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STUDENT AWARD FINALIST: A Kinetic Theory of Planar Plasma Sheaths Surrounding Electron Emitting Surfaces[1] J.P. SHEEHAN, University of Wisconsin - Madison, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory, NOAH HERSHKOWITZ, University of Wisconsin - Madison, YEVGENY RAITSES, Princeton Plasma Physics Laboratory — It has long been known that electron emission from a surface significantly affects the sheath at that surface. Typical fluid theory of a planar sheath with emitted electrons assumes that the plasma electrons follow the Boltzmann relation and the emitted electrons are emitted with zero energy and predicts a potential drop of $1.03T_e$ across the sheath at a floating boundary. By removing the assumption that all plasma electrons entering the sheath are reflected back into the bulk plasma (i.e. the Boltzmann relation) and considering electrons lost to the wall, we find that the predicted sheath potential is reduced to $0.91T_e$. Using a kinetic description of the emitted electrons, assuming a half Maxwellian distribution with temperature T_{ee}, greatly affects the sheath potential. We show that kinetic theory predicts that the sheath potential significantly depends on the plasma to emitted electron temperature ratio. For example, we predict that an emissive probe ($T_{ee} = 0.2$ eV) in a plasma with $T_e = 1$eV will have a sheath potential of $0.51T_e$. Additionally, it is noted that the electron velocity distribution function in the sheath is unstable to the two-stream instability.

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