Optoplasmonic detection of single particles and molecules in motion

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Propositions

Accompanying the thesis

Optoplasmonic Detection of Single Particles and Molecules in Motion

1. Characterization of single molecules via refractive index-based plasmonic detection is impossible without optimization of signal-to-noise ratio.
Chapter 2 and 3 of this thesis.

2. High bandwidth of interferometric scattering techniques enables them to measure fast dynamical process on the nanoscale.
Chapter 3 of this thesis.

3. The rotational correlation function is not an inherent property of a particle, but it also depends on the configuration of the measurement system.
Chapter 4 of this thesis.

4. Even though coupled plasmonic nanorods provide high signal-to-noise ratio, obtaining high angle sensitivity is challenging; therefore the chemical effort to build a plasmonic goniometer is not justifiable.
Chapter 5 of this thesis.

5. Scattering-based detection techniques are able to measure the hydrodynamic volume and mass of single molecules via translational diffusion but don't provide enough signal-to-noise ratio to address the rotational diffusion.
*Nano Letters **23**, 1629-1636, (2023); Nucleic acids research **48**, e97-e97 (2020).*

6. Inspired by biology, we can make physical systems such as nanomachines. Therefore, new methods to study the dynamics of biological process at the single-particle and single molecule level in real time are highly desirable.
*Nature nanotechnology **7**, 379-382 (2012).*

7. To improve the sensing performance of plasmonics sensors beyond the classical limit, quantum resources are promising.
*ACS Photonics 3, no. **6**, 992-999 (2016); Chemical Reviews 121, no. 8 (2021): 4743-4804.*

8. Brownian motion is more than just random motion, it has significant implications in understanding the nanoscopic world to biological process.
Nature 397, no. 6715 (1999): 129-134.

9. Artificial intelligence can yield countless hours of productivity for society. It can also dramatically influence the healthcare facilities and reduce costs.

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