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Control of focusing forces and emittances in plasma-based accelerators using near-hollow plasma channels[1] CARL SCHROEDER, CARLO BENEDETTI, ERIC ESAREY, WIM LEEMANS, Lawrence Berkeley National Laboratory — A near-hollow plasma channel, where the plasma density in the channel is much less than the plasma density in the walls, is proposed to provide independent control over the focusing and accelerating forces in a plasma accelerator. In this geometry the low density in the channel determines the focusing forces, while the accelerating field is determined by the high density in the channel walls. The channel also provides guiding for intense laser pulses used for wakefield excitation. Beam loading using a near-hollow plasma channel is examined. Properly shaping and phasing the witness particle beam, high-gradient acceleration can be achieved with high-efficiency, and without induced energy spread or emittance growth. Both electron and positron beams can be accelerated in a nearly symmetric fashion. Near-hollow plasma channels can effectively mitigate emittance growth due to Coulomb scattering for high-energy physics applications.

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