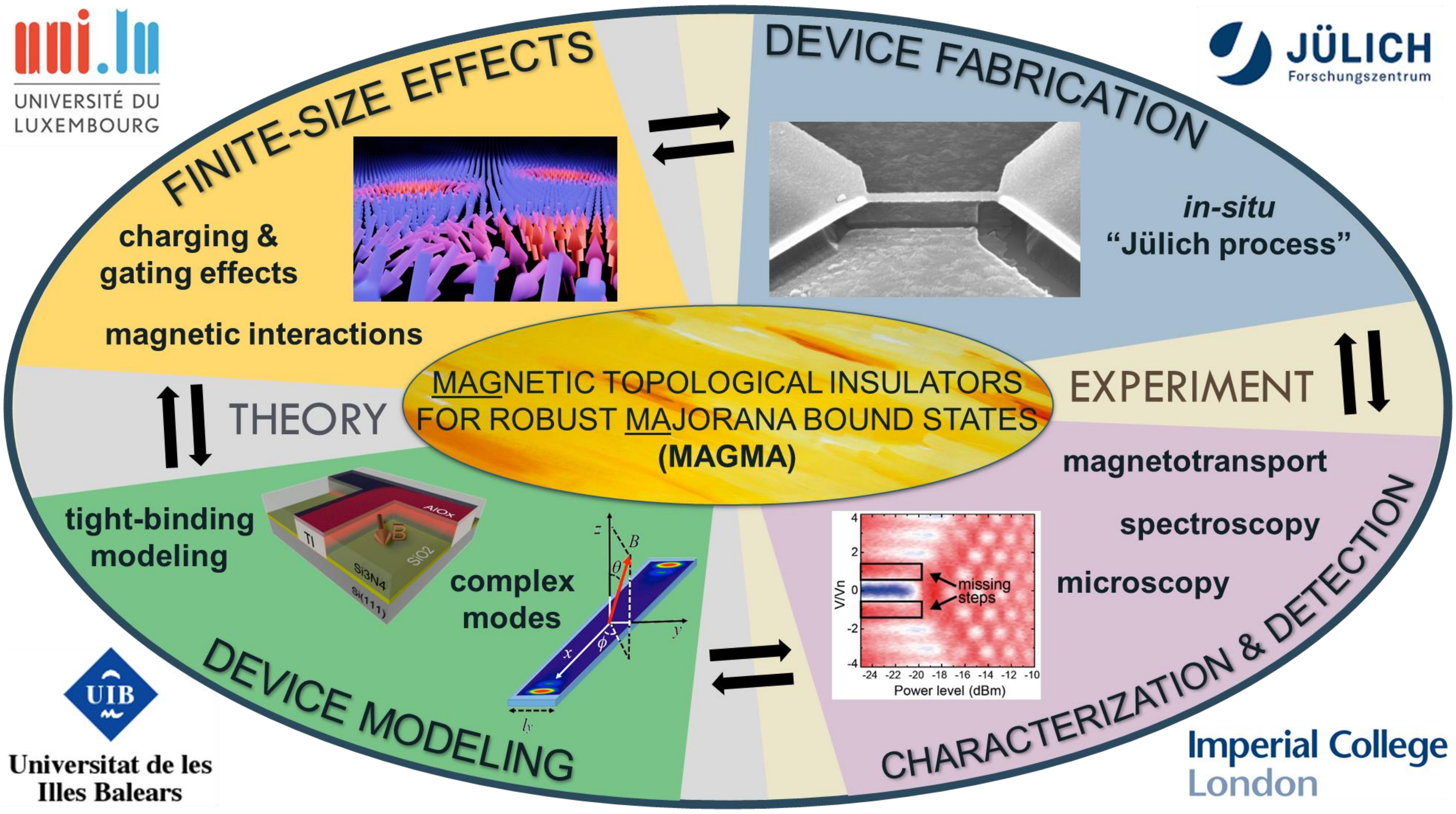

We propose to study the interplay between **magnetism, band topology, and superconductivity** with the aim of realizing robust topological states as future building blocks for quantum computation. Our project will combine experiments, materials simulations, and solid-state theory in order to study Majorana bound states based on magnetic topological insulators (MTIs) with proximity-induced superconductivity.

On the experimental side, we will construct **MTI nanostructures** in situ in different device geometries. We will apply superconducting leads for studying proximity-induced superconductivity and Josephson junctions based on MTIs. The techniques used by our theory and simulation cluster will allow **multiscale modeling of nanostructure-based devices** and will closely accompany the experimental efforts.

Meet the team:

Thomas Schmidt (U Luxembourg): project coordinator, magnetic structure calculations, finite-size effects, effective models for induced superconductivity.

Llorenç Serra (UIB, Spain): complex band structure methods, theory-experiment feedback for the choice of optimal parameter ranges, interpretation of results with simplified (analytical) models

Thomas Schäpers (FZ Jülich): nanofabrication of hybrid structures, characterization of MTI layers and MTI/superconductor interfaces, detection of Majorana states by Shapiro measurements and phase-coherent transport

Kristof Moors (FZ Jülich): hybrid-device modeling with tight-binding modeling approach, HPC implementations of hybrid-device simulations, aligning theoretical and experimental developments, interpretation of experimental data in comparison

Peter Schüffelgen (FZ Jülich): selective area growth of MTI nanostructures via MBE, stencil lithography of MTI–superconductor hybrid devices, DC and cQED measurements at low temperatures

Malcolm Connolly (Imperial College London): Millikelvin nanoanalysis scanning gate microscopy, DC transport and cQED measurements

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