A cathode fall model assuming a linearly varying electric field is used to obtain equations governing the operation of steady state emission driven microplasmas. The final manuscript will present additional results obtained from the model by solving these equations and compare with PIC/MCC simulation results for parameters including the plasma potential, cathode fall thickness, ion number density in the cathode fall, and current density vs. voltage curves. Both abnormal glow and arc modes will be shown to occur in a 10 μm gap.

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Microscopic mechanism of Rayleigh–Benard transition from thermal conduction to convection

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Transition and turbulence are one of the most important issues in fluid mechanics. Traditionally, they are primarily studied in the continuum frame. A typical example was Rayleigh's analysis on the transition from thermal conduction to convection firstly observed by Benard in experiment. What is the microscopic mechanism behind such a transition? Many studies were carried out such as those in Refs. [1–5]. Compared to previous studies, this paper attempts to understand the R–B transition through a direct analysis of molecular trajectories. Firstly, the diffusive information preservation (D-IP) method [6] has been used to calculate the trajectories of simulated molecules under two Rayleigh numbers below and above the critical value, respectively. From these calculations, we have known how the driving and damping forces acted on a simulated molecule under observation evolve. To find the resonant conditions at which the transition takes place, the power density spectrum of the driving and damping forces are being analyzed. More details will be reported in the full paper.

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