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Control of molecular ultracold plasma relaxation dynamics in mm-wave and radio-frequency fields RUOXI WANG, KEVIN MARROQUN, MAHYAD AGHIGH, The University of British Columbia, FERNANDA MARTINS[1], JAMES KELLER, Kenyon College, EDWARD GRANT, The University of British Columbia — Resonant mm-wave fields in the range from 50 to 100 GHz drive f⟶g transitions in a state-selected nf(2) Rydberg gas of NO. This transformation dramatically increases the early time intensity of high-Rydberg resonances in the selected field ionization (SFI) spectrum as well as in an enhanced long-time plasma signal. We associate these enhanced features with a decrease in the rate of predissociation owing to an increase in Rydberg orbital angular momentum. A 250 ns 60 MHz radio frequency pulse with a peak-to-peak amplitude as low as 400mV/cm, applied with zero delay similarly increases the signal of associated with a residue of lower-n Rydberg molecules detected microseconds later. Applied later to a plasma in a state of arrested relaxation, however, the same radiofrequency field depletes the residual Rydberg signal. We associate both effects with Rydberg electronic orbital angular momentum mixing. At early times the applied field mixes the photoselected nf state mixes with longer-lived states of high angular momentum. Later, electrons released by the radio frequency field collide with Rydberg molecules trapped in states of high angular momentum driving a predissociative flux through channels of low l.

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