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Recent results on compact FEL based on laser plasma accelerators

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The laser invention more than fifty years ago was a major scientific revolution.

Among the different possible gain medium, the Free Electron Lasers (FEL) uses free electrons in an undulator field, covering wavelengths from far infrared to X-ray. Nowadays, the advent of tuneable intense (mJ level) short pulse FELs with record peak power (GW level) in the X-ray domain sets a major step in laser development, and these reliable light sources enable to study unexplored scientific areas, such as deciphering molecular reactions in real time, understanding functions of proteins.

Besides, lasers have also been considered for driving plasma electron acceleration. A high-power femtosecond laser focused into a gas target resonantly drives a nonlinear plasma wave in which plasma electrons are trapped and accelerated. Nowadays, laser wakefield acceleration (LWFA) produces electron beams up to multi-GeV energies, hundreds pC charge, percent energy spread and milliradian divergence. It is relevant to consider a FEL application to quality these laser plasma produced electrons. The large energy spread and divergence of these beams should be mitigated, for handling chromatic effects. The different beam manipulation strategies are discussed. First results on the decompression chicane scheme, in particular from COXINEL experiment, are presented.

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