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Revisiting the capacitive sheath. EMI KAWAMURA, MICHAEL A. LIEBERMAN, ALAN J. LICHTENBERG, UC Berkeley, IGOR D. KAGANOVICH, Princeton Plasma Physics Laboratory — Traditional theory of the capacitive sheath assumes that the large negative charge at the electrode is screened by the ion space charge and the transition to the small rf electric field in the plasma occurs abruptly within the narrow transition region of the Debye length. However, careful self-consistent kinetic treatment of the problem reveals existence of additional transition layer of length V_T/ω, where V_T is the electron thermal velocity and ω is the discharge frequency [1,2,3]. Electrons interacting with the capacitive sheath acquire velocity modulations. As a result, the electron density bunches appear in the region adjacent to the sheath. These electron density perturbations decay due to phase mixing over a length of order V_T/ω. The electron density perturbations polarize the plasma and produce an electric field in the plasma bulk. This electric field, in turn, changes the velocity modulations and total power deposition. Recent particle-in-cell simulations [4,5] confirm the prediction of analytic theory. [1] L. D. Landau, J. Phys. (USSR) **10**, 25 (1946). [2] Igor D. Kaganovich, Phys. Rev. Lett. **89**, 265006 (2002). [3] I. D. Kaganovich, O. V. Polomarov, and C. E. Theodosiou, IEEE Trans. Plasma Sci. **34**, 696 (2006). [4] H. C. Kim, G. Y. Park, and J. K. Lee, Phys. of Plasmas **13**, 023501 (2006). [5] E. Kawamura, M. A. Lieberman, and A. J. Lichtenberg, Phys. of Plasmas **13**, 053506 (2006).

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