Dissertation Topic: **Advanced Beam Geometries for HHG**

Field of Study: Physical Engineering, Quantum Technologies

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Abstract

One of the key factors in controlling and optimizing the macroscopic XUV radiation from HHG is the shape of the driving laser beam. Adaptive optics consisting of a wavefront sensor and a deformable mirror, allows significant laser beam quality improvement and, subsequently, beam tailoring for specific tasks. A crucial part of this project is the detailed measurement of the XUV field generated, especially with an XUV wavefront sensor.

It is also possible to create advanced XUV beams using specially designed generation schemes. Recently, we conducted an initial study on HHG driven by Bessel-Gauss laser beams, whose unique geometry allows us to strongly control the phase of the field. We are continuing to develop this method and expect the candidate to join our team in this direction as well.

All these activities have both theoretical and experimental components. The candidate will participate in both. On the theory side, we use a numerical code that models the entire process, giving us key insights into physics and helping us design our setups. With supercomputers, we can also run advanced optimization schemes (for example, using machine learning) to tailor the XUV source for specific applications.

Expected Directions of the PhD Project:

- Developing tailored IR beams and performing metrology of the resulting XUV radiation
- Using numerical simulations to understand and optimize HHG schemes
- Contributing to projects on applying Bessel-Gauss beams in HHG