Probing van der Waals interactions with single molecule resolution far-field interferometry

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The quantum wave nature of molecules is shown in an elegant and visual way by a far field interferometer in combination with epi-fluorescence microscopy [1].

An intense beam of the dye molecule Phthalocyanine (PcH_2 – 514 amu) is produced by a micro-laser evaporation source whose micrometer size guarantees a sufficiently coherent illumination of the diffraction target without any additional aperture and collimating element. Stochastically arriving single diffracted molecules are collected on a quartz plate where they are imaged by a self-built fluorescence microscope with single molecule sensitivity.

We investigate the quantum phase imposed to the wave-function resulting from the interaction between a particle and a polarizable wall within the eikonal approximation, thus probing the role of van der Waals interaction in the population of high order interference maxima. We explore the diffraction occurring at nano-fabricated SiN grating with 100 nm periodicity and thickness included in the range 10 – 100 nm .

Finally, we present the first diffractive analysis with de Broglie waves of a biological nano-structure, namely the SiO_2 frustule of the alga *Amphipleura Pellucida,* a phytoplankton diatom naturally occurring in fresh water.

References:
[1] T. Juffmann et al, Nature Nanotechnology 7, 297-300 (2012)