

GEOL 609, Seminar in Earthquake Physics
Department of Earth Sciences
University of Southern California

Fall, 2019

Tuesday 11-12, Friday 2-3
ZHS 118

Instructor: [Yehuda Ben-Zion](#)

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Office hours by appointment

Course Description

The course covers state-of-the-art research material on the physics governing earthquakes, faults and plate boundary environments. Topics include theoretical and observational results on crustal deformation, ruptures, earthquake source properties, imaging of fault zone and lithospheric structures, spatio-temporal seismicity patterns, seismic hazard and more. The seminar series is aimed at graduate students of geophysics, physics, and engineering interested in promising directions in this field.

The format is two weekly meetings and the material will be covered via a blend of lectures by researchers and student presentations. One weekly meeting (Tue 2-3) will consist of a lecture by outside and in-house researchers (see list below). Speakers will include experts in various branches of earthquake science and will be available for additional discussions with students after the seminar. In the other weekly meeting (Friday 2-3), students will review papers related to the previous presentation and the next one. The grade will be based on the student presentations of papers, discussions, and a term project.

Lectures (Tuesday 11-12, ZHS 118, unless indicated otherwise)

August 27, Yehuda Ben-Zion (USC), Tracking the preparation process leading to large earthquakes

September 3, Fabian Bonilla (Université Paris Est, France), Observations of frequency dependency of velocity changes at the San Jacinto dense array (USA) and FNET (Japan)

September 10, SCEC meeting

September 17, Sylvain Barbot (USC), Fault friction: constitutive properties and dynamics

September 24, Sunyoung Park (Caltech), A New Method to Constrain Near-Surface Structure Based upon Body-Wave Polarization

October 1, Ilia Zaliapin (UNR), Variations of seismicity on seasonal to decade time scales

October 8, Zhongwen Zhan (Caltech), Potential of DAS in the next-generation seismic networks
October 15, Gareth Funning (UCR), TBD
October 22, Domniki Asimaki, (Caltech), On the complexity of seismic waves trapped in the shallow crust
October 29, Peter Shearer (UCSD), TBD
November 5, Tom Jordan (USC), Representations of complex seismic sources
November 12, Michael Bianco (UCSD), TBD
November 19, Mike Oskin (UC Davis), TBD
November 26, Chris Johnson (UCSD), Seasonal water storage, stress modulations, and variations in seismicity
December 3, Student presentations

General reading material relevant to the class topics

Aki, K., and Richards, P. G., *Quantitative Seismology* (second edition), University Science Books, 2002.
Turcotte, Donald L., *"Fractals and Chaos in Geology and Geophysics"*, Cambridge University Press, 1997.
Scholz, C. H., *The mechanics of earthquakes and faulting*, Cambridge, 2002.
Ben-Zion, Y., Appendix 2, Key Formulas in Earthquake Seismology, in *International Handbook of Earthquake and Engineering Seismology*, eds. W. HK Lee, H. Kanamori, P. C. Jennings, and C. Kisslinger, *Part B*, 1857-1875, Academic Press, 2003.
Kanamori, H., and E. E. Brodsky (2004), The physics of earthquakes, *Reports on Progress in Physics*, *67*, 1429 - 1496.
Ben-Zion, Y., Collective Behavior of Earthquakes and Faults: Continuum-Discrete Transitions, Evolutionary Changes and Corresponding Dynamic Regimes, *Rev. Geophysics*, **46**, RG4006, doi:10.1029/2008RG000260, 2008.

Specific reading material will be distributed before each lecture.

ACADEMIC INTEGRITY

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

STUDENTS WITH DISABILITIES

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website for DSP and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.