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**Controlling shock wave propagation in individual nanoplasmas: experiment and hydrodynamic simulations** DANIEL HICKSTEIN, WEI XIONG, FRANKLIN DOLLAR, JENNIFER ELLIS, ELLEN KEISTER, CHENGYUAN DING, HENRY KAPTEYN, MARGARET MURNANE, JILA - University of Colorado, JIM GAFFNEY, MARK FOORD, STEPHEN LIBBY, Lawrence Livermore National Laboratory, BRETT PALM, JOSE JIMENEZ, Chemistry Dept. Univ. of Colorado, GEORGE PETROV, Naval Research Laboratory — By coupling a velocity-map-imaging spectrometer with a nanoparticle aerosol source, we present the first observations of individual nanoscale plasmas (nanoplasmas) generated from isolated nanoparticles. We show that short (40 fs) infrared (800 nm) laser pulses at a relatively low intensity ($10^{14}$ W/cm$^2$) are capable of driving shock waves in the expanding nanoplasma, providing a new method for studying shock physics in a relatively unexplored regime of dense, low-temperature, nanoplasmas. We demonstrate control of the shock waves by using a 400-nm heating pulse to pre-expand the plasma on a picosecond timescale, providing a significant enhancement in the intensity of the shock wave. Numerical hydrodynamic calculations using the HYDRA software reveal the mechanism for shock formation and suggest how the energy and intensity of the shocks can be tailored by adjusting the laser parameters. In addition, we generate nanoplasmas from various dielectric and conducting nanomaterials, and demonstrate that the direction of ion ejection can be controlled by changing the geometric shape of metal nanostructures.

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