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Microwave interrogation of an air plasma plume as a model system for hot spots in explosives[1] RON KANE, JOSEPH TRINGE, GREG KLUNDER, EMER BALUYOT, JOHN DENSMORE, MARK CONVERSE, Lawrence Livermore National Laboratory — The evolution of hot spots within explosives is critical to understand for predicting how detonation waves form and propagate. However, it is challenging to observe hot spots directly because they are small ($\sim$ micron diameter), form quickly (much less than a microsecond), and many explosives of interest are optically opaque. Microwaves are well-suited to characterize hot spots because they readily penetrate most explosives. They also have sufficient temporal and spatial resolution to measure the coalescence of an ensemble of hot spots inside explosives. Here we employ 94 GHz microwaves to characterize the evolution of individual plasma plumes formed by laser ionization of air. We use interferometry to obtain velocity records as a function of plume position and orientation. Although the plasma plumes are larger than individual hot spots in explosives, they expand rapidly and predictably, and their structure can be optically imaged. They are therefore useful model systems to establish the spatial and temporal limits of microwave interferometry (MI) for understanding more complex hot spot behavior in solid explosives.

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