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Controlling electron energy distributions for plasma technologies[1]

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The basic function of low temperature plasmas in society benefiting technologies is to channel power into specific modes of atoms and molecules to excite desired states or produce specified radicals. This functionality ultimately depends on the ability to craft an electron energy distribution (EED) to match cross sections. Given electric fields, frequencies, gas mixtures and pressures, predicting EEDs and excitation rates can in large part be reliably done. The inverse problem, specifying the conditions that produce a given EED, is less well understood. Early strategies to craft EEDs include adjusting gas mixtures, such as the rare gas-Hg mixtures in fluorescent lamps, and externally sustained discharges, such as electron-beam sustained plasmas for molecular lasers. More recent strategies include spiker-sustainer circuitry which produces desired EEDs in non-self-sustained plasmas; and adjusting frequency in capacitively coupled plasmas. In this talk, past strategies for customizing EEDs in low pressure plasmas will be reviewed and prospects for improved control of plasma kinetics will be discussed using results from 2-dimensional computer models.

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