Abstract Submitted
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Wakefield structure of plasma hollow channels self-driven by tightly focused beams[1] LIGIA D. AMORIM, JORGE VIEIRA, RICARDO A. FONSECA, LUIS O. SILVA, GoLP/Instituto de Plasmas e Fusão Nuclear - Instituto Superior Técnico, Lisbon — Plasma based wakefield accelerators (PWFA) are promising alternatives to conventional configurations due to the high accelerating gradients they can sustain. For future linear colliders, however, PWFAs need to overcome the challenge of efficiently accelerating positrons. PWFAs regimes with high acceleration gradients typically defocus positron bunches. Several techniques have tried to solve this challenge [1]. Here we explore how tightly focused positron bunches sent through homogeneous plasmas can radially expel the plasma ions generating a hollow channel with high accelerating and focusing fields. We modeled the hollow channel accelerating and focusing wakefields structures analytically, and found good agreement with 3D numerical simulations performed with the PIC code OSIRS [2]. We demonstrated that this scheme could accelerate positrons to high energies. Furthermore, we analyzed the impact of the key drive bunch properties on the formation of the hollow channel, finding that bunches with short fall times (compared to electron bubble radius) and small transverse sizes (compared to plasma skin depth) maximize both accelerating and focusing fields. We also studied hollow channels driven by laser beams.

[1] J. Vieira, J.T. Mendonça, PRL 112, 215001 (2014)
[2] R. A. Fonseca et al., Lect. Notes Comput. Sci. 2331, 342 (2002)

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