GRS AS 791 – Special Topics
(Interstellar Medium - I)
Prof. Clemens – Spring 2006

Description:
Physical processes in the interstellar medium, heating, cooling, excitation, equilibria and disequilibria, gaseous regions (HII regions, SNRs, PNe), dust properties and effects, spectroscopic signatures and tracers of the ISM, spectroscopic line transfer effects, magnetic fields, cosmic rays, star formation, PDRs, astrochemistry.

Meeting Times:
Lecture: Tu 9:30-11am in CAS 500

Office Hours:
Mondays 11-noon, Tuesdays 2-3pm, Wednesdays 11-noon, Fridays 10-11 in room CAS 417, and by appointment (3-6140; clemens@bu.edu)

Synopsis:
For advanced graduate students who have already completed AS751 (Galactic Astrophysics). This course offers an in-depth look at the detailed physics underlying the nebular interstellar medium and how the emergent radiation we sense can be used to reveal the physical nature of the different components and types of objects making up the ISM. We will start by examining interstellar dust, its nature and physical characteristics, and its effects on starlight, magnetic fields, and cosmic rays. Next, we will delve into the details of atomic and molecular spectra, energy level excitation, ionization and recombination. HII regions and PDRs will be dissected and their structures revealed. The second semester of this course will feature a close look at the dense component of the ISM, including turbulence, collapse, and star formation.

Texts:
Lectures will be drawn from a variety of texts, but will more closely follow the arguments and orders of presentation found in the following:


Historically, the field has been dominated by two other books, listed below, but their bent is decidedly optical and weaker in infrared and radio spectroscopy and star formation applications:

“Physical Processes in the Interstellar Medium,” by Spitzer (1978)
Finally, for those headed into star formation, the new book listed below collects an enormous amount of very relevant material between its covers:


**Grading:**

The course grade will be computed by weighting your performance in the following areas by the percentages listed:

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<thead>
<tr>
<th>Course Component</th>
<th>Percentage Weight</th>
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<tbody>
<tr>
<td>Homework (4 or 5 expected)</td>
<td>80%</td>
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<tr>
<td>Attendance and Participation</td>
<td>20%</td>
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**Homework:**

Homework will focus on computer models, simulations, or solutions to applications of astrophysics to ISM settings. These will be about at the same level as seen in AS751 and should be done using IDL.

**Schedule:**

The rough order of topics to be covered this semester is as listed below.

1. Interstellar Dust – abundances, depletion, extinction, scattering, polarization, emission, formation and evolution
2. Interstellar Gas – spectral lines, atomic and molecular spectra, excitation, ionization, recombination, heating & cooling, thermal stability/equilibrium
3. HII Regions, PDRs, and PNe – structures, excitation, evolution
4. Astrochemistry

In the Fall semester, the topics will continue and refine our discussion this semester. Those upcoming topics are likely to be:

1. Shocks
2. Cosmic Rays & Acceleration
3. Turbulence
4. Star Formation