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To all members of the
Faculty of Physics

Vienna, 18 November 2024

Invitation to the public defense of the doctoral thesis

“Exploring molecular properties using far-field matter-wave diffraction”

by

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Monday, 25 November 2024, 10:15 a.m.
Romm 55, 1st Floor, Boltzmannngasse 5, 1090 Vienna

The work conducted within this dissertation focuses on using matter-wave diffraction of organic molecules in the far field to investigate their intrinsic optical and electronic properties. We explore two experimental configurations, employing either an optical or a nanomechanical grating.

The optical grating is, for the first time, realised using a deep-ultraviolet standing light wave at 266nm, allowing us to explore a broad range of photo-induced physical and chemical processes within biologically and technologically relevant molecules. The obtained diffraction images allow us to extract properties such as absorption cross section and polarisability, while the range of grating mechanisms observed simultaneously demonstrates various applications in future experiments. Electronic properties, on the other hand, are explored using a nanomechanical grating produced via focused neon ion beam writing. This novel fabrication method reduces the amount of implanted charges compared to previous experiments, allowing for diffraction of highly polar molecules without loss of contrast. Moreover, obtained diffraction images can be used to rank molecules by the magnitude of their permanent electric dipole moment, and even predict structures of same molecule's conformers in the gas phase.

Defense committee:

Dennis Schlippert, Universität Hannover, DE (reviewer)
Ivette Fuentes, University of Southampton, UK (reviewer)
Markus Arndt (supervisor)
Thomas Pichler (chair)