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Kinetic Theory of the Presheath and Bohm Criterion[1] S.D. BAALRUD, University of New Hampshire, C.C. HEGNA, University of Wisconsin — A kinetic theory of the Bohm criterion is developed that is based on positive-exponent velocity moments of the plasma kinetic equation. Our result is contrasted with the conventional kinetic Bohm criterion, which is based on a v^{-1} moment of the Vlasov equation. The salient difference between the two results is that low velocity particles dominate in the conventional theory, but are essentially unimportant in our model. The presence of low-velocity particles can cause unphysical divergences in the conventional model, which are not present in the new theory. A kinetic equation that accounts for wave-particle scattering by convective instabilities is also used to show that ion-acoustic instabilities in the presheath of low-temperature plasmas (where $T_e \gg T_i$) can cause both ions and electrons to obtain Maxwellian distribution functions in the presheath of a single-ion-species plasma. The same theory is also used to show how a strong collisional friction force can arise between ion species when ion-ion streaming instabilities arise in the presheath of a multiple-ion-species plasma. We show how this effect can determine the flow speed of each ion species at the sheath edge.

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