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Stability of the return-current-two-stream surface mode¹ EDWARD STARTSEV, MIKHAIL DORF, RONALD DAVIDSON, PPPL — When intense charged particle beam with sharp edge propagates in the background plasma, its current is neutralized by the return plasma current everywhere except at the beam edge over a characteristic transverse distance $\Delta x_{\perp} \sim \delta_{pe}$, where $\delta_{pe} = c/\omega_{pe}$ is the collisionless skin depth. Because the background plasma electrons neutralizing the beam current inside of the beam stream relative to the background plasma electrons outside of the beam, the background plasma can support an electrostatic surface mode with a wavelength larger than the collisionless skin depth. Such mode has been studied previously and it has been shown to be strongly unstable. In this paper we study the stability properties of this two-stream surface mode in detail. In particular, it is shown that the magnetic field inside of the unneutralized current layer, which has not been taken into account previously, stabilizes the surface mode.

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