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Characterization of cluster/monomer ratio in pulsed supersonic gas jets XIAOHUI GAO, BONGGU SHIM, XIAOMING WANG, MIKE DOWNER, University of Texas at Austin — While Rayleigh scatter and interferometry are standard methods for determining average cluster size and total atomic density, respectively, in cluster gas jets, determination of cluster mass fraction has required additional input from gasdynamic simulations. Here we determine cluster mass fraction experimentally with fs-time-resolved measurement of refractive index using frequency domain interferometery (FDI) after ionization and heating by a pump pulse. The essence of this method is that the negative index contribution of monomer plasma appears immediately after ionization by the pump, whereas the positive contribution of clustered plasma becomes significant only after clusters expand to a Mie resonance condition, enabling separation of monomer and cluster densities in the time domain. This method allows us to investigate various influences (nozzle geometry, temperature, etc.) on cluster fraction, which varies widely in nominally identical gas jets, and is a critical parameter in realizing phase-matched harmonic generation at high laser intensity, which would lead to an efficient table-top soft X-ray source.

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