Thomson-Scattering Measurements of Ion-Acoustic Wave Amplitudes Driven by the Two-Plasmon-Decay Instability

R.K. FOLLETT, D.T. MICHEL, J.F. MYATT, S.X. HU, B. YAAKOBI, D.H. FROULA, Laboratory for Laser Energetics, U. of Rochester — Thomson scattering was used to measure enhanced ion-acoustic waves (IAW’s) driven by the two-plasmon-decay (TPD) instability. The IAW amplitude scales with the $3/2\omega$ emission (a TPD signature). Up to 20 beams with 860-\(\mu\)m-diam laser spots generated by 2-ns-long pulses of 3\(\omega\) light with overlapped intensities up to \(4 \times 10^{14}\) W/cm\(^2\) were used to produce \(\sim 300-\mu\)m density-scale lengths. The IAW amplitudes were measured using 4\(\omega\) Thomson scattering near 3\(\omega\) quarter-critical densities. Time-resolved 3/2\(\omega\) spectroscopy was used to compare the amplitude of 3/2\(\omega\) emission to the IAW amplitude. QZAK\(^1,2\) modeling shows a similar onset threshold and wave amplitude as the experiments. The model suggests that the source of the IAW growth is from the beating of electron-plasma waves, which drive density perturbations through the ponderomotive force. This conclusion is supported by the experimental geometry. This process is shown to be a saturation mechanism for TPD from simulations.\(^3\) This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.