

Ay 102

Physics of the Interstellar Medium

Instructor:

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TA:

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Prerequisites:

- Astronomy: Ay 20 or equivalent.
 - Physics: Ph 1 and (2 or 12) or equivalent.
 - Math: Ma 1 and 2 or equivalent. (Note: ACM 95 is *not* a prerequisite.)
- If you have not taken these courses, please see the instructor.

Lectures:

Monday, Wednesday, Friday, 11:00-12:00. Location is Cahill #219 (Mon+Wed) or Cahill #211 (Fri).

Course Website:

<http://www.tapir.caltech.edu/~chirata/ay102/>

Textbook:

Osterbrock & Ferland, *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei*. (I will use the 2nd edition, but if you have a copy of the 1st edition then that should be sufficient.)

The following other books may be useful in some portions of the course but are not required:

- Dopita & Sutherland, *Astrophysics of the Diffuse Universe*.
- Spitzer, *Physical Processes in the Interstellar Medium*.
- Tielens, *Physics and Chemistry of the Interstellar Medium*.

Topics:

The preliminary schedule of topics for each lecture is below. The first few topics (and occasional other topics) will be material from the textbook. For the rest, I will hand out lecture notes and/or review articles.

W 01/05. Introduction; sky maps and the ISM's appearance across the EM spectrum
F 01/07. Atomic structure I: hydrogen and helium
M 01/10. Atomic structure II: metals
W 01/12. H II regions: Ionization structure
F 01/14. H II regions: Thermal structure
W 01/19. H II regions: Thermal structure (continued)
F 01/21. H II regions: Optical and radio spectra and diagnostics
M 01/24. Dust: fundamental processes (absorption, emission, scattering)
W 01/26. Dust: grain composition and material properties

F 01/28. Dust: size distribution, PAH features, microwave emission
 M 01/31. Molecular structure and spectroscopy
 W 02/02. Molecular structure and spectroscopy (continued)
 F 02/04. Photodissociation regions; formation and destruction of H₂
 M 02/07. Diffuse atomic gas: phases, 21 cm radiation, absorption lines
 W 02/09. Molecular gas
 F 02/11. Hot gas: collisional ionization and X-ray emission
 M 02/14. Magnetic fields and observational probes thereof
 W 02/16. Hydrodynamics and MHD
 F 02/18. Vertical structure of galactic disks; wave modes
 W 02/23. Interstellar shocks
 F 02/25. Supernova remnants
 M 02/28. Cosmic rays: basic properties, interaction with matter
 W 03/02. Cosmic rays: electromagnetic signatures
 F 03/04. Cosmic rays: acceleration and transport
 M 03/07. Interplanetary medium, solar wind

Homework and Exams:

- There will be 7 homework sets, 1 midterm, and 1 final exam.
- Homeworks will be due weekly. No homework will be assigned for the midterm or final week. All homework will be handed out in class and posted on the course website at least one week before the due date. Homework may be turned in either in class, or to the TA's mailbox (~~on the 3rd floor of Cahill~~ in South Mudd).
- Collaboration policy: You **may** discuss methods of solution, compare results with each other, draw diagrams together at the whiteboard, etc. However, you **may not** copy another student's solution, or read the paper that another student is actually planning to hand in.
- Late homework will be marked down 12.5% per day (or part of a day). Homework more than 7 days late will not receive credit. Extensions must be arranged with the TA in advance; retroactive extensions will only be granted in case of an emergency.
- The midterm and final will be take-home, with rules printed on the cover of the exam booklet.
- Homework and exams will be returned one week after the due date.

Grades:

- Your course grade will be made up of 50% homework, 20% midterm, and 30% final.
- Letter grades will be assigned according to the following table.

Grade	Range
A+	≥95
A	90–95
A–	85–90
B+	80–85

Grade	Range
B	75–80
B–	70–75
C+	66–70
C	62–66

Grade	Range
C–	58–62
D+	54–58
D	50–54
F	<50

- Students on pass/fail will receive a “P” for any passing grade (D or higher).
- If you believe your grade is in error, please discuss it with the TA. The instructor should be consulted if this does not resolve the issue.