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Experimental generation of petawatt power, extreme electron beams in a particle accelerator

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In this contribution we report on the experimental generation of high energy (10 GeV), ultra-short (fs-duration), ultra-high current (~ 0.1 MA), petawatt peak power electron beams in a particle accelerator. These extreme beams enable the exploration of a new frontier of high intensity beam-light and beam-matter interactions broadly relevant across fields ranging from laboratory astrophysics to strong field quantum electrodynamics and ultra-fast quantum chemistry. We generate such high peak current beams using the controlled shaping of the electron energy profile with an external, spectrally-modulated, ps-duration infrared (IR) laser pulse. This experimental demonstration opens the door to on-the-fly customization of extreme beam current profiles for desired experiments and is poised to benefit a broad swathe of cross-cutting applications of relativistic electron beams.

Footnotes

- C. Emma et al., "Experimental generation of extreme electron beams fro advanced accelerator applications" arXiv:2411.10413, (2024)

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