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# High efficiency uniform positron acceleration in plasma wakefield accelerator

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Next generation high energy electron-positron colliders are highly desirable for precision studies of the Higgs Boson and discovering physics. Current radio-frequency accelerators are limited by the accelerating gradients due to breakdowns, thus advanced acceleration schemes with high gradient, high efficiency are in demand. Plasma wakefield accelerator has achieved several breakthroughs in electron beam acceleration to provide large acceleration gradients and high energy transfer efficiency while maintaining excellent beam quality. However, no equivalent regimes for plasma based positron acceleration has been demonstrated. We investigated several novel positron accelerations regimes using hollow plasma channel or uniform plasma with electron drivers. Through self-consistent and nonlinear interaction of the positron beam and the plasma, stable, high-efficiency and uniform acceleration of the positron beam is realized. 3D Particle-in-Cell simulations show that an several tens of percent energy extraction efficiency from the wake to the positrons and a 1% level energy spread can be simultaneously obtained.

## Speaker's Name

Shiyu Zhou

## Speaker's Title

Dr.

## Speaker's Gender

Man

## Speaker's Pronouns

## Speaker's Preferred name (if any)

**Primary author(s) :** ZHOU, Shiyu; LU, Wei

**Presenter(s) :** ZHOU, Shiyu

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