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A Palmtop Synchrotron-like Radiation Source

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Synchrotron radiation sources are immensely useful tools for scientific researches and many practical applications. Currently, the state-of-the-art synchrotrons rely on conventional accelerators, where electrons are accelerated in a straight line and radiate in bending magnets or other insertion devices. However, these facilities are usually large and costly. Here, we propose a compact all-optical synchrotron-like radiation source based on laser-plasma acceleration either in a straight or in a curved plasma channel.

Summary

With the laser pulse off-axially injected in a straight channel, the centroid oscillation of the pulse causes a wiggler motion of the whole accelerating structure including the trapped electrons, leading to strong synchrotron-like radiations with tunable spectra. It is further shown that a ring-shaped synchrotron is possible in a curved plasma channel. Due to the intense acceleration and bending fields inside plasmas, the central part of the sources can be made within palm size. With its potential of high flexibility and tunability, such compact light sources once realized would find applications in wide areas and make up the shortage of large synchrotron radiation facilities.

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