Far-field sheaths due to fast waves incident on material boundaries*

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The problem of an rf fast wave (FW) incident on a tilted conducting wall (not aligned with a flux surface) is treated in a 1D model. The model shows that a reflected FW and a slow wave (SW) are generated locally at the wall [1] to satisfy the BC on the E-field imposed by Maxwell's equations. The SW generates a "far field" (FF) sheath potential at the wall, which can greatly exceed the Bohm value. Here, a self-consistent solution for the wave fields and sheath properties is obtained from a wave-coupling analysis using a nonlinear sheath BC [2]. The sheath BC contains a sheath plasma wave (SPW) resonance, [3] which can further enhance the magnitude of the sheath potential. The model is applied to a typical D(H) minority heating case with input parameters determined by matching the output of the AORSA-1D full-wave code. The calculation suggests that the conditions for large far-field sheath potentials can be met in experiments when (i) the single pass damping is low, and (ii) the wall shape deviates significantly from the magnetic surface. Far-field sheath formation is a good candidate to explain "missing power" (low heating efficiency) and rf-specific impurity generation in many experiments.

[1] J. R. Myra, D. A. D'Ippolito, M. Bures, Phys, Plasmas **1**, 2890 (1994)
[2] D. A. D'Ippolito and J. R. Myra , Phys. Plasmas **13**, 102508 (2006).
[3] J. R. Myra, D. A. D'Ippolito, et al., Phys. Rev. Lett. **66**, 1173 (1991).
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