Modelling of High Harmonic Generation

We offer student projects focused on the numerical modelling and theory of High Harmonic Generation (HHG) in gases. This process occurs when an intense laser field interacts with a gaseous target, producing a non-linear response that generates secondary XUV radiation. The result is the formation of ultrashort light pulses lasting on the order of attoseconds (10^{-18} s) , which is the natural timescale for electron motion in atoms and molecules.

Our computational model captures all key aspects of HHG: (1) non-linear propagation of a laser pulse, (2) microscopic quantum-mechanical response of a single atom in the laser field, and (3) propagation of the generated XUV radiation. The model allows for studying the entire process as a whole or focusing on specific subproblems.

The exact project assignment will be defined based on the student's interests and discussions with the supervisor. Possible directions include:

- Applying the model to specific projects in collaboration with experimental groups at the Department of Laser Physics and Photonics and/or at the ELI Beamlines laser centre (part of ELI ERIC)
- Developing new code functionalities (e.g. implementing advanced numerical methods, improving physical models, or adding post-processing tools)
- Theoretical studies of related physical phenomena