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**Mitigation of ion motion induced emittance growth in plasma wake field accelerator** WEIMING AN, XINLU XU, CHAN JOSHI, WARREN MORI, Univ of California - Los Angeles — Plasma based accelerator is being considered as the main accelerator for building a future linear collider. The nonlinear plasma wake field accelerator have ideal properties for focusing and accelerating electrons. However, for nano Coulomb beams with nanometer scale matched spot sizes, the large space charge forces around the beam can pull the plasma ions inwards and generate nonlinear focusing force inside the wake. As a result, the beam emittance cannot be preserved. We find that although the ion density becomes 100 times larger than the initial density on the axis, the width of the ion density peak is around 1/10 of the beam spot size and the emittance growth of the beam is only 75% in hydrogen plasma and 20% in a lithium plasma. To further mitigate the emittance growth, we can use an initial spot size a little smaller than the matched spot size. We also show that, for the same initial beam emittance, the emittance growth will decrease when using a lower plasma density and a correspondingly matched beam spot size.

Weiming An  
Univ of California - Los Angeles

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