Physics 224: The Interstellar Medium

Winter 2020

Instructors:

Lecturer: Prof. Karin Sandstrom
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Office: SERF 426
Office hours: by appointment

Course Schedule:

Lecture: MWF 11:00-11:50 am SERF 329

Course Materials:

Web Page:

Course Webpage: http://karinsandstrom.github.io/w20_phys224.html

Texts & Other Material:

Textbook: *The Physics of the Interstellar and Intergalactic Medium* by B. Draine

Other Resources:

Online LaTeX for writing up problem sets (if you don't have it on your computer): http://sharelatex.com or http://overleaf.com

Overview:

Physics 224 is a graduate level class on the physics of the interstellar medium. The goal of this class is to give you a broad understanding of the physical processes in the ISM and outline the borders of our current knowledge of this fascinating subject. In the process, you should learn some skills that will be of use in your future academic career including: reading scientific literature, presentations, data analysis, scientific writing and putting together proposals for telescope/supercomputer time and/or funding.

Course Logistics:

On Monday and Wednesday we will have lecture covering the topics listed in the schedule below. On most Friday's we will discuss two papers from the literature on the ISM. A google doc to sign up for the paper presentation will be posted during the first lecture of the quarter. There will be additional discussions on scientific writing and presentations on some Friday's when there are no paper presentations. **The schedule for this course is subject to change!! Updated schedules will be put on the website.**

Grading:

Your grade in this class will be based on the following:

- **Paper presentation to the class:** You will be expected to lead a discussion of one paper and participate in the discussion of other papers throughout the quarter. As discussion leader, you are expected to put together ~15 minutes of material to present to the class. The rubric I will use to evaluate the presentations will be posted on the website. Everyone else in the class is expected to submit a substantive question or comment about the paper via a google form that will be linked on the website by 5pm on Thursday before the Friday discussion. We will spend 10 minutes discussing each paper based on these questions or comments after the presentation.
- **Homework:** There will several problem sets assigned throughout the term. You are expected to submit your problem set as a pdf. I highly recommend writing up the problem set in latex using one of the free online latex tools (sharelatex or overleaf).
- **Final Proposal Project:** During the course we will discuss a wide variety of topics in the interstellar medium. As a final project, everyone will be expected to write a proposal following standard practices in the field to investigate one of the subjects we have covered. These can be theory proposals or observational proposals. You will need to read some current literature to learn about the topic. You will need to become familiar with the required elements of the type of proposal you are writing.

The overall percentage of your grade set by the various components is the following:

Activity	Grade Percentage	Notes
Paper presentation	15%	graded based on presentation rubric
Participation in paper discussions	10%	credit assigned for submitting substantive question or comment by 5pm on Thurs prior to discussion
Homeworks	25%	4 homeworks planned
Proposal	50%	includes: initial write up (abstract + bibliography), full proposal, your contribution to evaluation committee

While collaboration is encouraged, all assignments you turn in must be your own work - i.e. the write up must be yours. Extra credit may be given at the instructor's discretion.

Final letter grades will be set by the following scale (+/- assigned at instructor's discretion):

Letter Grade	Percent		Letter Grade	Percent		Letter Grade	Percent
A	90 - 100%		**C**	70 - 79.9%		**F**	0 - 59.9%
B	80 - 89.9%		**D**	60 - 69.9%			

Course Policies and Expectations:

Academic Conduct: In this course you are expected to abide by UCSD's policy on academic integrity, which every student should read in detail here: http://academicintegrity.ucsd.edu. This policy provides a detailed, strict definition of what constitutes academic misconduct. Students who are found to have committed academic misconduct will be reported and face administrative and academic sanctions. The current sanctioning guidelines for academic misconduct are available here. Note that academic misconduct is not just blatant cheating, but also includes things like copying off other student's homework or tests, copying old assignments from friends or websites, working with others on *individual* assignments or turning in work completed in part or fully by someone else as your own.

Academic Accommodations: The UCSD Office for Students with Disabilities (OSD) is available to work with students with disabilities to facilitate accommodations. These include adaptive software and technologies, captioning and interpreters, AS and peer notetakers and exam modifications. Students requesting these services must obtain and submit an Authorization for Accommodation (AFA) letter to the instructor no earlier than 3 working days prior to receiving accommodations (i.e., exam date). For more information, see the OSD website at http://disabilities.ucsd.edu.

Late Policy: If you need to turn in the homework late, please send me a note ahead of the due date to ask for an extension. I will give extensions, but it is best to keep up with the assignments as they are due, the work will pile up!

Class Schedule

Week	Lecture Date	Lecture Topic	Friday Discussion	Reading	Assignments Due
1	**Jan 6**	#1 Overview of the ISM	Jan 10: Lecture #3 Detailed Balance	Ch 1	sign up to lead paper discussion by end of week, HW 1 assigned (due Jan 24)
	Jan 8	#2 Collisional Processes & Thermodynamics		2,3,4	
2	**Jan 13**	#4 Energy Levels & Transitions	Jan 17: Lecture #6 Scientific Presentations	4,5,6	
	Jan 15	#5 Radiative Transfer, Absorption Lines		7,8,9	
3	**Jan 20**	no lecture - University Holiday	Jan 24: Papers #1 and #2		HW 2 assigned (due Feb 7)
	Jan 22	#7 HII Regions, Ionization, Recombination		13,14,15	
4	**Jan 27**	#8 Collisional Excitation, Nebular Lines, Heating/Cooling in HII Regions	Jan 31: Papers #3 and #4	17, 18, 27, 28	
	Jan 29	#9 Dust (optical properties, infrared emission)		21, 22, 23, 24	
5	**Feb 3**	#10 Dust (heating/cooling, PE effect, formation/destruction)	Feb 7: Papers #5 and #6	25, 26, *	HW 3 assigned (due Feb 21)
	Feb 5	#11 More Dust		25, 26, *	
6	**Feb 10**	#12 Diffuse Neutral Gas	Feb 14: Papers #7 and #8	16, 29, 30	Proposal Abstract & Bibliography due Feb 14
	Feb 12	#13 HI/H2 Transition & PDRs		31	
7	**Feb 17**	no lecture - University Holiday	Feb 21: Papers #9 and #10		HW 4 assigned (due Mar 6)
	Feb 19	#14 Fluid Dynamics, Turbulence		35, **	
8	**Feb 24**	#15 Molecular Clouds	Feb 28: Papers #11 and #12	32, 33	
	Feb 26	#16 Molecular Clouds & SF		41, 42	
9	**Mar 2**	#17 Molecular Clouds, Magnetic Fields, Chemistry, SF	Mar 6: Paper #13 and Lecture #19: Diffuse Ionized Gas	**	
	Mar 4	#18 Feedback, Supernovae, Cosmic Rays		34, 39, 40	
10	**Mar 9**	#20 Global ISM Models	Mar 13: Phys 224 TAC		Final Proposal due Mar 9
	Mar 10	#21 ISM in other galaxies			

Additional Readings

* Draine 2009 “Interstellar Dust Models and Evolutionary Implications"
http://adsabs.harvard.edu/cgi-bin/nph-data_query?bibcode=2009ASPC..414..453D&link_type=ABSTRACT

** Krumholz *Notes on Star Formation*
http://bender.astro.sunysb.edu/oab/star_formation_notes/sfnotes.pdf
For Feb 19 - chapter 4
For Mar 2 - chapter 10