Laboratory-Tutorial -3, Mie-TheoryTFY4200

To be submitted by 01.05.2020

The purpose of this tutorial is to get familiar with Mie-theory/code, vector spherical harmonics, the amplitude scattering matrix and the scattering matrix

Literature : Bohren and Huffman (BH) chapters 3,4 and results in 11 and 13.
Bohren and Huffman: http://onlinelibrary.wiley.com/book/10.1002/9783527618156

Matlab Software: http://www.mathworks.com/matlabcentral/fileexchange/36831-matscat

Python software: Search for example in T. Wriedt, "Scattport," webpage intended as an information portal for light scattering community, at https://scattport.org. One possible code could be : B. Sumlin, "Pymiescatt," python package for scattering calculations, webpage at http:// pymiescatt.readthedocs.io/en/latest/#.

0. Download the software and follow instructions for installation of libraries and paths.

1. **Analyse Code:** Write comments to the "matscat" library code, with specific references to equations in BH.

2. **Test the most important functions used in the solutions:** Bessel functions, Hankel functions, Legendre polynomials, π, τ and Bessel-Ricatti functions. Verify that functions are well behaved w.r.t. the literature.

3. For the series solutions that are truncated, run **convergence tests.**

4. To verify the code, reproduce some of the results by simulating the extinction efficiency Q, scattering amplitude and scattering matrix , using parameters and examples in e.g. chapter 11 (extinction) and chapter 13 (scattering matrix) of BH.

5. Using the Mie theory for a sphere, calculate the Scattering cross section and the extinction efficiency similar to Figure 5.3 in Maier for Silver and Au spheres in air and SiO2, and vary the sphere radius from below to above the quasistatic limit. Compare with the Cext from result of the quasi-static approximation.

Write short report with figures and references.