IGPP Virtual Seminar Series

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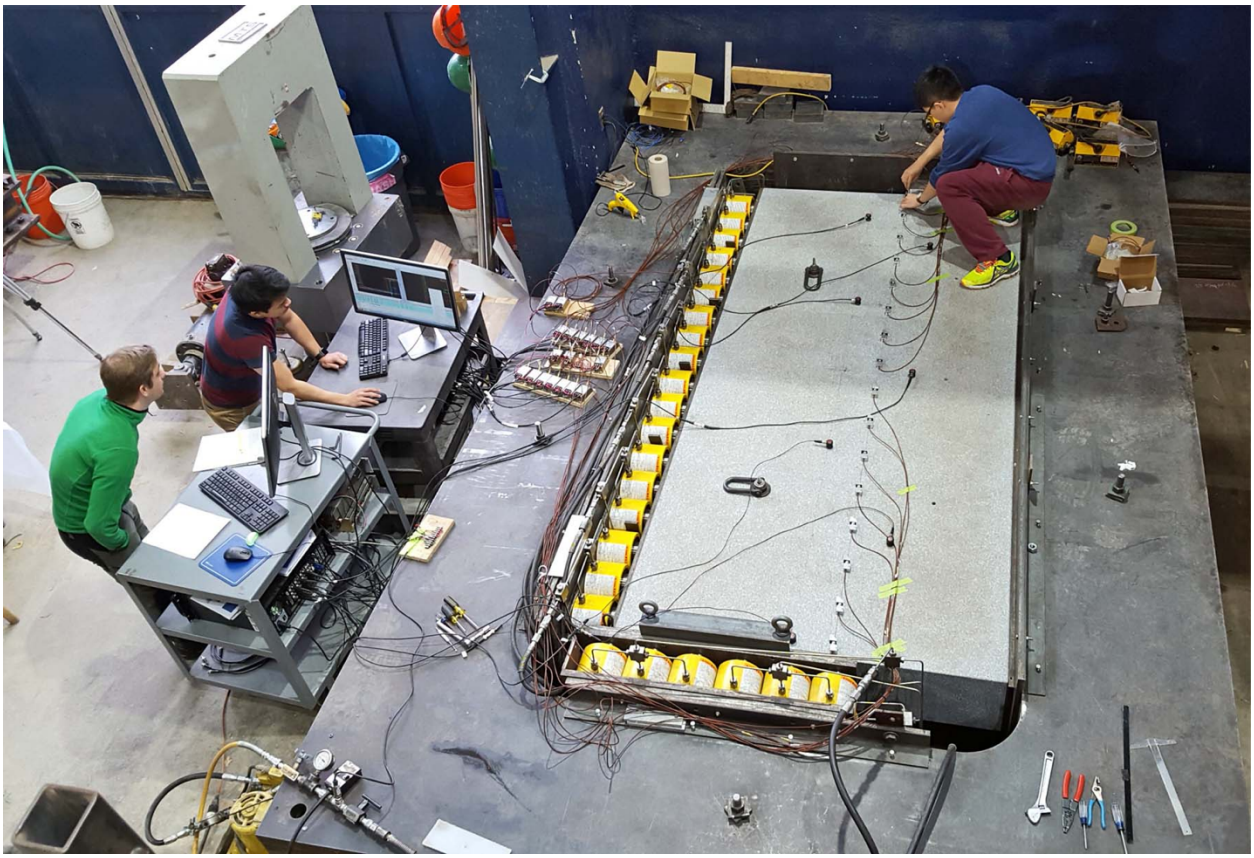
Laboratory Earthquakes on a 3 m Rock Provide Insights Into How Earthquakes Start, Stop, and Radiate Seismic Waves

Date: Tuesday, Apr 27, 2021
Time: 12:00 pm, Pacific Time
Host: Tianze Liu (tianzeliu@ucsd.edu)
Zoom link: https://ucsd.zoom.us/j/96329171564?pwd=UVUraEx5RTBaNitCNDV5bXFTay9aUT09
(Meeting ID: 950 5218 6250; Password: laboratory)



This talk presents mechanical and seismic analysis of magnitude -2.5 earthquakes generated by squeezing a 3-m slab of granite with 10 MN of force. Different from standard stick-slip events, these events do not rupture the entire sample. Instead, they produce a distribution of slip and stress changes along the fault. We use this laboratory experiment to study the way laboratory earthquakes initiate, the reasons why earthquake rupture terminates, and the reasons why we sometimes observe fast (100 mm/s slip rates) and slow (0.1 mm/s slip rates) earthquakes on the same fault. Most rupture events are preceded by a slow nucleation phase prior to dynamic rupture, but some events initiate far more abruptly, in a qualitatively different manner, which has important implications for the interpretation of foreshocks. When comparing slow and fast earthquakes, we find that slow events radiate seismic waves whose spectra are depleted near the corner frequency, similar to natural observations of slow, low-frequency earthquakes. When the nucleation observations and slow/fast observations are combined, they offer a possible explanation for the atypical scaling behavior observed for tectonic tremor.