

# EAS 8803/4803: PHYSICS OF EARTHQUAKES - FALL SEMESTER 2015

**Time and Location:** Tuesday/Thursday 12:05–1:25 pm, U A Whitaker Biomedical Engr 1214

**Office Hours:** Tuesday/ Thursday 1:30 pm–2:30 pm (or by appointment)

**Instructor:** Zhigang Peng, ES&T 2256, 404-894-0231, [zpeng@gatech.edu](mailto:zpeng@gatech.edu)

**TA/Co-Instructor:** Xiaofeng Meng, ES&T 2120, 404-680-9971, [xmeng7@gatech.edu](mailto:xmeng7@gatech.edu);  
Dongdong Yao, [dyao32@gatech.edu](mailto:dyao32@gatech.edu)

**General Description:** This course consists of a series of lectures and discussions on the current status of physical processes that control fault slips and earthquakes.

**Grading:** Midterm exam (30%), Midterm project (20%), Discussions (25%), Final course project (25%).

**Text Books (No books are reserved at the bookstore. Please order online)**

**Recommended:**

Scholz, C. H., The Mechanics of Earthquakes and Faulting, 2nd Edition, Cambridge University Press, 471 pp., 2002.

Udias, A., R. Madariaga, and E. Buforn, Source Mechanisms of Earthquakes: Theory and Practice, Cambridge University Press, 2014.

S. Stein and M. Wysession, An Introduction to Seismology, Earthquakes, and Earth Structure, Blackwell Publishing, 2003.

Additional material will either be handed out in class or made available on course website.

**Class website:** <http://geophysics.eas.gatech.edu/classes/EQPhysics/>

**Course Outline:**

**Lectures**

1. Brittle Fracture of Rock
2. Rock Friction
3. Mechanics of Faulting
4. Mechanics and Quantifications of Earthquakes
5. Collective Behaviors of Earthquakes and Faults
6. The Seismic Cycle
7. Midterm over lectures
8. Presentations from the midterm project

Discussions/Debates of Emergent Research (Tentative Titles)

1. Slow and Fast Earthquakes
2. Fracking and Injection Induced Earthquakes

3. Earthquake Triggering: Static vs. Dynamic
4. Earthquake Initiation: Nucleation vs Cascade
5. Earthquake Prediction: Optimistic vs. Pessimistic

# Topics and order are subject to change during the semester.

**Exams:** There will be a midterm exam\* (30%) covering all material presented during the lecture portion of the course. Reference to texts or other documents such as previous semester course materials during the exam is strictly forbidden. Using these materials will be considered a direct violation of academic policy and will be dealt with according to the GT Academic Honor Code. The use of electronic devices (e.g. cellular phones, computers etc.) other than non-programmable calculators during exams and quizzes is not allowed.

**Discussions:** Approximately half of this class will be comprised of detailed discussion of five topics of modern research in the field of earthquake physics (listed in the course outline). Before each discussion, you will be expected to read the assigned papers and submit (electronically) a 2-page summary (double-space, 12 font-size, not including reference) of the topic. After discussion is completed on that topic, you will submit a new 2-page synthesis of your understanding of the current state-of-the-art of that topic. Your grade will depend on both your written summaries (10%) and synthesis (10%), and in class participation (5%). In the last three topics that involve debates, we will divide the classes into opposite groups and present their arguments.

**Course Project:** There will be two course projects. The first project is due immediately after the midterm and is a fixed topic on analyzing earthquake sequences. The final course project is open to any topics related to earthquake physics. This can be a literature review of a selected topic, or research project involving calculations, data analysis, or theoretical results done in consultation with the instructor. The topic needed to be approved by the instructor before the midterm. Your paper should be written up in a journal form with length, figures and referencing in a format suitable for submission to journals like Geophysical Research Letters (GRL). You will present your term paper in a 15 minute AGU-style talk; a 12 minute presentation with 3 minutes of questions. The midterm project will count as 20%, and the final project will count as 25% of your overall course grade.

**Academic Honesty:** It is expected that all students are aware of their individual responsibilities under the Georgia Tech Academic Honor Code, which will be strictly adhered to in this class. The complete text of the Georgia Tech Academic Honor Code is at <http://www.honor.gatech.edu/>.

\* Different exams will be assigned to graduate and undergraduate students.