The first part of the course will introduce the theory of radiative transfer; the second part will discuss applications that are of interest to the students. These will be firmed up during the first week. A preliminary syllabus for the course:

1. Introduction; basic concepts
   a. “Black body” radiation
2. The spectral radiative transfer equation and its formal solution
3. Scattering of radiation
   a. Molecular scattering
   b. Scattering by finite particles
   c. Rainbows, haloes, and glories
4. Absorption and emission of radiation
   a. Quantum transitions and selection rules
   b. Line broadening
   c. Line and band absorption characteristics
5. Practical solutions of the radiative transfer equation
   a. The plane-parallel approximation
   b. Treatment of infrared radiation in planetary atmospheres
   c. Approximation methods (orders of scattering, two-stream methods)
   d. Application to greenhouse effect and solar radiation
6. Radiative heating and cooling
   a. The Chapman layer
   b. Water vapor and its feedback
7. Radiation in fluids
   a. Radiative-convective equilibria in heated fluids/atmospheres
   b. Radiation and planetary atmospheric circulations

As we discuss the above, theoretical topics, we will discuss how they can be applied to Earth’s atmosphere and, occasionally, stellar radiative transfer.

Optional further application topics for the second part of the course:

8. Remote Sensing
9. The Greenhouse effect and global climate change
10. Current topics in radiative forcing of Earth’s climate
11. Radiative damping of planetary disturbances and “Newtonian Cooling”
12. Stellar emission
13. Survey of the solar system

For a final project, I would like to see a report on a theoretical or practical application of radiative transfer or remote sensing. Examples can come from any field (atmospheric science, oceanography, planets, astrophysics, engineering, technology). Original work or calculations are not necessary, but welcomed. An historical report would also be acceptable.