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Ultrafast electron cooling in an expanding ultracold micro-plasma[1] JULIETTE SIMONET, TOBIAS KROKER, MARIO NEUNDORF, MARKUS DRESCHER, KLAUS SENGSTOCK, PHILIPP WESSELS-STAARMANN, The Hamburg Centre for Ultrafast Imaging (CUI), University of Hamburg, Germany — Strong-field ionization of a quantum gas by ultrashort laser pulses allows creating electrons and ions with tunable excess energy. A single femtosecond laser pulse focused to a micrometer-sized waist can ionize up to several thousand atoms out of a Bose-Einstein condensate, thus triggering the formation of strongly coupled ultracold plasmas. We report on the observation of electron cooling in an expanding micro-plasma from initially 5000 K electron temperature to about 1 K within a few hundred nanoseconds. Our experimental setup grants access to the electronic kinetic energy distribution with meV resolution. Furthermore, we have performed numerical simulations of the collective Coulomb driven plasma dynamics which are in excellent agreement with the measurements. The simulations reveal an efficient energy transfer to the ionic system within the first ten picoseconds.

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