Wave scattering from disordered surfaces

When an electromagnetic wave interacts with a disordered surface, so-called speckle patterns result. Such patterns have fascinating statistical properties and they have been studied both experimentally and theoretically for a long time.

To solve this scattering problem rigorously, that is, to solving the Maxwell equations without approximations, requires high-performance computer facilities and has, therefore, only become available recently. If some approximations can be done, the problem can be solved semi-analytically and the resulting calculation can be performed on a laptop.

We propose two projects related to this topic and both requires python programming skills:

1. **Project 1** will solve the scattering project by assuming the so-called *phase perturbation theory*. Within this approximation the relevant analytic expressions have been developed and are therefore know. The project aims to develop a *Python module* that are able to evaluate these expressions, including to calculate the involved integrals, given the statistical properties of the surface and the properties of the source.
2. **Project 2** deals with simulation results produced by running a high-performance simulation code and which are stored in a binary file in the HDF5 (Hierarchical Data Format) format. The goal of the project is to design and develop a post-processing module in Python for such data that will facilitate the visualization of the results.

For both projects, the students should be experienced in Python programming and have experience with numerical calculations. The task will be completed in close collaborations with the member of the research group (including master and PhD students).

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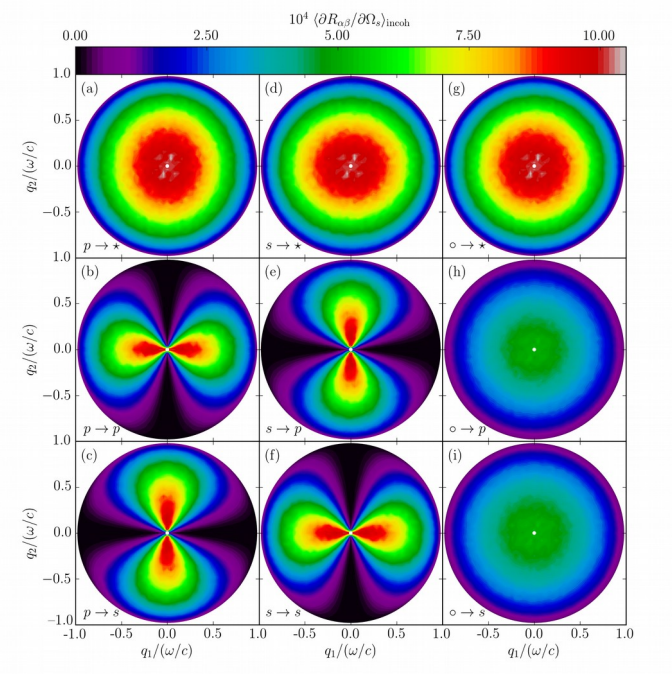

Examples of the average angular dependent intensity distributions that can be obtained when light is scattered from a rough glass surface