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A planned deployment of KABBA broadband seismometers in Parkfield, California to determine the relation between microseismicity and non-volcanic tremor.

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In recent years, several studies have shown that non-volcanic tremor occurs in shallow, strike-slip fault zones, and are not confined to subduction zone interfaces. Regardless of the environment in which it is observed, tremor has been largely studied as a phenomenon independent of other types of seismic signals located nearby. Part of the treatment may result from the fact that locating tremor is challenging, making the link between tremor and traditional seismicity tenuous. However, while observations of tremor are being fairly ubiquitous, the physics behind the tremor source remains largely enigmatic, and how or why tremor occurs is still a mystery. Linking the physical mechanisms of regular seismicity, which are better understood and may occur in the same location, might be the key to developing a physical model for the tremor source. Furthermore, if both physical and temporal relationships between tremor and other types of seismicity can be established, then perhaps causal relationships can also be established. The goal of this project is to deploy seismometers near Cholame, CA, on the San Andreas fault, in a location with observed shallow microseismicity and non-volcanic tremor, in order to obtain dense, high-quality observations of both phenomena. We aim to create an accurate spatial mapping of source properties, and determine the relationship and interaction of co-located (or nearly co-located) seismicity and tremor.

Previous work indicates that small earthquakes located on the San Andreas fault in our study area, near the creeping-locked transition in the San Andreas fault, exhibit unusual behavior in terms of source parameter scaling. Specifically, earthquake source durations do not scale with earthquake size, as expected for most tectonic environments. Observations of tremor in Cholame indicate that tremor may occur at the base of the seismogenic zone, in locations near microseimicity. A detailed spatial and temporal mapping of the physical characteristics of both tremor and microseismicity may help illuminate the poorly understood tremor source mechanism. Determining how the unusual source characteristics of microearthquakes on the San Andreas change as their proximity to tremor locations increases, as well as any temporal relationships between tremor and microseismicity, may also help to understand any causal relationship between tremor and seismic slip. Instrumentation capable of recording both small earthquakes and tremor near Cholame is sparse. Therefore, we will deploy 13 STS-2 broadband seismometers from the KABBA broadband array for a period of approximately 18 months with a station spacing of approximately 5 km. Using the data collected, we will determine accurate locations for both tremor and microseismicity using cross-correlation relocation techniques, and calculate source parameters such as duration, stress drop, and radiated energy. With an accurate determination of the relative location of events and their physical properties, we will investigate the physical relationship between tremor and tectonic earthquakes.