EUROPEAN NETWORK FOR NOVEL ACCELERATORS
EuroNNAc4
NPACT supported by EU via I-FAST

Contribution ID: **45** Type: **Poster (student)**

Simultaneous space-time focusing with radially-chirped laser pulses for ionization injection in LWFAs

Monday, 19 September 2022 19:15 (1 hour)

Simultaneous space-time focusing occurs when a transversely-chirped ultrashort laser pulse is focused using a conventional lens. Before the lens different frequencies are separated radially so that at any point on the transverse plane the local bandwidth is relatively low. These frequencies are brought together downstream of the lens as they approach the focus. As the spatial overlap between different frequency components increases, so does the local bandwidth, thereby reducing the pulse duration to its minimum at the focus. This reduces the space-time volume of the region in which the intensity is high. This may have potential advantages towards reducing the phase-space volume of electrons injected in a wakefield accelerator by optical ionisation injection.

The focusing of a radially-chirped laser pulse is studied both analytically and numerically. Decomposing any arbitrarily chirped input laser pulse as a superposition of Laguerre-Gaussian modes allows for an exact expression of the electric field at any longitudinal position of the focusing beam. A numerical investigation is also performed using Collins' method: a diffraction integral based on ray-matrices. It is investigated whether the radial chirp gives enhanced intensity roll-off in space and time over conventional focusing.

Primary authors: ARCHER, Emily; Prof. BOOTH, Martin (University of Oxford); Dr CHAPPELL, James (University of Oxford); Dr COWLEY, James (University of Oxford); Dr FEDER, Linus (University of Oxford); Dr SUN, Bangshan (University of Oxford); Prof. WALCZAK, Roman (University of Oxford); Mr WANG, Warren (University of Oxford); Prof. HOOKER, Simon (University of Oxford)

Presenter: ARCHER, Emily

Session Classification: Poster Session