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Ion acceleration by an ultrashort laser pulse interacting with a near-critical-density gas jet and perspectives to micro-compression

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Produced alpha particle beams are directly applicable in radiochemistry and radiopharmacy, hence a future increase of number density is desirable for a higher reaction yield. Besides ongoing improvements of the gas density profiles towards CSA, all-optical beam transport elements for spectral bunching are under investigation. In experiments at the high power laser PHELIX with 500 fs pulses interacting with coil targets, strong EM fields are induced by kAscale return-currents and a pulsed potential dynamics that both follow the laser-driven target discharge at intensities of 10^{19} Wcm^{-2}. These have shown efficiency in tailoring 10 MeVion beam emittance, with the possibility of chromatic tuning the effects by simply controlling the delay between laser pulses or geometric properties of the target.

Compact generation and short-track beam tailoring offer promising perspectives to many applications in exploratory HEDP ranging from the controlled heating of warm-dense matter, over studies of collective stopping effects, to ion beams for fast ignition.


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