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Ambipolar Potential of a Collisionless Scrape-off-Layer[1] ERIK GRANSTEDT, LEONID ZAKHAROV, PPPL — Low-recycling plasma-facing-components may permit fusion devices to attain higher edge temperatures, reducing the global energy transport. Reduced collisionality at the edge would raise questions about the plasma-wall interaction, including the magnitude of the ambipolar potential. We describe an analytic model to give qualitative insight into the value of the ambipolar potential in the SOL, and in particular its dependence on the temperature of the SOL particle source. The SOL is treated as a magnetic mirror; curvature is neglected; a square-well (spatially uniform) potential and magnetic field are assumed; and only classical end-losses are considered. The key difference from previous studies of magnetic mirrors is that a substantial fraction of the incident particle flux is injected directly into the loss region, hence the passing particle density cannot be neglected. The model predicts the ambipolar potential to decrease with temperature, and eventually flatten in the collisionless limit where the passing particle density is small. Larger mirror ratios increase ion trapping, resulting in a higher potential to maintain quasineutrality by confining more electrons. An estimate of the SOL current in the case of unequal end-wall potentials is also given.

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Erik Granstedt
PPPL

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