Manipulating Relativistic Electrons with Intense Laser Pulses

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In many domains, modern science relies on robust technology, and advanced technology relies on basic fundamental research. Fundamental researches on superconductivity, even if some aspects are not yet fully understood, have conducted to the discovery of many applications such as magnetic resonance imaging or superconducting cavities that are now used in modern accelerators, which have been then successfully used to understand deeply the structure of matter and fundamental interactions. This "virtuous circle" also applied for Laser Plasma Accelerators (LPA). LPA required first powerful laser systems able to deliver stable laser pulses in the few tens of TW to a few PW and, second, the mastering of the giant electric field components with TV/m amplitude [1] in the plasma medium with this well characterized laser pulse. The art of this new area of science relies on our abilities to manipulate relativistic electrons with intense laser pulses.To illustrate the beauty of laser plasma accelerators I will show different experimental results that we recently performed that allow to improve the quality of the electron beam, its stability [2] and its energy gain in longitudinal field [3], or the reduction of its divergence using radial field [4]. I'll then show how by controlling the quiver motion of relativistic electrons intense and bright X-rays beam are produced in a compact and elegant way [5-7]. Finally I'll show some examples of applications [8].

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