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**Collisionless to space charge dominated transition of a DC low pressure wire discharge** RENAUD GUEROULT, Ecole Polytechnique / Onera, PAUL-QUENTIN ELIAS, DENIS PACKAN, Onera — Depending on operating conditions, the low pressure ($10^{-4} - 10^{-2}$mbar) DC wire plasma source (WIPS) exhibits two distinct modes of discharge. Experimental measurements show that each mode presents a specific spatial extension in terms of discharge glow. Transition from one mode to the other is sudden and triggers a discharge voltage jump. Using two-dimensional particle in cell modeling, discharge modes of the low pressure low current ($\approx 1$ mA) wire source in Helium are accurately reproduced. The discharge behavior in the transition regime is explained in light of PIC simulations results, which justifies the mode transition as a transition from a collisionless to a space charge dominated regime. Modeling the discharge as an ion flow with both inertial and friction term confirm this analysis, the transition occurring when the pressure reaches a threshold value - function of the discharge voltage and current - permitting the formation of a positive space charge. Confrontation with simulations confirms the efficiency of this simple model for prediction of both the pressure of mode transition and the voltage jump across the transition.

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