PHYS264 Environmental Optics and Transport and Scattering of light and particles

1. Quantum Scattering and transport Topics

Why do we combine all the three topics?

Fourier Methods - a good reason

Quantum and Classical mechanics

The concept of a beam of particles. Transport or scattering.

Bessel functions.

Travelling waves; (Standing waves)

Plane waves and spherical Bessel functions.

Concept of Cross Section; Mean free path; Scatterer density

Mean Free Path, Density of scattering agents; Beer's law

Intensity / probability density.

Cross Section and Differential Cross Section.

Classical Collisions - Scattering from a hard sphere (classical)

Scattering theory, Green's Function

Huygens Principle and Green's Function

Green's Function and Method of variation of constants

Born Approximation

Partial waves - mathematical background.
Spherical separation of Variables, Spherical Harmonics

Inelastic Scattering - Objects with structure

Cross Section - Objects with structure;

Reactions; Inelastic Scattering.

Example: Critical Mass for atomic bomb - neutron reactions

How to measure Cross Sections? Thin Target and Thick target

Elastic Scattering on objects with structure (electrons on atoms)

Inelastic Scattering (objects with structure) (electrons on atoms)

2. Enviromental Optics Topics

Basic Properties of Radiation, Atmospheres, and Oceans

Radiative Interaction with Planetary Media Feedback Processes

Radiative Equilibrium and the Thermal Structure of Atmospheres

Climate Change: Radiative Forcing and Feedbacks

Climate Response to a Change in the Solar Constant

Ocean Spectral Reflectance and Opacity

Basic State Variables – Geometrical Optics

Basic State Variables – Radiative Flux or Irradiance

Theorems on Intensity - The Extinction Law, the Beer-Lambert law

The Differential Equation of Radiative Transfer I

Basic Scattering Processes

Lorentz Theory for Radiation-Matter Interactions

Scattering in Random Media

Absorption by Solid, Aqueous, and Gaseous Media

Absorption on Surfaces, Aerosols, and within Aqueous Media

Molecular Absorption in Gases

Thermal Emission and Radiation Laws - Planck's Spectral Distribution Law

Radiative Excitation Processes in Molecules

Microscopic Radiative Transfer Equation

Absorption in Molecular Lines and Bands

Molecular Vibration and Rotation - Line Strengths

Absorption Processes in the UV/Visible parts of spectra

Thermal Emission from a Surface - Absorption by a Surface

Kirchhoff's Law: Volume Absorption and Emission

Differential Equation of Radiative Transfer II

For the students who register for the course
the following additional materials are available:

https://miside.uib.no/dotlrn/classes/det-matematisk-naturvitenskapelige-fakultet/phys264/phys264-2014v//file-storage/index?folder_id=115928536