

Syllabus  
Tidal and Planetary Waves  
(PHYS 8750 – 007)  
Fall Semester 2018

**Instructor**

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**Office Hours**

MWF 2:00 – 3:00 or come on an as needed basis any time. **Students are strongly encouraged to make use of the office hours, to discuss homework assignments and for conceptual questions.**

**Prerequisite**

Atmospheric Physics (PHYS 4250 or PHYS 8250 – or equivalent courses, or consent of instructor).

**Class Hours**

MWF, 3:30-4:20, 223 Kinard. If I am late for class and do not have a substitute, I do not expect students to wait more than 15 minutes.

**Attendance Policy**

Attendance is required for the first class. Thereafter, it is not required but is *strongly recommended*. It is the responsibility of the student to be aware of what is announced in class, including changes to homework assignments. Please also see the general statement on attendance in the Graduate Announcements.

**Required Texts**

Groundbreaking papers from the peer-reviewed literature. Access will be provided by the instructor through Clemson's Library subscription.

**Recommended Texts**

*Atmospheric Tidal and Planetary Waves* by Hans Volland  
*Atmospheric Tides* by Chapman and Lindzen

**Class Web Page**

The course web site can be accessed via Canvas. Course announcements, assignments, instructional material etc. can be found there.

**Course Objectives**

The overall objective is to provide the student with an advanced graduate level understanding of the theory, observation and impact of tides and planetary waves in

Earth's middle atmosphere and in the ionosphere-thermosphere system. The course will also address tides on Venus and Mars, and future challenges and directions of the field.

### **Course Outline and Learning Outcomes**

1. Theory (about 5 weeks) Classical tidal and planetary wave theory: Hough modes and vertical structure equation; external energy sources: solar and lunar; internal energy sources and sinks: latent heat, diffusion, radiative damping, gravity wave and ion drag, critical layers; tidal and planetary wave equations with dissipation but without mean winds; tidal equations with mean winds: interaction with mean flow, seasonal and inter-annual variations, mode coupling; nonlinear processes: secondary waves and resonances
2. Observation (about 4 weeks): what parameters to measure; ground-based versus space-based measurements; satellite sampling of tides and planetary waves; satellite data analysis of tides (solar and lunar) and planetary waves; diagnostics of tidal and planetary wave "weather": diagnosing and interpreting short-term tidal variability; lunar tide amplification during sudden stratospheric warmings
3. Impacts and Hot Topics (about 5 weeks): observation and empirical modeling of thermospheric tides and planetary waves, tidal and planetary wave impact on mean structure of the thermosphere: energy and momentum deposition, constituents, energy budget; plasma density variations imposed by waves due to dynamo action; short-term tidal and planetary wave variability for space weather predictability; new data analysis concepts for the GOLD and ICON satellite missions; tides on Venus and Mars

### **Course Credit**

Project: Students will be assigned an advanced topic not covered in class to demonstrate their mastery of the concepts taught. This will require a literature study of fundamental and contemporary peer-reviewed papers and to overview the assigned topic in a 10-15 page written summary and present the key points to the class in a 20 min short lecture. The grade for the project will be 75% written part and 25% lecture part.

Homework: will be assigned on a bi-weekly basis

Exams: one midterm and one final exam

### **Course Grades and Weights**

- 40% Project
- 20% Homework
- 15% Mid-term exam
- 25% Final exam

A: 85-100; B: 70-85; C: 55-70; F: <55 (no D grade)

## **Academic Integrity Policy**

The graduate academic integrity policy, as stated in the Graduate School Policy Handbook, applies. In addition, students may discuss homework problems with other students, but only in general terms. **Copying homework solutions from the web is strictly forbidden!**

The official statement on “Academic Integrity” reads: “As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity.”

## **Disability Access Statement**

It is university policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students with disabilities requesting accommodations should make an appointment with Accessibility Services (656-6848), to discuss specific needs within the first month of classes. Students should present a Faculty Accommodation Letter from Student Accessibility Services when they meet with instructors. Accommodations are not retroactive and new Faculty Accommodation Letters must be presented each semester.

## **Clemson University Title IX (Sexual Harassment) Statement**

Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran’s status, genetic information or protected activity (e.g., opposition to prohibited discrimination or participation in any complaint process, etc.) in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The policy is located at <http://www.clemson.edu/campus-life/campus-services/access/non-discrimination-policy.html>. Alesia Smith serves as Clemson’s Title IX Coordinator and may be reached at [alesias@clemson.edu](mailto:alesias@clemson.edu) or (864) 656-3181.