

## Lecture 13.

### Review for Midterm Exam 1: Terrestrial IR radiative transfer processes

#### Topics to review:

- **Basic radiometric quantities: intensity and flux. Spectrum of EM radiation.**

Eqs.[1.1]-[1.17]

- **Concepts of extinction (scattering + absorption) and emission. Extinction, scattering and absorption coefficients. Optical depth.**

Eqs.[2.3]-[2.10]

- **Beer-Bouguer-Lambert law.**

Differential form: Eqs.[2.1]-[2.2], [2.8]

- **Differential equation of radiative transfer and its solutions.**

Eqs.[2.11]-[2.13]

- **Differential equation of radiative transfer and its solutions in a plane-parallel atmosphere.**

Eqs.[2.13]-[2.15]

- **Main radiation laws. Concepts of a blackbody, thermodynamical equilibrium, and local thermodynamical equilibrium.**

Planck function, Stefan-Boltzmann law, Wien's displacement law, Kirchhoff's law:

Eqs.[3.1]-[3.12]

- **Basic properties of gases, aerosols and clouds that are important for radiative transfer (Lecture 4)**

- **Absorption/emission by atmospheric gases. Concepts of rotational, vibrational and rotational-vibration transitions. Line profiles. Absorption coefficient of gases. Path length (i.e., amount of absorbing gases) and optical depth.**

**Transmission function.**

Eqs.[5.6]-[5.10], [7.10]-[7.12]

- **IR absorption spectra of main atmospheric gases (H<sub>2</sub>O, CO<sub>2</sub>, O<sub>3</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs) (Lectures 6 , 11 and 12 )**

- **IR radiative transfer equation and its solution in a plane-parallel atmosphere.**

Eqs.[7.1]-[7.9]

- **Basics of line-by-line radiative transfer (Lectures 7 and 9)**

- **Basics of the K-distribution approximation (Lecture 8)**

Eqs.[8.1]-[8.4]

- **Concept of absorption band models. Equivalent width. (Lecture 10)**

- **Diffuse transmission function (for fluxes). Broadband flux emissivity.**

Eqs.[11.3]-[11.4], [11.9]-[11.11]

- **IR radiative transfer equation for fluxes and its solution in a plane-parallel atmosphere.**

Eqs.[11.1]-[11.2], [11.5],[11.9]-[11.11]

- **IR radiative heating/cooling rates (Lectures 11 and 12)**

Eqs.[11.6]-[11.2], [11.5]

**NOTE:** Please also review lectures' required reading, homeworks, and problem solving examples.