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Influence of Electron Evaporative Cooling on Ultracold Plasma Expansion[1] WEI-TING CHEN, TRUMAN WILSON, JACOB ROBERTS, Colorado State University — The expansion of ultracold neutral plasmas (UCP) is driven by the thermal pressure of the electron component and is therefore sensitive to the electron temperature. At lower densities (less than 10^8 /cm^3), evaporative cooling has a substantial impact on the UCP expansion rate. We studied these effects of electron evaporation in this density range. Owing to the low density, the effects of three-body recombination were negligible. We observed a significant decrease in the ultracold plasma expansion rate when the electron evaporation rate was deliberately increased. We modeled the expansion by taking into account the change in electron temperature owing to evaporation as well as adiabatic expansion and found good agreement with our expansion data. We also developed a simple model for initial evaporation over a range of ultracold plasma densities, sizes, and electron temperatures to determine over what parameter range electron evaporation has a significant effect.

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