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Temporal and Spatial evolution of the EEPf and the Discharge Mechanism in a Microwave Surface-Wave Plasma RON BRAVENEC, Fourth State Research and Tokyo Electron America, Inc., JIANPING ZHAO, MERRITT FUNK, LEE CHEN, Tokyo Electron America, Inc., TOSHIHISA NOZAWA, Tokyo Electron Technology Development Institute, Inc., TOKYO ELECTRON AMERICA, INC. TEAM, TOKYO ELECTRON TECHNOLOGY DEVELOPMENT INSTITUTE, INC. COLLABORATION — Surface-wave plasma excited at 2.45GHz by the radial line slot antenna (RLSA) has been used for plasma CVD, film-growth and more recently, etching applications. Its noted performance advantage is thought to be due to a low T_e quiescent plasma in the wafer-region. 2-D particle-in-cell (PIC) numerical experiments are used to elucidate its energy-coupling mechanism in sustaining plasma ionization. Temporal evolution from power onset through ignition to steady state reveals E-field amplification under the ω_P=ω resonance. Consequent Langmuir waves serve to complete the ignition process through Landau damping on the fast electrons. Approach toward steady state results from a continuation of the ω_P=ω resonance or heating by the surface wave's ponderomotive force depending on the density. The steady-state EEPf near the dielectric plate exhibits a beam-like component which is verified by probe measurements. Spatially resolved probe measurements away from the plate reveal an EEPf which asymptotes toward a Maxwellian with T_e ~1eV near the wafer-region. Microwave opaqueness of the over-dense plasma and electron-neutral collisions contribute to the demise of the beam-component of the EEPf making it a genuine decoupled plasma.

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