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First steps of the plasma-filled undulator concept for high-quality compact FEL

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The importance of coherent brilliant light sources for research and industry makes free electron laser (FEL) facilities a cornerstone of today's science. The improvements of such facilities are of great importance. Here I present the first steps to enhance the undulator sections in FEL facilities by adding a plasma inside the undulator [1]. Instead of propagating the electron beam in vacuum inside the undulator, by filling part of the undulator with a low-density plasma one may reduce the transverse divergence of the electron beam during the propagation inside the undulator, thus, keeping or reducing the emittance. In addition, a pre-bunching occurs thanks to the interaction between the beam, plasma and undulator field potentially shortening the necessary undulator length to start FEL generation. The additional focusing could also reduce the needs of magnetic elements between undulator sections. The concept could be considered as a merge between the plasma lens and the undulator. Therefore, is a middle step between the current undulators and the full plasma undulators, i.e., the plasma filled undulator.

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Footnotes

[1]- INT. J. ELECTRONICS, 1988, VOL. 65, No.3, 551-564 The effect of background plasma in the undulator on free electron lasers

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