

Abstract Submitted
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Collisional Friction Enhanced by Two-Stream Instabilities Determines the Bohm Criterion in Plasmas With Multiple Ion Species¹ S.D. BAALRUD, C.C. HEGNA, J.D. CALLEN, University of Wisconsin-Madison — Ion-ion streaming instabilities are excited in the presheath region of plasmas with multiple ion species if the ions are much colder than the electrons. Streaming instabilities onset when the relative fluid flow between ion species exceeds a critical speed, ΔV_c , of order the ion thermal speeds. Using a generalized Lenard-Balescu theory that accounts for instability-enhanced collective responses [1], one is able to show the instabilities rapidly (within a few Debye lengths) enhance the collisional friction between ion species far beyond the contribution from Coulomb collisions alone. This strong frictional force determines the relative fluid speed between species. When this condition is combined with the Bohm criterion generalized for multiple ion species, the fluid speed of each ion species is determined at the sheath edge. For each species, this speed differs from the common “system” sound speed by a factor that depends on the species concentration and ΔV_c .

[1] S.D. Baalrud, J.D. Callen, and C.C. Hegna, *Phys. Plasmas* **15**, 092111 (2008).

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Scott Baalrud
University of Wisconsin-Madison

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