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Maxwellianization of electron distribution functions by convective instabilities in presheaths[1] S.D. BAALRUD, C.C. HEGNA, J.D. CALLEN, Engineering Physics Department, University of Wisconsin-Madison — Langmuir's paradox is a measurement of anomalous electron scattering where a Maxwellian electron velocity distribution function was measured much closer to a boundary than the electron collision length in a stable plasma; here one should expect truncation corresponding to the sheath energy. In this paper we theoretically analyze the presheath region that is present in Langmuir paradox-relevant plasmas ($T_e \gg T_i$). It is shown that the ion-acoustic instability is present throughout the presheath causing convective amplification of thermal fluctuations. A collision operator for the plasma kinetic equation including instabilities in a finite space-time domain is derived [1] which shows that electron scattering can be dominated by wave-particle interactions in the presheath. The modified collision operator satisfies the Boltzmann $\mathcal{H}$-theorem, so the only equilibrium is a Maxwellian which is achieved at a rate depending on collisionality. Wave-particle scattering shrinks the electron collision length to within a few cm for these discharges suggesting that one should expect a Maxwellian at the location of previously reported measurements. [1] S.D. Baalrud, J.D. Callen, C.C. Hegna, UW-CPTC 08-4, June 2008 (sub. to Phys. Plasmas).

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