Abstract Submitted
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Analytical expression for the sheath edge around wedge-shaped cathodes T.E. SHERIDAN, Ohio Northern University — The sheath is the boundary layer separating a quasi-neutral plasma from a material electrode. Understanding the sheath is important for numerous applications, including plasma-based ion implantation, plasma etching of semiconductors, plasma assisted electrostatic cleaning, and Langmuir probes. In a 1D planar geometry, the Child-Langmuir (CL) law describes the sheath when the bias on a negative electrode, i.e., a cathode, is much greater than the electron temperature. In this case, the sheath width s is an eigenvalue of the problem. In 2D, the sheath edge is an unknown line (an "eigenboundary") which is determined by a set of coupled, nonlinear, partial differential equations. I have found an expression for the sheath edge around a 2D wedge-shaped cathode with included angle θ_w. In polar coordinates (r, θ), the sheath edge is a solution of $r \sin(a\theta) = as$ where s is the planar sheath width far from the corner and $\theta_w = 2\pi - \pi/a$, so that $a = 1/2$ gives a knife edge, while $a = 2/3$ gives a square corner. This result is verified by comparison with the numerical solutions of Watterson [P. A. Watterson, J. Phys. D **22**, 1300 (1989)].

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