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First results of the two-color LWFA experiments at ATF

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Two-color ionization injection is a promising method for realizing an all-optical, plasma photocathode. In this method, a nonlinear plasma wakefield is driven by a long-wavelength laser, and the ionization injection occurs using a second, high-intensity laser pulse with a short wavelength. Recent upgrades at the Accelerator Test Facility (ATF) of the Brookhaven National Laboratory has provided an ideal opportunity for this experiment by integrating a long-wave infrared (LWIR) CO_2 laser pulse (λ~9.2 μm) with a Ti:Sapphire (λ~0.8 μm) laser pulse at the interaction point. Previous simulations have shown the potential for this combination of lasers to produce bright electron beams with normalized emittance of tens of nm [1,2]. In this talk, we present the first results on the impact of a transverse Ti:Sapphire laser pulse on the electrons generated in the CO_2-driven LWFA in the self-modulated regime using a ~2.5 TW, 2 ps CO_2 laser and a ~ 5 mJ Ti:Sapphire laser. This work lays the foundation towards the realization of the all-optical plasma photocathode experiment as the facility plans upgrades towards >10 TW, sub-ps CO_2 pulses and terawatt class Ti:Sapphire lasers.

References:
[1] Schroeder, et al., arXiv:1505.05846 [physics.plasm-ph] (2015)
[2] Xu, et al., Phys. Rev. ST Accel. Beams 17, 061301 (2014)

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Primary authors: VAFAEI-NAJAFABADI, Navid (Stony Brook University, Brookhaven National Laboratory); PETRUSHINA, Irina (Stony Brook University); Dr KUPFER, Rotem (Lawrence Livermore National Laboratory); Dr POGORELSKY, Igor (BNL); Dr POLYANSKIY, Mikhail (BNL); Mr BABZIEN, Marcus (BNL); Dr FEDURIN, Mikhail (Brookhaven National Laboratory); Mr KUSCHE, Karl (BNL); LI, William (Brookhaven National Laboratory); PALMER, Mark (Brookhaven National Laboratory)

Presenter: VAFAEI-NAJAFABADI, Navid (Stony Brook University, Brookhaven National Laboratory)

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