



Contribution ID: 665

Type: **Poster (student)**

## Curved hydrodynamic optical-field-ionised waveguides

*Wednesday, 24 September 2025 19:00 (1h 30m)*

Curved plasma waveguides have been proposed as a means to: guide fresh laser pulses into multistage plasma accelerators [1, 2], replace plasma mirror tapes used to eject depleted laser pulses [3], and to bend electron bunches for radiation generation [4-6]. However, all curved channel experiments so far have employed discharge capillaries, which are prone to laser damage especially at high pulse repetition rates.

In contrast, hydrodynamic optical-field ionized (HOFI) channels are free-standing and hence immune to laser damage. Furthermore, they have been demonstrated to operate at kHz repetition rates [7-10]. We will describe experiments and simulations on the formation and operation of curved HOFI channels. Particle-in-cell simulations show, for a parameter regime relevant to PW-scale facilities, that curved HOFI channels can be used to introduce a fresh laser drive pulse in a staged laser-wakefield accelerator. A 100% electron capture efficiency can be achieved between stages although the asymmetric sheath fields led to emittance blow-up. We have demonstrated experimentally that introduction of the appropriate phase modulation can curve the trajectory of the channel-forming Bessel beam by more than 10 laser spot sizes in a distance of 120 mm. We will also present the results of experiments to generate curved HOFI channels.

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**Session Classification:** Poster Session

**Track Classification:** PS1: Plasma-based accelerators and ancillary components