AT 652 -- Atmospheric Remote Sensing

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Course Objective – To familiarize stuudents with the basic principles of remote sensing, to make them comfortable with today's broad spectrum of algorithms, and to provide a sense for where the logical progress will occur in the field.

Office hours: Any time my door is open in ATS or CIRA, or by appointment.
Course material on Web site: http://rain.atmos.colostate.edu – Courses – AT652

Course Outline

1. **Introduction**
   - Course detail, objectives and outline
   - Satellite platforms and orbits
   - Inversion theory (brief overview)
2. **Basic properties of electromagnetic radiation**
   - Electromagnetic spectrum
   - Propagation, polarization and Doppler effect
   - Surface Properties across the EM spectrum
   - Extinction and Beer's law
3. **Interaction on the microscopic scale: molecular absorption**
   - Molecular absorption spectra
   - Line absorption, transmission functions
   - Radiative transfer
   - Column water vapor and liquid water
   - Weighting functions, sounding of temperature and moisture
4. **Interaction on the macroscopic level: particle scattering**
   - Refractive index, scattering
   - Particle scattering, backscattering: Depolarization ratios, ZDR and CDR
   - Radiative transfer
   - Radar and lidar remote sensing
5. **Optimal Estimation**
   - OE solutions
   - Bayes' theorem
   - Data Fusion
   - Process Understanding

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Course Expectations:

- A paper will be assigned most Thursdays (see schedule for paper). Students should be prepared to present 2-3 minute summary on following Tuesday.
- A group project detailing a specific "data fusion" project will be assigned to assess what student progress in the course.
- A final project will be assigned inividually to guge student's ability to apply material learned in the course to build workign retrieval algorithm for precipitation.

While there is no text book for the class, there are a number of remote sensing books that students may avail themselves of.

- Stephens, G., 1994: Remote Sensing of the Lower Atmosphere: An Introduction. Oxford University Press, Inc. 523pp.

- Rodgers, C., 2000: Inverse Methods for Atmospheric Sounding – Theory and Practice. World Scientific, Series on Atmospheric, Oceanic and Planetary Physics, Vol. 2. 240 pp.

- Elachi, C., 1987: Introduction of the Physics and Techniques of Remote Sensing, Wiley, 413 pp.

- Bringi, V. N., and V. Chandrasekar, 2001: Polarimetric Doppler Weather Radar. Cambridge University Press, 636 pp.

- Ulaby, F. T., R. K. Moore and A. K. Fung, 1981: Microwave Remote Sensing Vols I-III, Addison-Westy, 2161 pp.

In addition, there are a number of good textbooks covering the basic principles of atmospheric radiation:

- Liou, K. N., 2002: An Introduction to Atmospheric Radiation (second edition), Academic Press - International Geophysical Series, 583 pp.

- Petty, G. W, 2006: A First Course in Atmospheric Radiation (second edition). Sundog Publishing. Madison, Wisconsin.460pp. (www.sundogpublishing.com/AtmosRad.htm)

- Bohren, C. F. and D. R. Huffman, 1983: Absorption and Scattering of Light by Small Particles, Wiley, 530 pp.

- Goody, R. M. and Y. L. Yung, 1989: Atmospheric Radiation: Theoretical Basis, Oxford Univ. Press, 519 pp.