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Modeling of the "death-ray" phenomenon in tokamak edge[1] M.V. UMANSKY, LLNL, D. BRUNNER, B. LABOMBARD, MIT PSFC, T.D. ROGNLIEN, LLNL — In the "death-ray" regime often seen in tokamak edge plasma experiments, the downstream electron pressure, as measured by Langmuir probes at the divertor plate, exceeds the upstream values by nearly a factor of 2 over a narrow radial region at the strike point [1,2]. However, recent studies on Alcator C-Mod indicate that the death-ray over-pressure may be a result of local plasma perturbation by the negative probe bias [3]. We investigate the effects of probe perturbation of the plasma using the tokamak edge fluid code UEDGE. The code models a slab-like configuration roughly matching the basic dimensions and characteristics of edge plasma in Alcator C-Mod near detachment, where the death-ray is often observed. In the code setup, a small axisymmetric segment of target plate is biased, which mimics a plate-mounted Langmuir probe. It is observed in the simulations that at sufficiently large negative bias voltage the probe substantially modifies the local plasma characteristics. Moreover, the simulations reproduce the overpressure along the field line, similar to the experimental death-ray; pointing to the interplay of ion-neutral momentum exchange and the sheath boundary conditions [4].

[1] D. Brunner et al., APS DPP 2010, poster TP9.00069;
[2] B. LaBombard et al., J. Nucl. Mater. 241-243, 149-166 (1997);
[3] A. Loarte et al., Nucl. Fusion 38, 331 (1998);
[4] M.V. Umansky et al., Contrib. Plasma Phys., accepted (2011).

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