Projects

In lieu of a final exam, there will be a final project. The project should consist of developing a model for, or performing an in depth analysis of, a low temperature plasma or electric discharge system. Some possible choices of electric discharge systems are:

- Plasma processing reactors
- Fluorescent lamps
- He-Ne, excimer, CO$_2$ lasers
- Sputter deposition reactors
- E-beam pumped systems
- Arc jets and plasma thrusters

The project should include a literature search to provide you with background on how these devices operate and to see how other researchers have analyzed them. Some of the models which appear in the literature are quite involved and complex. The intent of the project is not for you to duplicate the complexity of those models. Rather, the intent is to give you some sense of how the device and the "final product" (e.g., laser power, deposition rate, etch rate) scales. Your model should have at least the degree of sophistication of our homework assignments but should include real device parameters. For example, use the actual gas pressures, gas mixtures, dimensions, cross sections, currents, and voltages. (Note, you can obtain the real cross sections for the majority of cases of interest by request from M. Kushner.)

Your final project deliverables will consist of a short oral presentation to the class, your PowerPoint slides and a the written report. The limit on length is 25 pages, though 25 pages are not required. (Fewer pages of higher quality are preferred.) Please include a description of the discharge system, how you have analyzed it, the scaling laws you developed and a discussion of what you have learned. Generously use plots to display parametric results. Your analysis might include issues such as:

- Electron densities
- Electron or ion energy distributions
- Electron and ion temperatures
- Efficiency of producing the "product"
- Current density, power deposition, operating E/N
- Densities of excited states.
- Etch or deposition rates
- Spectrum of emitted light.

Due dates:  
Oral presentations: December 8 & 10, 2009  
(PowerPoint emailed to mjkush@umich.edu)  

Document:  
Monday, December 14, 2009, 5:00 PM  
Paper copy to Prof. Kushner office, PDF copy to mjkush@umich.edu