

# AS 713 – Astronomical Spectroscopy

## Prof. Dan Clemens – Spring 2017

**Catalog Description:** Spectroscopic processes in astrophysics. Energy levels in atoms and molecules. Atomic and molecular spectral lines. Excitation of atoms and molecules. Transfer of line radiation. Spectroscopic instruments. Derivation of physical parameters from spectroscopic observations.

**Meeting Times:** Lecture MWF 9:05-9:55am in CAS502

**Office Hours:** Mondays 11-12 and Wednesdays 10-11, in room CAS 417, and by appointment (3-6140; [clemens@bu.edu](mailto:clemens@bu.edu) )

**Synopsis:** Spectroscopic processes in astrophysics. Energy levels in atoms and molecules. Atomic and molecular spectral lines. Excitation of atoms and molecules. Transfer of line radiation. Spectroscopic instruments. Derivation of physical parameters from spectroscopic observations.

### **Texts :**

- **Required:** “Introduction to Quantum Mechanics in Chemistry, Materials Science, and Biology,” by S.M. Blinder, ISBN 0-12-106051-9 (paperback; ~ \$50)
- **Highly (Highly!) Recommended**
  - “Introduction to Quantum Mechanics in Chemistry,” by Ratner & Schatz, ISBN 0-13-895491-7 (paperback; ~\$50, used)
  - “Introduction to Quantum Mechanics,” (2<sup>nd</sup> Edition) by Griffiths, ISBN 0-13-111892-7 (hardcopy) [many, most students likely already have a copy of Griffiths]
- **Recommended**
  - “Molecular Quantum Mechanics,” (mine is 3<sup>rd</sup> Edition, a 4<sup>th</sup> Edition is available) by Atkins & Friedman, ISBN 0-19-855947 (paperback; ~\$50, used)
- **Background and Lecture Sources**
  - “The Physics of Astrophysics, Vol 1. Radiation,” by Shu, ISBN 0-935702-64-4 – quantum theory is part 3 of this three part book.
  - “Radiative Processes in Astrophysics,” by Rybicki & Lightman, ISBN 0-471-82759-2 – see the last couple of chapters [most students ought to already have this book]
  - “Microwave Spectroscopy,” by Townes & Schawlow, ISBN 0-486-61798-X – the authoritative book on molecular spectroscopy
- **Lecture Sources leading into Interstellar Medium Studies**
  - “The Physics and Chemistry of the Interstellar Medium,” Tielens, ISBN 0-521-82634-9
  - “Physics and Chemistry of the Interstellar Medium,” Kwok, ISBN 978-1-891389-46-7

### **Grading:**

Course Component	Percentage Weight
Homework (10-12 expected)	40%
Midterm Exam	30%
Final Exam	30%

**Expectations:**

**Lecture Attendance** – I expect each student will attend every lecture for this course. Chronic absences (more than 5 lectures) may result in a failing course grade. I also expect (and encourage!) questions and participation in and out of the classroom.

**Homework** – I expect to issue homework assignments nearly every week. Each homework assignment will be due generally one week plus 8 hours later, by **5pm each Wednesday**. I expect every student will complete every homework assignment. Failure to turn in more than 75% of the homework assignments may result in a failing course grade.

**Academic Standards** – I expect the homework you turn in is your work and not the work of your fellow classmates (see below). In class, we will discuss the distinction between allowable collaboration and violation of academic standards.

**Exams:**

There will be one 75-minute duration, closed-book, in-class **Midterm Examination** on **Friday, March 3rd**. It will cover all material up through the preceding lecture.

There will be a 2-hour duration, closed-book **Final Examination** on **Wednesday, May 10th from 9-11am**.

**Required Homework Format:**

- written in **INK**
- no more than one problem per page (though any one problem may cover multiple pages)
- written on the front side of each paper sheet only
- highly legible
- please provide sufficient space between lines for my comments
- scanned into PDF form, assembled into a single file and submitted via BlackBoard

**Late Policy:** *Failure to turn in an assignment on the designated date, by the designated time, in the designated format will result in a loss of 15% of the total value of the assignment for each calendar day the assignment is late.*

**Conduct Standards & Collaboration:** It is important that students submit for evaluation work that is properly executed and attributed. I encourage you to discuss problems together, but to write up and submit your assignments separately. You may help each other to find how to solve a problem, but you must present your own discussion of the steps needed to achieve the solution. Do not copy from another student or from another student's work (including students not in this class).

Students are reminded that their behavior is governed by the Graduate School Academic Conduct Code, as may be accessed via the following link:

<http://www.bu.edu/cas/students/graduate/grs-forms-policies-procedures/academic-discipline-procedures/>

**No Lecture Dates:** 1/27