

# Plasma Seminar

Thursday, December 1 @ 2:00 PM

Physics & Astronomy Building (PAB) Room 4-330

## New Predictions for the Sheath and Presheath Distributions Above Strongly Emitting Surfaces

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Plasma-facing surfaces often emit secondary, thermionic or photon-induced electrons. Examples include tokamak divertor plates, Hall thruster channel walls, emissive probes, dust grains, and the sunlit side of the moon. Conventional theories long assumed that a strongly emitting floating surface has a “space-charge limited” (SCL) sheath [1]. Similar to a classical Debye sheath, a SCL sheath potential is negative and requires an ion-accelerating Bohm presheath. Recent theory and simulation studies predict that SCL sheaths are actually unstable and the equilibrium sheath potential under strong emission should be positive [2]. This “inverse sheath” completely alters the particle and energy balance. For example, plasma ions are repelled by an inverse sheath and may not even be able to reach the surface. Distinct presheath-scale distributions of plasma density, potential and ion velocities above inverse sheaths should be measurable in devices even if the sheath itself is too thin to access. Some past experiments testing SCL theory reported anomalies which could now be viewed as consistent with the inverse regime. More fundamental experiments are needed to study the interaction between plasmas and strongly emitting surfaces.

[1] G. D. Hobbs and J. A. Wesson, *Plasma Phys.* 9, 85 (1967).

[2] M. D. Campanell and M. V. Umansky, *Phys. Rev. Lett.* 116, 085003 (2016).