Harvard University Solid Earth Physics Seminar
***and* SEAS Applied Mechanics Colloquium**

4:00 p.m. Wednesday 26 February 2014
209 Pierce Hall, 29 Oxford Street

Gas-driven Fracturing – Influence of Gas Composition and State

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Abstract: Gaseous stimulants offer some advantages in the "hydraulic" fracturing of low permeability reservoirs over traditional water-based fluids. These include conserving water as a resource, avoiding the activation of clays with added water and in potentially sequestering greenhouse gases and in utilizing competitive sorption for the improved recovery of the hydrocarbon reserve. In addition, the energetics of the gas stimulant may be advantageous in developing networks of increased complexity. Experimental observations are presented of the influence of gas composition and state on the breakdown pressures and evolving fracture complexity of fractures driven by gas – as an analog to hydraulic fracturing *in situ* for hydrocarbon recovery – for example in gas shales. Gas-fracturing experiments on finite-length boreholes indicate that the breakdown pressure is a strong function of fracturing fluid composition and state – converse to the principle of effective stress. Breakdown stress is shown to correlate with fluid exclusion or invasion into the borehole wall as a function of interfacial characteristics. Interfacial tension, in turn, is modulated by fluid state, as sub- or super-critical, and thus gas type and state influence the breakdown pressure. We explore linkages in the resulting fracture complexity that is indexed by breakdown pressure.