

Computational light scattering, PAP315, fall 2020, period 1, 5 cr

Prof. Karri Muinonen, Dr. Guanglang Xu,

Dr. Antti Penttilä

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Overlook

- Zoom Lectures, Aug. 31 – Oct. 16 (28 h)
 - on Mondays, 10.15-12.00
 - on Wednesdays, 12.15-14.00
- Zoom exercise sessions, Aug. 31 – Oct. 16 (13 h)
 - on Mondays, 9.15-10.00 (excluding Aug. 31)
 - on Wednesdays, 9.15-10.00
- Project tasks
 - Single scattering
 - **Discrete-dipole approximation** or
 - **T-matrix method** or
 - Ray-tracing approximation
 - Multiple scattering
 - **Radiative transfer & coherent backscattering** or
 - Radiative transfer with reciprocal transactions or
 - **Geometric optics in close-packed media**
- Zoom workshop with student presentations on project tasks
- Home page of the course:
 - <https://wiki.helsinki.fi/display/PAP315/Computational+light+scattering>

Overlook

- Exams (2)
 - project tasks including an interactive session, maximum 6 points
 - interactive session on Oct. 14, 2020
 - short reports due on Oct. 19, 2020
 - final exam, maximum 24 points
 - home exam on Oct. 14-19, 2020
 - 30 points in total from exams
- Exercises (20)
 - 20% of points required
 - maximum 6 bonus points on a linear scale
- Course points, maximum 36/30 points

Literature

Main reading:

- K. Muinonen, Light Scattering, Lecture Notes (latest draft)
- C. F. Bohren & D. R. Huffman, Absorption and Scattering of Light by Small Particles, Wiley & Sons, 2010
- J. D. Jackson, Classical Electrodynamics, Wiley & Sons, 1998
- M. I. Mishchenko, L. D. Travis, A. A. Lacis, Multiple Scattering of Light by Particles: Radiative Transfer and Coherent Backscattering, Cambridge University Press, 2006

Supplementary reading:

- H. C. van de Hulst, Light Scattering by Small Particles, Wiley & Sons, 1957 (Dover, 1981)
- M. I. Mishchenko, J. W. Hovenier, & L. D. Travis, Light Scattering by Nonspherical Particles, Academic Press, 2000
- M. I. Mishchenko, L. D. Travis & A. A. Lacis, Scattering, Absorption, and Emission of Light by Small Particles, Cambridge University Press, 2002
- A. Doicu, Y. Eremin & T. Wriedt, Acoustic & Electromagnetic Scattering Analysis Using Discrete Sources, Academic Press, 2000
- M. I. Mishchenko, Electromagnetic Scattering by Particles and Particle Groups, An Introduction, Cambridge University Press, 2014

Lectures

The lectures on the **computational methods** will introduce **open source software**.
Guidance for exercises and projects available during lectures and exercise sessions.

- Aug. 31, Introduction to single scattering, 10-12, KM
- Sept. 2, Introduction to single scattering, 12-14, KM
- Sept. 7, Scattering by a spherical particle (Mie scattering), 10-12, KM
- Sept. 9, Discrete-dipole approximation, volume integral equation, 12-14, KM, AP
- Sept. 14, Finite-difference time-domain method, 10-12, GX
- Sept. 16, Ray-optics approximation, 12-14, KM
- Sept. 21, *T*-matrix method, 10-12, AP
- Sept. 23, Superposition *T*-matrix method, 12-14, AP
- Sept. 28, Introduction to multiple scattering, 10-12, GX
- Sept. 30, Introduction to multiple scattering, 12-14, GX, AP
- Oct. 5, Monte Carlo methods for multiple scattering, 10-12, KM, AP
- Oct. 7, Monte Carlo methods for multiple scattering, 12-14, KM, AP
- Oct. 12, Geometric optics for close-packed particulate media, 10-12, KM, AP
- Oct. 14, Geometric optics for close-packed particulate media, 12-14, KM, AP

Exercises

- Sept. 2, 9-10, [Guidance](#) for Exercise 1, answers due Sept. 7 (KM)
- [Sept. 7, 9-10, Guidance for Exercise 2, answers due Sept. 14 \(KM\)](#)
- [Sept. 9, 9-10, Exercise 1 \(KM\)](#)
- Sept. 14, 9-10, Guidance for Exercise 3, answers due Sept. 21 (GX, AP)
- Sept. 16, 9-10, Exercise 2 (KM)
- [Sept. 21, 9-10, Guidance for projects \(AP, GX, KM\)](#)
- [Sept. 23, 9-10, Exercise 3 \(GX, AP\)](#)
- Sept. 28, 9-10, Guidance for Exercise 4, answers due Oct. 5 (GX)
- Sept. 30, 9-10, Guidance for projects (GX)
- [Oct. 5, 9-10, Guidance for Exercise 5, answers due Oct. 12 \(GX, KM\)](#)
- [Oct. 7 30, 9-10, Exercise 4 \(GX, KM\)](#)
- Oct. 12, 9-10, Guidance for projects (AP, GX, KM)
- Oct. 14, 9-12, Exercise 5 (AP, GX, KM), [Project Workshop, All](#)