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Thermalization via collisional and non-collisional mechanisms in ultracold neutral plasmas[1] CRAIG WITTE, JACOB ROBERTS, Colorado State University — Many ultracold neutral plasmas (UCPs) are formed with non-uniform electron and ion densities. They are also formed in a way that the initial electron velocity distribution is not in thermal equilibrium. We present the results of a numerical simulation that compares the electron velocity distribution evolution after UCP formation between uniform and non-uniform density UCPs. We find three distinct thermalization time periods for the electron velocity: a rapid thermalization on the order of the electron plasma frequency timescale where position variations lead to velocity randomization; a slower second phase where non-collisional effects play a role in thermalization as evidenced by differences between thermalization rates in uniform density and non-uniform density plasmas; and an even slower third phase where the highest velocity portion of the electron thermal distribution equilibrates primarily via collisional mechanisms. These mechanisms are relevant for understanding the establishment of equilibrium in the electron component of UCPs in experimentally relevant conditions.

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