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Ultracold neutral plasma resonant response to few-cycle radiofrequency pulses[1] TRUMAN WILSON, WEI-TING CHEN, JACOB ROBERTS, Colorado State University — Ultracold neutral plasmas exhibit a resonant response to applied radiofrequency (RF) fields in the frequency range of several MHz to hundreds of MHz for achievable densities. In typical experiments a single-frequency RF field is applied to the plasma as it expands. When the plasma density drops enough to be in resonance with the applied field, the resonant response is observed as an increase in electron evaporation rate. In contrast, we have conducted measurements where short bursts of RF were applied to the plasma, with pulse durations as short as two cycles studied in detail. We still observed a density-dependent resonant response with these short pulses. The usual description of the increase in evaporation rate being due to local resonant heating of electrons in the plasma is inconsistent with the timescale of the response and other factors. Instead, our results are consistent with rapid energy transfer from collective motion of the entire electron cloud to electrons in high-energy orbits. In addition to providing a potentially more robust way to measure ultracold neutral plasma densities, these measurements demonstrate the importance of collective motion in the energy transport and evaporation rate in these systems.

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