

Topic PhD QT: Sub-shot-noise interferometric scattering microscopy

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Abstract: Shot noise occurs due to photon counting statistics in optical devices, it is associated with the particle nature of light and conventionally follows the Poisson statistic. Shot noise sets the limit of quantification in optical measurements and this fundamental limit is well understood theoretically as well as practically. Recent implementations of efficient light-matter interactions between single nanoparticle plasmons and single photons on the quantum level shows, that it is possible to accomplish measurements of light extinction with an accuracy exceeding that of the shot-noise limit. In this project, we would like to not only sheds new light on a light-matter interaction at the single-photon level but push the optical detection limits to a sub-shot-noise regime with the use of interferometric scattering microscopy. The project will be carried out in collaboration with a group of Prof. Dr. Andreas Schell from Leibniz Universität Hannover.

Challenges and implementation:

- Survey of the existed technology,
- Theory survey of a squeezed state of light and its noise,
- Build and experimental characterization of measuring setup,
- Combination and characterization of the setup with a single-photon source (photon gun).

References:

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