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Petawatt laser guiding and electron beam acceleration to 8 GeV in laser-heated capillary discharge waveguides[1]

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In order to take advantage of the large acceleration gradients in laser plasma accelerators and achieve high beam energies, preformed plasma waveguides can be used to mitigate laser diffraction of focused laser pulses, which increases the acceleration length and the energy gain for a given laser power. Here we report on guiding of relativistically intense laser pulses with PW peak power over 15 diffraction lengths by increasing the focusing strength of a capillary discharge waveguide using laser inverse Bremsstrahlung heating. This allowed production of electron beams with quasi-monoenergetic peaks in energy up to 7.8 GeV [1], almost double what was previously demonstrated [2]. [1] A.J. Gonsalves et al. Phys. Rev. Lett. 122, 08401 (2019) [2] W. P. Leemans et al., Phys. Rev. Lett. 113, 245002 (2014)

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