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Quantum-interference assisted Metrology with complex Biomolecules

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Abstract:

Diffraction of complex molecules at gratings formed by standing light waves has the potential for both probing the transition between quantum and classical physics and for studying the physical properties of those molecules. Biomolecules are a promising and challenging candidate for both aims.
We develop a refined theory of the molecules' interaction with the diffracting light field and probe the model. Metrology at the interface between quantum optics and molecular science allows determining electrical and optical properties of the molecules. We demonstrate the application of this tool to vitamins and show good agreement of the results with chemical modelling.
We also demonstrate for the first time the interference of Peptides. The successful experiments motivate extending interference to more complex biomolecules in the future. The challenge is in building sources yielding stable, intense and focused molecular beams, in detecting them with high efficiency, and in building an interferometer that handles these beams with the necessary accuracy.