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FAST-GREENS: a High Efficiency Free Electron Laser Driven by Superconducting RF Accelerator

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In this paper we'll describe the status of the FAST-GREENS experimental program where a 4 m-long strongly tapered helical undulator with a seeded prebuncher is used in the high gain TESSA regime to convert a significant fraction (up to 10 %) of energy from the 240 MeV electron beam from the FAST linac to coherent 515 nm radiation. We'll also discuss the longer term plans for the setup where by embedding the undulator in an optical cavity matched with the high repetition rate from the superconducting accelerator (3,9 MHz), a very high average power laser source can be obtained. Eventually, the laser pulses can be redirected onto the relativistic electrons to generate by inverse compton scattering a very high flux of circularly polarized gamma rays for polarized positron production.

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