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Velocity and Temperature Evolution of Ultracold Neutral Plasmas with Exponentially Decaying Density Distributions[1] MACKENZIE WARRENS, GRANT GORMAN, STEPHEN BRADSHAW, TOM KILLIAN, Rice University — Ultracold neutral plasmas (UNPs) occupy an exotic low-temperature and low-density regime of plasma physics, and they provide a powerful platform for studying fundamental plasma physics processes such as plasma waves, transport, and expansion into vacuum. Previous UNP experiments have used plasmas with an initial Gaussian density distribution, for which the expansion into vacuum is well understood. Another interesting initial profile is an exponentially decaying density distribution, which is formed by photoionizing atoms in a quadrupole magnetic trap. While exponential plasmas have similar characteristic length and time scales as Gaussian plasmas, and are predominantly in the hydrodynamic regime, the velocity and temperature profiles differ. This talk compares the velocity and temperature evolution of exponential and Gaussian UNPs, and examines the potential for wave breaking and shock waves in exponential UNPs.

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