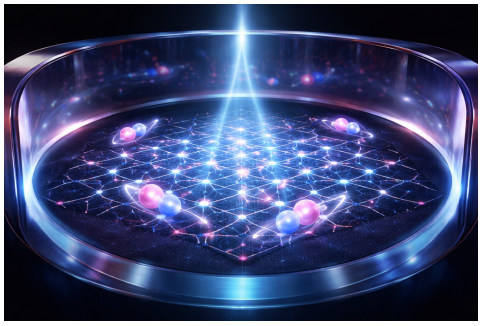
Project thesis: Repulsively bound states with long-range interaction in light-matter coupled systems (German/English)

The research group of Prof. Thomas Pohl is looking for students interested in a theoretical project in the field of quantum optics.



Photons are ideal carriers of quantum information, but under normal conditions they do not interact with each other. However, strong photon–photon interactions and pronounced optical nonlinearities are essential for quantum information processing. The controlled generation of such nonlinearities is therefore a central topic of current research, for example in two-dimensional quantum materials and coupled light–matter systems.

The goal of this project is to investigate repulsively bound states as a mechanism for enhancing optical nonlinearities. Such states can arise in lattice systems despite purely repulsive interactions and have already been demonstrated theoretically and experimentally for local interactions. This project focuses on states induced by long-range interactions. Since the involved particles remain spatially separated in this case, dissipative scattering is suppressed, potentially enabling a higher efficiency of the resulting optical nonlinearity.

The project provides an introduction to a current research area at the interface of quantum optics, condensed matter physics, and quantum information, and is aimed at students with an interest in theoretical physics.

If you are interested or have further questions, please send a short email to jan.kumlin@tuwien.ac.at. This will be followed by an informal meeting to discuss the project details and possible next steps.

We aim to increase the representation of women in the group.

Link to our web page: https://www.tuwien.at/phy/itp/pohl-group