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Role of Neutral Gas Dynamics in Plasma Gun Devices[1] WILLIAM RIEDEL, THOMAS UNDERWOOD, MARK CAPPELLI, Stanford University — Neutral gas dynamics is described in plasma accelerators by considering the impact of the initial neutral gas distribution within the gun volume. A model based on the Rankine-Hugoniot formulation in combustion is presented and used to predict both characteristic operating regimes observed experimentally. Precise neutral gas triggering is used to change the gas distribution within the accelerator and modify the initial conditions governing the breakdown process. Both bulk energy transfer and time-of-flight measurements show that with increasing gas diffusion time, the directed energy in the flow decreases and the mode transitions from a deflagration to a snowplow mode. Neutral gas simulations indicate that neutral gas governs the transition between these operating modes. This informs strategies to maintain high acceleration efficiency in pulsed plasma accelerators and eliminate shocking conditions caused by higher gas loadings.

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William Riedel
Stanford University

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