Molecular Dynamics and Structure in Interferometry

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Abstract

Kapitza-Dirac-Talbot-Lau interferometry (KDTLI) has been successfully established as a well-adapted tool for studying the wave nature of massive and complex molecules [3].

De Broglie coherence is to first order only associated with the center-of-mass motion. In the presence of external perturbations, quantum metrology however also becomes highly sensitive to internal molecular properties, such as electric susceptibilities or dipole moments, which may affect the interference contrast or phase shift without introducing genuine decoherence. Molecular structure or internal dynamics determine the electric properties and become accessible through KDTLI.

We present recent experimental data from interference experiments showing the influence of molecular dynamics on de Broglie coherence [1].

In addition, high-contrast interference measurements now show for the first time the possibility to distinguish two structural isomers, i.e. two sorts of perlfuoralkyl-functionalized molecules with the same mass (1592 amu) and the same chemical sum formula, in molecule interferometry [2].

Keywords: MATTER WAVE INTERFEROMETRY, METROLOGY, MOLECULAR PHYSICS

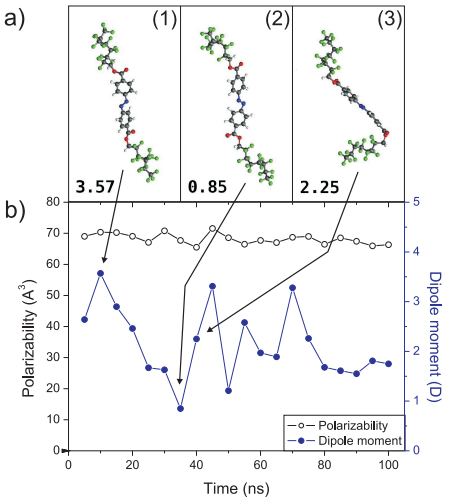

Figure 1: a) Snap shots of the simulation of perfluoroalkylated azobenzenes at 10 ns (1), 35 ns (2), and 40 ns (3). b) Static scalar polarizability, α_{stat} and electric dipole moment d along the MDS trajectory.

References

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