

**Particles Surfing on Plasma Waves:
Ultrahigh Intensity Lasers used for High-Gradient Acceleration of Electrons and Ions**

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Abstract:

The Berkeley Lab Laser Accelerator (BELLA) Center is a routinely operating laser facility dedicated for laser plasma acceleration (LPA) research. The PW facility provides high quality focused laser pulses in the range of 10^{19} W/cm² intensity with controllable spatial distribution within the typical focus size of ~ 50 μ m by a deformable mirror, exceptional beam pointing, shot-to-shot energy, intensity and pulse duration stability for high precision LPA experiments [1]. The thoroughly characterized and monitored femtosecond laser pulses are delivered into a radiation shielded target room for laser-plasma-driven electron and ion acceleration experiments, including the use of gas-jet and capillary-discharge-based LPAs, and thin-foil target studies.

Operational experience, including the daily laser and experimental systems preparations, support and maintenance requirements, personal and equipment protection methodologies will be reviewed. The enhanced maintenance routine, continuous operator and safety training, experiment planning and implementation strategies, standardized data acquisition, data analysis, and data archiving systems are all crucial operational components of a successful user facility. Highlights of recent results [2], and plans for gradual opening up the available resources for a broader user community in the recently established collaborative framework of the LaserNetUS will also be described.

[1] K. Nakamura et al., IEEE J. QE, 53, 1200121 (2017).

[2] A.J. Gonsalves et al., Phys. Rev. Letters, 122, 084801 (2019).

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