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PIC simulations of electrically asymmetric dual frequency capacitive RF discharges[1] ZOLTAN DONKO, Hungarian Academy for Science, JULIAN SCHULZE, EDMUND SCHUENGEL, UWE CZARNETZKI, Ruhr-University Bochum — A geometrically symmetric dual frequency capacitively coupled RF discharge operated in argon at 13.56 MHz and 27.12 MHz with variable phase shift between the driving voltage waveforms is investigated by a 1d PIC simulation. Due to the Electrical Asymmetry Effect (EAE) a variable DC self bias is generated as a function of the phase shift, that allows efficient separate control of ion energy and flux at the electrodes. An analytical model demonstrates why the ion flux does not depend on the phase shift. The quality of this separate control is found to be better compared to conventional dual frequency discharges operated at substantially different frequencies, where limitations due to frequency coupling occur. The EAE is optimized by choosing optimum amplitudes of the low and high frequency voltage waveforms. For the first time non-linear self excited plasma series resonance (PSR) oscillations are observed in geometrically symmetric discharges. The PSR oscillations and non-linear electron resonance heating (NERH) are turned on and off depending on the electrical discharge asymmetry controlled by the phase shift between the driving frequencies.

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