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A concept for an active plasma undulator

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Acceleration of electron bunches in a plasma channel implies a matched beam spot size at the micron level: this property, together with generally low values for slice emittance and energy spread (and large peak current), boosts the rho pierce parameter value up to order of 10^{-2} or even more. Upon leaving plasma channel, due to prompt electrons divergence, rho is reduced quickly so that allowing the bunch to wiggle within plasma seems mandatory to fully exploit its potential. To date, proposed plasma based undulators exploit plasma wave transverse fields to wiggle beam's particles, incurring in two main disadvantages, namely an initial transverse position dependent undulator parameter and a likely energy change due to longitudinal plasma field. We present the concept scheme for a new plasma based undulator enabling, in principle, to exploit the extremely large potential brightness of plasma accelerated beams. In our scheme, plasma only serves as a conductive media to allow properly tailored, intense currents to generate magnetic fields able to both wiggle and keep the electron bunch focused to micron size. The resulting device is a cheap and versatile undulator.

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