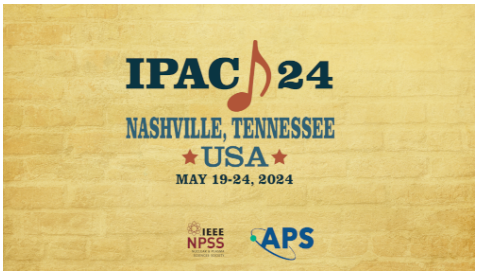

Contribution ID: **1407** Contribution code: **TUBN2** Type: **Contributed Oral Presentation**

Next-generation laser-plasma acceleration

Tuesday, 21 May 2024 11:50 (20 minutes)

Most current laser-plasma accelerators (LPAs) require driver lasers with relativistic intensities and pulse durations that are significantly shorter than the plasma wavelengths. This severely limits the laser technology that can be used to drive LPAs and with that their wide spread and the currently achievable LPA parameters, such as repetition rate and accelerating gradient. Here, we report a widely unexplored regime of laser-plasma electron acceleration that is based on the direct parametric excitation of plasma waves. This method markedly relaxes the driver laser requirements in terms of peak power and pulse duration. We show experimental data that demonstrates the generation of high-charge mildly relativistic electron bunches with laser-to-electron conversion efficiency that is unprecedented in gas-phase targets. The accelerating field gradient in this regime reach 3 TV/m.
The experimental results demonstrate a novel regime that opens LPA electron acceleration for a wide range of driver laser technologies and holds the promise for a path to ultracompact high-repetition rate LPAs with extreme field gradients for future compact particle accelerators and secondary sources.

Footnotes

Funding Agency

This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences Division of Materials Sciences and Eng. under Award Number DE-SC0021132.

Paper preparation format

LaTeX

Region represented

Europe

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Session Classification: TUBN: Novel Particle Sources and Acceleration Techniques (Contributed)

Track Classification: MC3: Novel Particle Sources and Acceleration Techniques: MC3.A15 New Acceleration Techniques