**Atmospheric Chemistry and Climate: AOSC433 / AOSC633 / CHEM433 / CHEM633**

**Instructor**:
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**Spring 2013: Tues – Thurs 2:00 to 3:15 pm, CSS 2416**

**Website:** http://www.atmos.umd.edu/~rjs/class/spr2013

**Required Text:**

Chemistry in Context: Applying Chemistry to Society, **6th Edition**, American Chemical Society

**Supplemental Text** (selected readings, all to be provided):

Global Warming: The Complete Briefing by John Houghton

The Atmospheric Environment by Michael B. McElroy

Beyond Oil and Gas: The Methanol Economy by George A. Olah, Alain Goeppert, and G. K. Surya Prakash

Atmospheric Pollution by Mark Z. Jacobson

**Course Description.** The effects of human activity on atmospheric composition, focused on global warming, the carbon cycle, air pollution, and the ozone layer. Fundamentals of atmospheric chemistry (spectroscopy, kinetics, isotopic analysis, and biogeochemical cycles) are related to the modern understanding of climate change, air quality, and ozone depletion, based on resources such as satellite missions, field campaigns, and scientific assessments published by international agencies. We also examine how society's future energy needs could be met in a manner with less impact on atmospheric composition than the present heavy reliance on combustion of fossil fuels. The course is taught at a level appropriate for upper class undergraduate chemistry or physical science majors and graduate students.

**Prerequisites:** (CHEM 131 or CHEM135 or CHEM146) and (MATH241); or permission of instructor.

**Grades:** Grades will be determined based on problem sets (30%), two in class exams (20% each), a final exam (20%), and daily short questions to be turned in at start of lecture that are based on the readings (10%). In addition, graduate students will be required to write a research paper on a topic of their choosing, give a presentation on this paper, and will occasionally be assigned an extra question on the problem sets. For computation of a final course grade, the graduate student paper/presentation will have equal weight as each exam (all 15% of total).

**Course Topics**

- How to Build a Habitable Planet: Geological Evolution of Earth's Atmosphere
- Overview of Global Warming, Air Quality, and Ozone Depletion
- The Greenhouse Effect: Radiative Transfer; Cloud and Water Vapor Feedbacks
- Climates of the Past
- Modeling of Earth's Climate
- The Global Carbon Cycle
- Biogeochemical Cycles of Methane and Nitrous Oxide
- Pollution of Earth's Troposphere: Air Quality, Acid Rain, and Aerosols
- Pollution of Earth's Stratosphere: Ozone Depletion and Ozone Recovery
- World Energy Needs and Future Fossil Fuel Reserves
- The Kyoto Protocol and the Science of $CO_2$ Stabilization
- Geo-engineering of Climate
- Renewable Energy I: Solar, Geothermal, Hydro, and Wind
- Renewable Energy II: Ethanol, Methanol, and Biofuels
- The Hydrogen Economy and Nuclear Energy