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Characterization of self-injected electron beams from LWFA experiments at SPARC_LAB

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The plasma-based acceleration is an encouraging technique to overcome the limits in the conventional RF LINAC. A plasma accelerator is able to provide accelerating fields around hundreds of GeV/m, i.e. order of magnitude greater than RF structures, paving the way to accelerate particles to several MeV over a short distance (millimiter scale).
In this work, the characteristics of electron beams obtained through Laser WakeField Acceleration (LWFA) in the self-injection regime produced with the FLAME high-power laser at the SPARC_LAB test facility are shown.
In our setup, the high intensity laser power (10^19 W/cm^2) ionizes the gas coming out from a gas-jet, while the ponderomotive force creates a bubble inside the plasma where a strong electric field arises on the back of the bubble. Therefore, electrons are self-injected in this region and quickly accelerated. In detail, with a laser energy on focus of 1 J and a pulse temporal length (FWHM) of 40 fs, we obtained an electron plasma density of 10^19cm^-3, transversal dimensions in the range 5-15 mm (rms), energy up to 220 MeV and beam charge of the order of 10^2 pC.

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