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Laser wakefield accelerators for industry

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Taking advantage of GV/cm acceleration gradients, laser-plasma accelerators appear poised to reduce the cost and footprint of high-energy particle beam facilities for a wide variety of applications [1,2]. Combining cutting-edge laser technology with centimeter-scale gas cells can, in a few hundred square meters of floor space, yield 8-10 GeV electron bunches with charge density comparable to that obtained from radio-frequency accelerators [3] (Fig. 1). Laser wakefield accelerator beams have a few unique advantages, such as naturally short (<30 fs) bunches, and the ability to produce secondary particles, such as photons and neutrons that naturally inherit the short pulse duration. Tuning the laser and plasma enables the same machine to produce either higher-charge/lower-energy bunches or lower-charge/higher-energy bunches. Tau Systems is a start-up headquartered in Austin, Texas, that is commercializing the laser wakefield accelerator for several industrial applications [4] (Fig. 2). I will describe some of Tau's activities and interests, highlighting progress on wakefield-driven free-electron laser experiments at BELLA [5], electronics testing prototype experiments at UT, proposed laser-driven neutron and photon sources, and simulation and data analysis development.

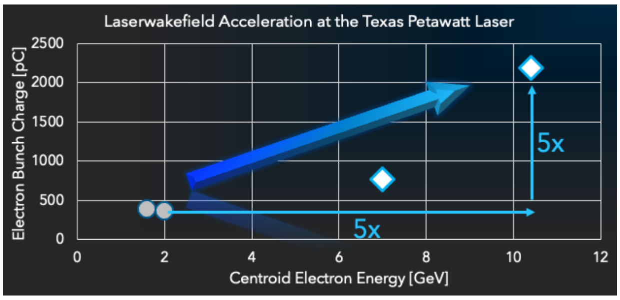

Fig. 1. Electron bunch energy and charge enhancement, up to 10 GeV and 340 pC using nanoparticles at the Texas Petawatt.

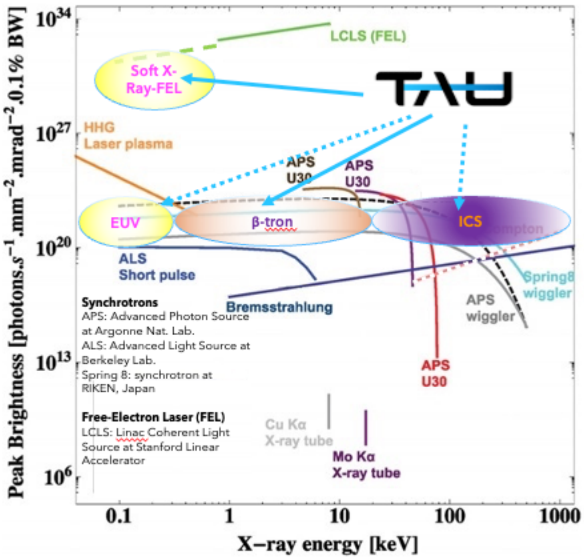

Fig. 2 Estimated brightness of lightsources at different photon energies as driven by a laser-plasma accelerator, such as developed by Tau.

References

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