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Laser wakefield signatures: from gas plasma to nanomaterials[1]
DEANO FARINELLA, Univ of California - Irvine, XIAOMEI ZHANG, Shanghai Institute of Optics and Fine Mechanics, YOUNGMIN SHIN, Northern Illinois University, TOSHIKI TAJIMA, Univ of California - Irvine — The signatures of laser wakefields have become increasingly important in recent years due to the invention of a novel laser compression technique [1] that may enable the creation of single cycle x-ray pulses. This x-ray driver may be able to utilize solid density targets to create acceleration gradients of up to TeV/cm. On the other hand, Laser Wakefield Acceleration (LWFA) has been identified as a potential mechanism for the generation of Extreme High Energy Cosmic Rays (EHECR) in Active Galactic Nuclei (AGN) [2]. Though these disparate density regimes may include different physics, by investigating scalings of the ratio $n_{\rm cr}/n_{\rm e}$ we are able to survey a wide range of parameters to gain insight into particle acceleration and photon emission properties. The scaling of electron acceleration and photon radiation from wakefields as a function of the parameter $n_{\rm cr}/n_{\rm e}$ has been studied [3]. Further, acceleration gradient as well as other scalings were investigated in solid density channels and compared to gas plasma [4]. [1] G. Mourou et al., Eur. Phys. J. Spec. Top. 223, 1181 (2014) [2] T. Ebisuzaki and T. Tajima. Astropart. Phys. 56, 9 (2014) [3] D. M. Farinella et al., Phys. Plasmas 23, 073107 (2016) [4] X. M. Zhang et al., "X-ray wakefield acceleration and betatron radiation in nanotubes," (2016), (submitted to Phys. Rev. AB)

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