

Abstract Submitted
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Why ions enter the sheath entrance at supersonic speed?¹ XI-ANZHU TANG, ZEHUA GUO, Los Alamos National Laboratory — In a boundary plasma of a fusion device, the sheath Knudsen number, which is defined as the ratio of the plasma mean-free-path and the plasma Debye length, is much greater than unity, so one anticipates a collisionless sheath, even though the overall boundary plasma in the scrape-off layer is collisional. This is supposed to be the regime for which the Bohm criteria for the ion entry flow at the sheath entrance, $v \geq c_s$ with c_s the sound speed, is usually satisfied at the equal sign. But numerical simulations using first-principles particle-in-cell codes tend to report a supersonic flow. Here we revisit the two-scale and transition layer analysis of the sheath-presheath transition, in tandem with the conventional Bohm criteria analysis, to understand why and how the supersonic sheath entry flow is established at the sheath entrance, which is a few Debye length away from the wall, and its impact on plasma particle and power load at the wall. Works supported by DOE OFES.

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