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High Transformer ratio PWFA for Applications on XFELs WEI LU, WEIMING AN, CHENGKUN HUANG, CHAN JOSHI, WARREN B. MORI, UCLA, MARK HOGAN, T.O. RAUBENHEIMER, A. SERYI, SLAC, PATRIC MUGGLI , USC, TOM KATSOULEAS, Duke, UCLA COLLABORATION, SLAC COLLABORATION, USC COLLABORATION, DUKE COLLABORATION — Fourth generation of light sources (e.g.,LCLS and the XFEL) require high energy electron drivers (16-20GeV) of very high quality. We are exploring the possibility of using a high transformer ratio PWFA to meet these challenging requirements. This may have the potential to reduce the size of the electron drivers by a factor of 5 or more, therefore making these light source much smaller and more affordable. In our design, a high charge (5-10nC) low energy driver (1-3GeV) with an elongated current profile is used to drive a plasma wake in the blowout regime with a high transformer ratio (5 or more). A second ultra-short beam that has high quality and low charge beam (1nC) can be loaded into the wake at a proper phase and be accelerated to high energy (5-15GeV) in very short distances (10s of cms). The parameters can be optimized, such that high quality (0.1% energy spread and 1mm mrad normalized emittance) and high efficiency (60-80%) can be simultaneously achieved. The major obstacle for achieving the above goals is the electron hosing instabilities in the blowout regime. In this poster, we will use both theoretical analysis and PIC simulations to study this concept.

Wei Lu
UCLA

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