Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

Conditions and growth rate of Rayleigh instability in a Hall thruster under the effect of ionization SUKHMANDER SINGH, HITENDRA KUMAR MALIK, Plasma Waves and Particle Acceleration Laboratory, Department of Physics, Indian Institute of Technology Delhi, New Delhi - 110 016, India — Rayleigh instability is investigated in a Hall thruster under the effect of ionization . The instability occurs only when the frequency of the oscillations ω falls within a frequency band, described by $\omega_{\min} << \omega << \omega_{\max}$ where $\omega_{\max} = \frac{\alpha k_y u_0 + \sqrt{(\alpha k_y u_0)^2 - 4\alpha(\alpha+v)\left(\alpha k_y u_0 + \frac{\omega_{pi}^2 \Omega^2}{\omega_{pe}^2}\right)}}{2(\alpha+v)}$, $\omega_{\min} = \frac{\alpha}{2}\left(1 - \frac{v}{k_y u_0}\right) + \alpha\sqrt{\frac{1}{4} - \frac{v}{2k_y u_0} - \frac{\omega_{pi}^2 V_{thE}^2\left(\frac{\partial^2 u_0}{\partial x^2} + \frac{\Omega}{n_0}\frac{\partial n_0}{\partial x}\right)}{\alpha^2 \omega_{pe}^2 u_0}}$,u_0 is the drift velocity of the electrons, Ω is their gyration frequency under the effect of magnetic field, k_y is the wave propagation constant, n_0 is the plasma density together with $\partial n_0/\partial x$ as the density gradient, and V_{thE}, α, v and $\omega_{p_i}(\omega_{p_e})$ are the electron thermal velocity, ionization rate, collision frequency and plasma frequency of the ions (electrons), respectively. A relevant Rayleigh equation is derived and solved numerically using fourth-order Runge-Kutta method for investigating the perturbed potential under the effect of ionization rate and collision frequency. It is obtained that the growth rate of the instability gets reduced with the ionization rate and collision frequency.

Sukhmander Singh
Plasma Waves and Particle Acceleration Laboratory, Dept of Physics,
Indian Institute of Technology Delhi, New Delhi - 110 016, India

Date submitted: 25 Jul 2011 Electronic form version 1.4