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Electron Distribution of an Ultracold Neutral Plasma KEVIN TWEDT, STEVEN ROLSTON, Joint Quantum Institute and Department of Physics, University of Maryland — Electrons in an expanding ultracold plasma are expected to be in quasi-equilibrium, since the collision times are short compared to the plasma lifetime, yet we observe electrons evaporating out as the ion density decreases during expansion. We observe that a small electric field that shifts the electron cloud with respect to the ions increases the evaporation rate. We have calculated the spatial distribution of a zero-temperature electron cloud as a function of applied field and ion density, which is assumed to be Gaussian at all times. This calculation allows us to predict the flux of cold electrons from the plasma at all times, and is in good agreement with our observed electron signal. In addition, short electric field pulses can dump a fraction of plasma electrons without affecting the ion expansion. Evaporation ceases for several microseconds before quickly refilling to match the shape of the unperturbed signal. The dynamics of this process should yield insight into the actual electron distribution, especially for high-energy electrons, where deviations from a Boltzmann distribution should be most pronounced.
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