Abstract Submitted
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Analytical model of plasma sheaths at intermediate radio frequencies MARK SOBOLEWSKI, National Institute of Standards and Technology — Analytical models of plasma sheaths provide physical insight and are useful in 2-d and 3-d plasma simulations, where numerical solution of the sheath equations at each boundary point is impractical. Analytical models have long been known for the high-frequency and low-frequency limits, where the ion transit time is either much greater than or much less than the rf period. At intermediate frequencies, however, sheath behavior is more complicated. In addition to the well-known narrowing of ion energy distributions (IEDs) there are other, lesser known effects, including changes in the ion current (which becomes strongly time-dependent within the sheath) and in IED peak intensities, average ion energy, sheath impedance, and sheath power. Here, we describe a new approach for modeling intermediate-frequency, collisionless sheaths. It captures the essential elements of ion dynamics yet still provides analytical expressions for most sheath properties. Predictions of the analytical model are compared to previous analytical models, numerical models, and, where possible, experimental data. The model yields new insights into ion dynamics and may serve to increase the accuracy of plasma simulations, particularly their predictions for average ion energy and power.

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