

# Capability Snapshot



## Fractured Earth Lab

Earth and Environmental Science Division

### Applications

- **Geothermal energy:** improved design and understanding of fracture propagation, permeability and reaction
- **Fracture caging:** Fracture containment to prevent seismicity and enhance production
- **Fracture branching:** Optimization of stimulation to fully penetrate rock mass
- **Well integrity:** Well failures prediction, cement stress state and THMC coupled properties measurements, thermoporoelectric/thermoplastic analysis, well leakage assessment
- Fracture permeability and subsurface transport
- Carbon storage, hydrogen storage, subsurface containment

### Partners and Sponsors

- National Labs (NETL, Lawrence Livermore, Lawrence Berkeley, Pacific Northwest, Sandia, Brookhaven)
- Universities (New Mexico Tech, University of Wisconsin, University of Minnesota, Clemson University, Purdue University, Penn State, NWU, University of Oklahoma, CSM, MST)
- Sponsors (DOE-OS-BES, DOE-FECM, DOE-EERE, Industrial Partners)

### Contact Information

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### Overview

- **High PT (140 MPa, 500°C)** triaxial coreflood system designed for coupled analysis of fracture, flow and geochemical reactions
- **Wellbore cement characterization (300°C, 70 MPa)**, including mechanics, hydraulics, rheology, calorimetry, and bonding strength
- **Optical fiber measurement** (FBG and OFDR) for strain and temperature sensing
- **Integrated X-ray tomography/radiography and triaxial coreflood system (35 MPa, 100°C)** for coupled analysis and imaging of fracture, flow and reaction
- **Microfluidics lab (10 MPa, 70°C)** for 2D characterization and visualization of multiphase flow and reaction in synthetic materials and minerals, rock and geomaterials
- **GeoDT - Geothermal design tool** for modeling stimulation, fracture growth, fluid flow, heat transfer and economics
- Integrated with modeling teams applying dfnWorks (discrete fracture network), HOSS (finite/discrete element), PFLOTTRAN (continuum flow and reaction), OLGA (wellbore and pipeline transient multiphase flow) and Amanzi (coupled flow, mechanics and reaction) **softwares**

### Projects

- **DOE-OS-BES:** Emergent Flow Phenomena from Fracture Coalescence, Branching and Network Geometry; Geo-processes in Mineral Carbon Storage
- **DOE-EERE (geothermal):** FORGE; Improved drilling technology and cementing formulations
- **DOE-FECM (CCS):** Caprock integrity, well integrity, NRAP, Undocumented Orphan Wells
- Hydraulic fracturing, well sealants, assessment and mitigation of well leakage

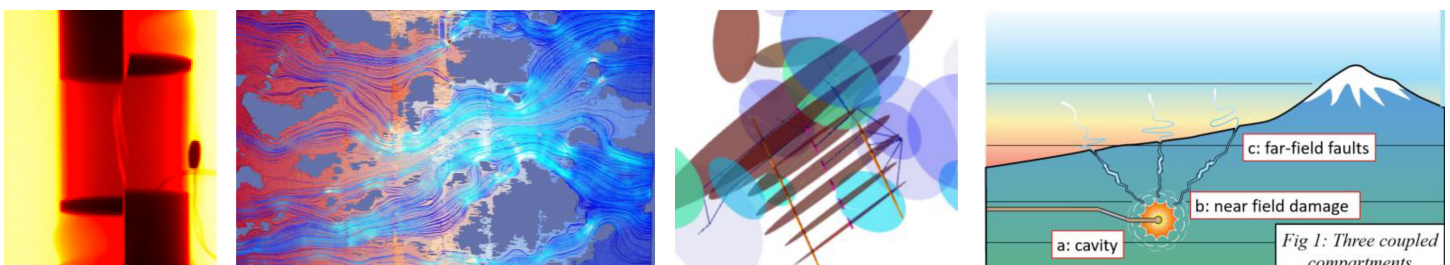


Fig 1: Three coupled compartments