

Laser plasma accelerators: then and now through cutting-edge experiments

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Laser Plasma Accelerators (LPA) are changing the scientific and societal landscape. Opening new hopes for high energy physics, offering alternative to synchrotron light sources with the recent demonstration with LPA's based Free Electron Radiation, and delivering particle and radiation beams for medical and security applications, they are among the most innovative tools of modern sciences. I'll explain the main involved concepts, and why these wonderful machines rely on our ability to control finely the electrons motion with intense laser pulses. I'll show how the electrons collective manipulation permits to produce giant electric fields of value in the 100GV/m exceeding by 3 orders of magnitude or more the ones used in current machines. This control is crucial for electrons injection that is essential for delivering stable ultra-short and ultra-bright energetic particle or radiation beams. To illustrate the beauty of laser plasma accelerators I will show some concepts we recently demonstrated that allow these controls for beams improvements. Finally, I will discuss on the next challenges together with new ideas that will be tested in the next future.

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