Bay Area Geophysical Society Seminar Series

Electromagnetic TDR for Low-Cost Well Integrity Screening

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Thursday, April 23, 2026 5:30 PM

265 McCone Hall

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Abstract: Subsurface wellbores and pipelines are critical components of energy infrastructure for the extraction and transport of natural gas, petroleum, and geothermal resources. Following installation, however, these systems are subjected to mechanical loading, corrosion, and other degradation processes that may compromise integrity. Existing monitoring approaches rely largely on intrusive downhole logging tools, which can disrupt operations and require deployment of specialized electronics in high-temperature, high-pressure environments. This talk presents ongoing work on the application of electromagnetic time-domain reflectometry (TDR) as a rapid, noninvasive method to supplement conventional well logging. By introducing a TDR signal at the wellhead and analyzing reflected responses associated with impedance contrasts along the wellbore, the method can identify potential integrity anomalies without deploying downhole electronics. The approach is particularly attractive for geothermal wells, where harsh downhole conditions complicate conventional logging and increase equipment costs. Our objective is to develop a practical, lower-cost screening tool for routine wellbore integrity assessment.

Jiannan Wang is a Senior SEA in the Geophysics Department at Lawrence Berkeley National Laboratory. He received his PhD from the University of Houston and his earlier degrees from the Chinese Academy of Sciences and China University of Geosciences. His research develops and applies novel geophysical methods for subsurface energy and environmental applications, with current work spanning electromagnetic time-domain reflectometry for wellbore and pipeline integrity assessment, coupled-process monitoring in the subsurface, and remote sensing for undocumented well detection.

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