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New Raman Spectroscopy Results of Single-electrode Pulsed Plasma Branches in Water for Interrogation of High-Pressure Liquid-Solid Phase Transition CHRISTOPHER CAMPBELL, DAVID STAACK, Texas AM Univ — Pulsed plasmas in liquids are broadly useful phenomena, already employed for chemical conversion and sterilization among other applications. However, these plasmas exhibit complex multiphase behavior over short timescales (<20 ns) which is not well-described by conventional plasma theory. Using a low-jitter laser-triggered voltage pulse (30 kV, 5 mJ), resulting plasmas achieve high instantaneous power density ($\sim$1 TW/cm^2), which in liquids causes local isotropic and isochoric behavior. In water, phase transitions which exist at pressures above 1 GPa (Ice VI and VII) are achievable via such thermodynamic processes. Prior results provided tentative evidence of this type of local phase transition during pulsed plasmas in water, using time-resolved Raman spectroscopy of the O-H stretching mode of H_2O. Here we present updated imaging and Raman spectroscopy results at higher time resolutions and larger sample sizes, further investigating the local presence of a transient high-pressure solid phase. Such a phase may limit achievable energy densities, which has ramifications across several fields interested in producing high-energy-density plasma processes in liquids.

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