UCF Physics: AST 6165 Planetary Atmospheres

Spring 2020 Syllabus

1 Course Vitals

Room:	BA1 206 / remote instruction	Lecture:	TR 9:00 – 10:20
Grading:	ABCDF with +/- modifiers	Credits:	3(3,0)
Dates:	7 January – 16 April 2020	Final:	R 23 April 2020 7:00 – 9:50
Satisfies:	core class in Physics PhD, Planetary Sciences track		
Prerequisites:	AST 5151 Physics of Planetary Processes PHY 6246 Classical Mechanics		
Class URL:	https://planets.ucf.edu/academics/courses/ast-6165/ and WebCourses		
Textbook:	Andrews, D. G. 2010. *An Introduction to Atmospheric Physics*, 2nd ed. Cambridge University Press. ISBN-13: 978-0521693189		
	Pierrehumbert, R. T. 2011. *Principles of Planetary Climate* Cambridge University Press. ISBN-13: 978-0521865562		
Resources: (no assignments)	Ingersoll, A. P. 2013. *Planetary Climates* Princeton University Press. ISBN-13: 978-0-691-14505-1		
	Seager, S. 2010. *Exoplanet Atmospheres* Princeton University Press. ISBN-13: 978-0-691-14645-4		

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See separate lecture schedule document.

2 Course Description

AST 6165 Planetary Atmospheres presents the basic physics and chemistry of planetary atmospheres. Rather than teaching a category of physics, this course focuses on a class of *objects*, and applies physics and chemistry to interpret its behavior. It also provides exposure to the wide variety of atmospheric studies on worlds of our solar system and others. It is taught in half-lecture, half-seminar style.

3 General Objectives

By the end of the course, those who successfully complete it will understand how material in an atmosphere

1. distributes itself,
2. receives, releases, absorbs, redistributes, and loses energy,
3. alters itself physically and chemically,

4. is gained from sources and lost to sinks,
5. moves, and
6. interacts with its boundaries.

In addition, students will broadly sample current topics in planetary atmospheres sufficiently to assimilate all future information about the topic that they encounter.

4 Commitment

This is a *challenging* course that covers one of the broadest topics in physics. The small class size will allow us to use the most effective learning methods, including reading and discussing research papers, individual research followed by presentation to the class, and computational exercises. That is to say, the class is as much a graduate seminar as a traditional lecture class. The seminar approach falls apart unless everyone does his or her part for *every* seminar assignment. The credit for doing these parts of the course is thus correspondingly large, and failing to come prepared and to participate fully carries a substantial grade penalty. More importantly, not only will you be penalized, but you and all your classmates will not learn that material as effectively as you might have otherwise. Expect to spend about 6–9 hours studying outside of class per week. Expect to spend substantially more when it is your turn to present. This is an average; different students will spend dramatically more or less to achieve the same grade. If you do not feel you can commit the time and effort in every week of the course, please consider taking the class in a semester when you can do so.

5 Format

The topic of planetary atmospheres is so broad that a quantitative introduction to all of it cannot adequately be done in one course. In some departments, the introductory class focuses exclusively on the physics of Earth's lower atmosphere, and does not present the non-terrestrial aspects that concern planetary scientists. The job of a core graduate curriculum is to enable students to become full participants in the scientific community of their program, so our class cannot take this approach. The design of this course is thus a compromise between the two goals of teaching atmospheric physics and chemistry and introducing the breadth of planetary atmospheric studies.

About half the sessions are traditional lectures that follow the textbook closely. These present the basic physics and chemistry of the lower atmosphere, which on Earth corresponds to the region from the surface into the ionosphere.

The remainder of the sessions introduce the "planetary" aspects of atmospheric study. The goal is to create a mental map of the topics and their relationships to one another, one that is sufficiently interconnected that all future information a student receives about planetary atmospheres can assimilate into it. In other words, we wish to lay a foundation for future learning.

The non-lecture time is thus taught as a graduate seminar, with some time spent on the core material but most on planetary topics. *You* will teach this part of the course, by giving 25-minute presentations on a few topics. For each of these, you will choose your own and the class's reading, and will prepare a lecture with visuals. You will also lead the discussion following each presentation. The instructor will provide guidance in the selection of topics and materials.

Homework problems include both the traditional lectures and the planetary topics. Reading assignments from the book accompany those, while research papers and excerpts from other texts go with the planetary lectures. There are a mid-term and a cumulative final exam.

COVID-19 Format Modification: Due to the state-mandated lockdown to reduce the spread of the COV-SARS-2 virus and the COVID-19 disease, following Spring Break, the course will be delivered remotely, via Zoom. A Zoom room number will be given and class will continue to be recorded. Students are expected to participate in real time. The lecture, assignment, and assessment formats will not otherwise change.

6 Grading

The grading criteria are weighted as follows:

Class preparation and participation	10%	
Homework average	15%	
Mid-term exam	20%	
Final exam	30%	
Presentation average	25%	
Talk content, length, level, organization		35%
Visuals		20%
Speaking and presentation		15%
Knowledge of material, article selection		30%
Solved homework problem, if used in HW		5% extra credit

No late homework will be accepted and no make-ups will be given, except for exams, so PLAN AHEAD. This is because we may discuss each graded item in the class after it is due, thus giving away the answers. However, you have one homework drop to cover unexpected absences. This is for our convenience in not giving makeups and is not intended as a form of grading relief. You can choose to spend your drop, but then you have spent your safety net and will take a zero later in the semester if you have to have an unexcused miss.

Following the Physics Missed-Work Policy (see below), if you have a medical, family, or university excuse, you must bring documentation as soon as possible (in advance for university excuses), and certainly within one week of the end of the excusable situation. In general, that item will then not count toward your final grade.

Because many of the problems in this course are challenging even to professionals, your letter grade is determined by the table below (no rounding):

Grade assignment:

	-			straight			+		
A	90	–	93 1/3	93 1/3	–	100			
B	75	–	79.9999	80	–	84.9999	85	–	89.9999
C	60	–	64.9999	65	–	69.9999	70	–	74.9999
D	50	–	53 1/3	53 1/3	–	56 2/3	56 2/3	–	59.9999
F	below 50%								

To encourage co-operation and group participation, there is no curved grading, so it is possible for everyone to get an A. It is also possible for everyone to fail (but I hope not!).

7 Computing and Communication

You will need a numerical computing and graphing environment to do some of the problems. An array programming environment such as Python/Numpy, IDL, or Matlab is a much better choice than a spreadsheet for this. If you do not have access to one of these, please see the instructor.

You must check your email several times per week, and you will need to access the web and WebCourses to do and turn in your assignments, and to receive course communications and grades..

I encourage you to bring your computer and a flash drive to class! This will allow you to try some numerical things out when we work problems, and to exchange computer files. If you do not have a computer, *I encourage you to get one!* Since the seminar assignments will be handed in electronically, you must have access to word-processing and possibly presentation software that can produce your assignment in (preferably) Portable Document Format, any OpenOffice.org format, or (if necessary) Microsoft Word or PowerPoint formats. Regular homework assignments must be submitted electronically through WebCourses. Please name files in the form `assignment#-username-itemname.ext`, for example, `hw2-jh.pdf` or `lect16-fred-aurorae.ppt`.

8 Academic Honesty

We all follow the UCF Creed, whose first point is Integrity. Specific rules for honest academic conduct are covered in the University's Rules of Conduct (see http://osc.sdes.ucf.edu/process/roc). Please collaborate on reading and studying. However, each person must do the written assignments and take each examination alone. The nature of in-class assignments will be clearly stated. When writing, you must cite all sources (including web sites), and in all cases you must rephrase what was said in your own words. Penalties for cheating and plagiarism can include failing that evaluation or the entire course.

Looking at computer files or paper notes of another student is not permitted without that student's explicit permission on a per-case basis. **Looking at or suggesting the content of others' homework answers is expressly prohibited in all cases.**

See also the standard UCF statement on Academic Integrity, below.

9 Learning Effectively

Learning is hard work, because the process of learning is that of changing what your brain already knows. This class is designed around specific learning methodologies that will seat the material for the long term. You will learn most effectively if you **read the assignments ahead of the relevant class**. The lectures then give you a second run through the material that will solidify what you have learned from the book. They also serve as a chance to ask questions and hold discussions on points of interest, which will further seat the material. If you have not read the assignment, advanced discussions may go over your head and you will be stuck with your book and the office hours to answer your questions. Our discussions will be quite boring and one-sided in this case. You will spend less total time, will learn the material better, and will enjoy the class more if you read before coming to class. On discussion days, students who have not read the assignment may be asked to leave, read it, and return when prepared.

Likewise, and more importantly, it is critical that you do homework by the due date, as each assignment prepares you for in-class discussion. Since answers will be discussed in class, **no late homework will be accepted**.

Homework is also a prime exam study tool! Read and study the material, then "take" the homework like a test, without book or notes. Check and correct your answers. Then, meet with your study group, figure out what's difficult for each of you, and do problems from the ends of each chapter with each other. It is certainly possible to do less work and hand in satisfactory homework. However, exams count much more than homework.

10 Assignment Standards

Mathematics may be handwritten, but must be both neatly organized and very legible. If we have to guess or hunt, it is wrong.

In math problems, present, in order:

- Known expressions.
- Derivation or proof.
- Final expression in simplest form. **Box this.**
- List of input values, **units, and sources** (if not from class materials).
- Final numerical answer. **Box this.**
- Interpretation.

All of these items are graded, even if the problem only asks for the numerical answer.

While many problems will use input values with low precision, use high precision, **4 digits or more**, in calculations. This makes grading easier.

- Plot/calculate with values for the Earth-sun system.
- Use standard planetary variables: R is radius, a is orbital semimajor axis, ϕ is latitude, T is temperature, A is albedo, $_*$ denotes stellar variables, $_{\mathrm{p}}$ (or blank) denotes planetary variables, $_{\text{standard symbol}}$ denotes the sun or a specific planet.
- Even if a problem does not call for it, **derive** an **analytic** expression **before** plugging in any values, calculating, or plotting. Then identify the values you use, then calculate/plot. This will facilitate the best learning, enable the most simplifications, give you maximum partial credit if you are wrong, and make the assignments easiest to grade.
- Please explain your solution logic before throwing equations. If it's right, well, it will look like the solution in any case. If it's wrong, it will be much faster to spot where and how you thought incorrectly, and to point that out, rather than trying to divine what you were thinking from the math. This makes it much easier to give out partial credit.

11 Relevant Policies

While I currently intend to follow what is outlined here, this syllabus is a guideline and not a contract. It may be updated at any time, and I may vary from it, either for the entire class or on an individual basis. I may disseminate information about changes either in class, via email or text messaging, or through WebCourses.

11.1 Physics Department Missed-Work Policy

It is Physics Department policy that making up missed work will only be permitted for University-sanctioned activities and bona fide medical or family reasons. Authentic justifying documentation must be provided in every case (in advance for University-sanctioned activities). At the discretion of the instructor, the make-up may take any reasonable and appropriate form including, but not limited to the following: a replacement exam, replacing the missed work with the same score as a later exam, allowing a 'dropped' exam, replacing the missed work with the homework or quiz average.

11.2 Disabilities Policy

The University of Central Florida is committed to providing reasonable accommodations for all persons with disabilities. This syllabus is available in alternate formats upon request. Students with disabilities who need accommodations in this course must contact the professor at the beginning of the semester to discuss needed accommodations. No accommodations will be provided until the student has met with the professor to request accommodations. Students who need accommodations must be registered with Student Disability Services, Student Resource Center Room 132, phone (407) 823-2371, TTY/TDD only phone (407) 823-2116, before requesting accommodations from the professor.

11.3 Establishing Academic Activity For Financial Aid

All instructors/faculty are required to document students' academic activity at the beginning of each course. In order to document that you began this course, please be present in class, where attendance will be taken, and/or complete the first homework assignment, by the end of the first week of classes or as soon as possible after adding the course. Failure to do so may result in a delay in the disbursement of your financial aid.

12 Required UCF Policies and Statements

The following material is required to be included in all UCF syllabi. It is important information that all students should know and follow. It comes from:
`http://www.fctl.ucf.edu/TeachingAndLearningResources/CourseDesign/Syllabus/statements.php`
It is presented here without modification, not even the correction of grammar and punctuation errors.

12.1 UCF Core Syllabus Statements

See section 8 of UCF Policy 4-403.1, "Required Elements of the Course Syllabus"

12.2 Academic Integrity

Students should familiarize themselves with UCF's Rules of Conduct at <http://osc.sdes.ucf.edu/process/roc>. According to Section 1, "Academic Misconduct," students are prohibited from engaging in

1. Unauthorized assistance: Using or attempting to use unauthorized materials, information or study aids in any academic exercise unless specifically authorized by the instructor of record. The unauthorized possession of examination or course-related material also constitutes cheating.

2. Communication to another through written, visual, electronic, or oral means: The presentation of material which has not been studied or learned, but rather was obtained through someone else's efforts and used as part of an examination, course assignment, or project.

3. Commercial Use of Academic Material: Selling of course material to another person, student, and/or uploading course material to a third-party vendor without authorization or without the express written permission of the university and the instructor. Course materials include but are not limited to class notes, Instructor's PowerPoints, course syllabi, tests, quizzes, labs, instruction sheets, homework, study guides, handouts, etc.

4. Falsifying or misrepresenting the student's own academic work.

5. Plagiarism: Using or appropriating another's work without any indication of the source, thereby attempting to convey the impression that such work is the student's own.

6. Multiple Submissions: Submitting the same academic work for credit more than once without the express written permission of the instructor.

7. Helping another violate academic behavior standards.

For more information about Academic Integrity, consult the International Center for Academic Integrity <http://academicintegrity.org>.

For more information about plagiarism and misuse of sources, see "Defining and Avoiding Plagiarism: The WPA Statement on Best Practices" <http://wpacouncil.org/node/9>.

12.2.1 Responses to Academic Dishonesty, Plagiarism, or Cheating

Students should also familiarize themselves with the procedures for academic misconduct in UCF's student handbook, The Golden Rule <http://goldenrule.sdes.ucf.edu/docs/goldenrule.pdf>. UCF faculty members have a responsibility for students' education and the value of a UCF degree, and so seek to prevent unethical behavior and when necessary respond to academic misconduct. Penalties can include a failing grade in an assignment or in the course, suspension or expulsion from the university, and/or a "Z Designation" on a student's official transcript indicating academic dishonesty, where the final grade for this course will be preceded by the letter Z. For more information about the Z Designation, see <http://goldenrule.sdes.ucf.edu/zgrade>.

12.3 Course Accessibility Statement

The University of Central Florida is committed to providing access and inclusion for all persons with disabilities. Students with disabilities who need disability-related access in this course should contact the professor as soon as possible. Students should also connect with Student Accessibility

Services (SAS) <http://sas.sdes.ucf.edu/> (Ferrell Commons 185, sas@ucf.edu, phone 407-823-2371). Through Student Accessibility Services, a Course Accessibility Letter may be created and sent to professors, which informs faculty of potential access and accommodations that might be reasonable. Determining reasonable access and accommodations requires consideration of the course design, course learning objectives and the individual academic and course barriers experienced by the student.

12.4 Campus Safety Statement

Emergencies on campus are rare, but if one should arise during class, everyone needs to work together. Students should be aware of their surroundings and familiar with some basic safety and security concepts.

- In case of an emergency, dial 911 for assistance.
- Every UCF classroom contains an emergency procedure guide posted on a wall near the door. Students should make a note of the guide's physical location and review the online version at <http://emergency.ucf.edu/emergency˙guide.html>.
- Students should know the evacuation routes from each of their classrooms and have a plan for finding safety in case of an emergency.
- If there is a medical emergency during class, students may need to access a first-aid kit or AED (Automated External Defibrillator). To learn where those are located, see <http://www.ehs.ucf.edu/AEDlocations-UCF> (click on link from menu on left).
- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to <https://my.ucf.edu> and logging in. Click on "Student Self Service" located on the left side of the screen in the toolbar, scroll down to the blue "Personal Information" heading on the Student Center screen, click on "UCF Alert", fill out the information, including e-mail address, cell phone number, and cell phone provider, click "Apply" to save the changes, and then click "OK."
- Students with special needs related to emergency situations should speak with their instructors outside of class.
- To learn about how to manage an active-shooter situation on campus or elsewhere, consider viewing this video (<https://youtu.be/NIKYajEx4pk>).

12.5 Campus Safety Statement for Students in Online-Only Courses

Though most emergency situations are primarily relevant to courses that meet in person, such incidents can also impact online students, either when they are on or near campus to participate in other courses or activities or when their course work is affected by off-campus emergencies. The following policies apply to courses in online modalities.

- To stay informed about emergency situations, students can sign up to receive UCF text alerts by going to <https://my.ucf.edu> and logging in. Click on "Student Self Service" located on the left side of the screen in the toolbar, scroll down to the blue "Personal Information" heading on the Student Center screen, click on "UCF Alert", fill out the information, including e-mail address, cell phone number, and cell phone provider, click "Apply" to save the changes, and then click "OK."

- Students with special needs related to emergency situations should speak with their instructors outside of class.

12.6 Make-Up Assignments for Authorized University Events or Co-curricular Activities

Students who represent the university in an authorized event or activity (for example, student-athletes) and who are unable to meet a course deadline due to a conflict with that event must provide the instructor with documentation in advance to arrange a make-up. No penalty will be applied. For more information, see the UCF policy at:
http://policies.ucf.edu/documents/4-401.1MakeupAssignmentsForAuthorizedUniversityEventsOrCocurricularActivities.pdf

12.7 Religious Observances

Students must notify their instructor in advance if they intend to miss class for a religious observance. For more information, see the UCF policy at:
http://regulations.ucf.edu/chapter5/documents/5.020ReligiousObservancesFINALOct17.pdf

12.8 Deployed Active Duty Military Students

Students who are deployed active duty military and/or National Guard personnel and require accommodation should contact their instructors as soon as possible after the semester begins and/or after they receive notification of deployment to make related arrangements.

12.9 Unauthorized Use of Class Materials

There are many fraudulent websites claiming to offer study aids to students but are actually cheat sites. They encourage students to upload course materials, such as test questions, individual assignments, and examples of graded material. Such materials are the intellectual property of instructors, the university, or publishers and may not be distributed without prior authorization. Students who engage in such activity are in violation of academic conduct standards and may face penalties.

12.10 Unauthorized Use of Class Notes

Faculty have reported errors in class notes being sold by third parties, and the errors may be contributing to higher failure rates in some classes. The following is a statement appropriate for distribution to your classes or for inclusion on your syllabus:

Third parties may be selling class notes from this class without my authorization. Please be aware that such class materials may contain errors, which could affect your performance or grade. Use these materials at your own risk.

12.11 In-Class Recording Policy

Outside of the notetaking and recording services offered by Student Accessibility Services, the creation of an audio or video recording of all or part of a class for personal use is allowed only with the advance and explicit written consent of the instructor. Such recordings are only acceptable in the context of personal, private studying and notetaking and are not authorized to be shared with anyone without the separate written approval of the instructor.