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Expansion of an ultracold plasma affected by spatial correlation and the delayed injection of charged particles HOSSEIN SADEGHI, Department of Chemistry, University of British Columbia, MARKUS SCHULZ-WEILING, JACHIN HUNG, Department of Physics & Astronomy, University of British Columbia, JACK WARREN, Department of Chemistry, University of British Columbia, NICOLAS SAQUET, ISMO Université Paris-Sud, JONATHAN MORRISON, EDWARD GRANT, Department of Chemistry, University of British Columbia
— A dense Rydberg gas of nitric oxide formed in a supersonic molecular beam evolves on a tens of nanoseconds timescale to form an ultracold plasma. Images of electron density recorded as a function of flight time gauge the rate of plasma expansion. Over regions of Rydberg gas density well matched to the selected initial principal quantum number, dissociation of deactivated Penning partners depletes the distribution of nearest neighbours, giving rise to a gas of spatially correlated ions, which has a discernible effect on plasma expansion and durability in a pulsed electrostatic field. Post-avalanche injection of hot electrons and stationary ions or stationary Rydberg molecules affects plasma expansion in distinctive ways. Model calculations describe the potential energy characteristics of the Penning lattice and couple the kinematics of an initial ambipolar expansion to those of subsequently added charged particles with positive or negative energy.

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