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Advanced Acceleration and THz Generation by Dielectric Based Structures: ANL/AWA/Euclid Techlabs Collaboration Activities

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Relativistic, high intensity and small emittance electron bunches are the basis of linear collider and FEL projects. Using Cherenkov radiation generated by a high current bunch passing a dielectric wake-field accelerator may provide a significant cost saving and reduction of the linear collider or FEL facility size. Femto-pico-second electron bunches are used for high power THz generation for particle acceleration and other applications. With this talk, we present our recent developments on (1) a linear collider concept based on a short rf pulse, high gradient dielectric two beam acceleration scheme to avoid the breakdown regime and achieve higher gradient; dielectric materials are likely to withstand higher electric fields than metals; we use structures that can accelerate electrons and also positrons; our schemes allow for staging. (2) We also consider a concept for a multi-beamline FEL driven by high repetition rate dielectric based wakefield accelerators. (3) Additionally, our interest is focused on wakefields generated by using dielectric based structures and introducing an energy modulation that allows THz radiation in the range 0.5 - 1 THz as well as a passive energy chirp correction.

Primary author: Dr KANAREYKIN, Alexei (Euclid Techlabs LLC/ANL)

Presenter: Dr KANAREYKIN, Alexei (Euclid Techlabs LLC/ANL)

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