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Quantum interference experiments with complex molecules

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Molecular matter-wave interferometry has opened the path to delocalization studies with ever more complex particles.
We report on the current mass record in quantum interference investigations [1,2], and discuss the development of high-mass interference experiments.

We study the importance of internal molecular properties on the coherence in a matter-wave interferometer. Tiny external forces can lead to fringe shifts or dephasing of the molecular density pattern.
Properties such as electric polarizabilities and susceptibilities, electric dipole moments as well as internal molecular dynamics become thus accessible in molecule interferometry [3,4]. Recently, we have implemented the measurement of an absolute molecular absorption cross section in our Kapitza-Dirac-Talbot-Lau interferometer [5]. The recoil imparted on a molecule when it absorbs a single photon from a probe laser beam leads to an effective reduction in the quantum fringe visibility. This allows us to extract the cross section with high accuracy and independent of the molecular beam density.

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