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Effects of Inverse Sheath Formation at Divertor Plates, Dust Grains, and Negative Ion Sources, on Tokamaks[1] MICHAEL CAMPANELL, GRANT JOHNSON, Lawrence Livermore Natl Lab — Recent simulations [1] show that surfaces with strong electron emission form inverse sheaths, which differ from the conventional sheaths assumed in the tokamak literature [2]. We offer analytical calculations predicting that for the same SOL input power that leads to a tens-or-hundreds-of-eV target plasma in a conventional sheath operating regime, a few-eV or sub-eV target plasma will form if there is an inverse sheath, possibly facilitating detachment [3]. Other advantages of inverse sheaths would include reduction of ion impact energies (minimizing sputtering) and prevention of arcs. A recent paper by Masline et al. [4] offers the first fluid modelling of divertor plasmas with inverse target sheaths. Besides the target plates, inverse sheaths could form at hot tungsten dust grains, with implications on grain lifetime. Zhang et al. [5] found that inverse sheaths can also form under negative H emission and induce ion-ion plasmas in negative ion sources for tokamak neutral beam heating. [1] G. R. Johnson and M. D. Campanell, Plasma Phys. Rep. 45, 69 (2019) and PRL 122, 015003 (2019). [2] S. Takamura et al., CtPP 44, 126 (2004). [3] M.D. Campanell, PoP 27, 042511 (2020). [4] R. Masline et al., CtPP (2019) DOI: 10.1002/ctpp.201900097 [5] Z. Zhang et al., PSST 27, 06LT01 (2018).

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