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First Electron Beams from the High-Average-Power Laser-Plasma Accelerator KALDERA

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Laser-plasma acceleration (LPA) is a promising technology for future compact accelerators. However, the low repetition rate (typically few Hz) of today's high-power laser systems prevents reaching the average power required by applications and hinders the implementation of fast feedback systems to mitigate beam instabilities. To this end, DESY has established a dedicated research program on high-average-power LPA. Our flagship project KALDERA pursues the development of a new laser tailored to plasma acceleration. Based on Ti:Sa technology, the system will deliver pulses at 100 TW peak power at up to 1 kHz repetition rate and by that enable the application of active stabilisation techniques to enhance LPA performance. Here, we report on the development and commissioning of MAGMA, the first LPA powered by KALDERA. We demonstrate electron injection and acceleration to around 100 MeV at a repetition rate of 100 Hz, reaching into previously uncharted LPA territory.

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