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Electron Forced Evaporative Cooling in Ultracold Plasmas[1]
CRAIG WITTE, Colorado State University, JACOB ROBERTS, Colorao State University — Ultracold plasmas (UCPs) are formed by photoionizing a collection of laser cooled atoms. Once formed, these plasmas expand, cooling over the course of their expansion. In theory, further cooling should be obtainable by forcibly inducing electron evaporation through applying DC electric fields to extract electrons. However, for many UCP parameters, UCP electrons are not fully thermalized until very late in the expansion. This creates complications in analyzing the UCP. This problem can be remedied by creating the ultracold plasma at substantially lower initial temperatures since thermalization rates increase with decreasing temperature. Unfortunately, traditional models of UCP dynamics tend to break down in cases of substantial non-neutrality when used in the limit of zero temperature. We have developed a theoretical model that calculates potential depth and expansion dynamics of non-neutral UCPs in the limit of zero temperature. Such a model will allow us to quantify the degree of cooling obtained by evaporation as measured experimentally.

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