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Electron heating mechanisms and dynamics in magnetized Capacitively Coupled Plasmas

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Electron heating mechanism and dynamics based on resonance effects are reported both theoretically and experimentally in magnetized capacitively coupled plasmas at very low pressure.

It is found that a nonlocal to local transition of discharge characteristics is induced at different magnetic fields for various discharge frequencies, as can be seen in figure 1 [1].

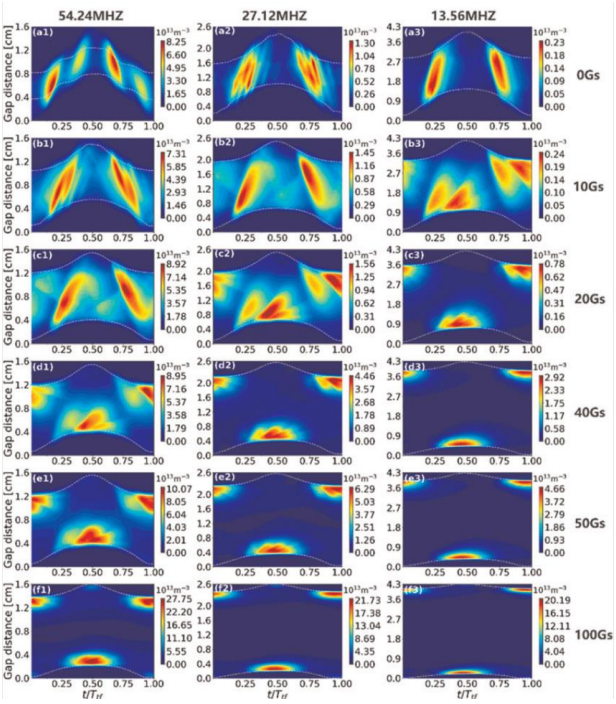

Figure1 Spatiotemporal plots of the fast electron densities with energies above 30 eV at various magnetic fields and rf frequencies [1]

Moreover, resonance effects could happen to enhance the discharge (as displayed in figure 2) when the applied magnetic field and the driving frequency meet certain conditions, which do not depend on the initial velocity of the electrons, and allow the majority of electrons in the plasma to be affected [2-3].The resonance effects are expected to be highly relevant to both fundamental and applied plasma science.

In fact, they help to understand the electron heating dynamics in low pressure magnetized radio frequency (rf) capacitively coupled plasmas and may promote the industrial applications of magnetized rf plasmas in semiconductor fabrication.

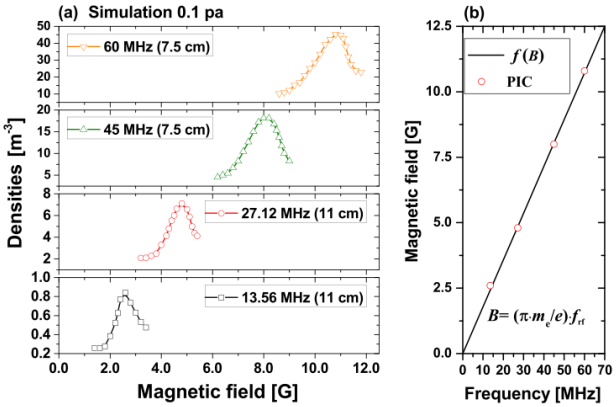

Figure 2 (a) Space- and time-averaged plasma density (unit in $10^{15}m^{-3}$) as a function of the transverse magnetic fields for different frequencies and electrode gaps resulting from PIC simulations at 0.1 Pa, (b) externally applied magnetic field at which the highest plasma density is found as a function of the driving frequency [2]

References

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