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## **Flexible X-ray source from Hermite-Gaussian laser modes driven plasma channel wakefield**

A plasma channel undulator/wiggler may be created through the plasma wakefield excited by beating of several Hermite-Gaussian laser modes propagating in a parabolic plasma channel. Control over both the betatron and undulator forces is conveniently achieved by tuning the amplitude ratios, colors, and order numbers of the modes. A special structure of the undulator/wiggler field without the focusing force near the propagation axis is generated inside the plasma wakefield by matching the strengths of the fundamental and the first-order Hermite-Gaussian modes. The electron beam only experiences forced undulator oscillations in such a field, which significantly improves the quality of the emitted radiation. Since the value of the undulator strength parameter could be in a wide range, less or larger than unity, it is capable of generating narrow bandwidth X-ray, as well as the synchrotron-like high-energy X/gamma-ray radiation by harmonics. Additionally, controlling the relative phases between the laser modes allows for the polarization control of the plasma undulator. High-order harmonics produced from a circularly polarized plasma undulator clearly show the vortex nature and carry well-defined orbital angular momentum.

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