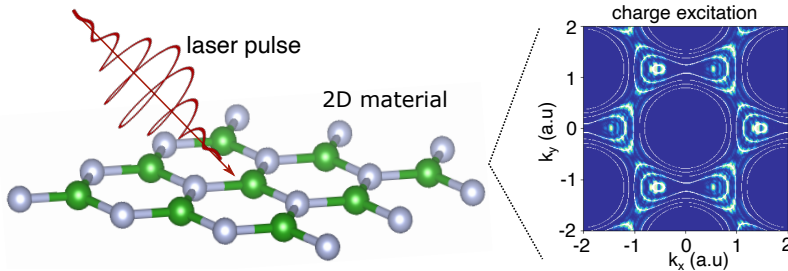


# Master thesis / Summer internship

at the Institute of Theoretical and Computational Physics, TU Graz  
in the Elise-Richter research group of Dr. Anna Galler

## Project 1: Nonlinear optical phenomena in 2D materials

When solids are irradiated by intense light fields, they can show a plethora of fascinating light-driven phenomena. In this project, we will study how 2D materials such as graphene and transition-metal dichalcogenides react to intense ultrafast laser pulses and numerically model photocurrents and high harmonic generation.

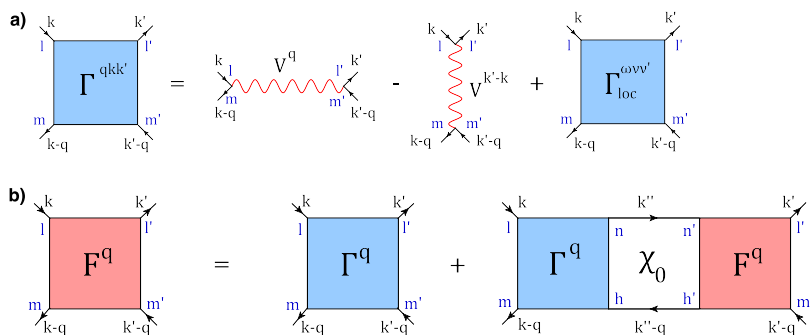


**Helpful prerequisites:** quantum mechanics and electrodynamics lectures, interest in numerical methods and simulations

**What you will learn:** use of modern electronic structure codes (Vasp, Octopus), insights into the control of material properties with light

## Project 2: Multi-orbital charge- and spin susceptibilities

In quantum materials, the Coulomb interaction among the electrons can give rise to new phases such as superconductivity and quantum magnetism. Diagrammatic methods are



ideal to model the electron-electron Coulomb interaction in these materials. Here, we will use and implement multi-orbital charge and spin susceptibilities and explore charge and spin order in quantum materials such as certain cuprates.

**Helpful prerequisites:** quantum mechanics lecture, good knowledge in linear algebra, programming skills (Python, Fortran)

**What you will learn:** skills in high-performance computing, insights into state-of-the-art many-body methods and the physics of strongly correlated materials

If you are interested in any of the student research projects, please contact [anna.galler@tugraz.at](mailto:anna.galler@tugraz.at). Employment as student assistant possible, funded by the FWF project V-988 'Transition-metal dichalcogenides in and out of equilibrium'.