AVVISO DI SEMINARIO

Il giorno martedì 10 dicembre 2019 alle ore 11.00

presso l'Area della Ricerca di Pisa

Aula 33, Piano terra

Il Dott. Matteo Tamburini

del Max Planck Institute for Nuclear Physics, Heidelberg, Germany
terrà due seminari dai titoli:

Strong-field QED beyond the local-constant-field approximation in laser-plasma interaction

The local-constant-field approximation (LCFA) is an essential theoretical tool for investigating strong-field QED phenomena in background electromagnetic fields with complex spacetime structure. In fact, it allows to evaluate the probabilities of processes occurring in arbitrary electromagnetic fields starting from the corresponding quantities computed in a constant electromagnetic field. For the above reasons, it is widely employed in numerical codes, such as Monte Carlo and particle-in-cell (PIC) codes, which are used for the design and interpretation of present and upcoming experiments at ultrahigh intensities, where strong-field QED effects are of critical importance.

Here, we scrutinize the validity of the LCFA in the case of nonlinear Compton scattering focusing on the role played by the energy of the emitted photon on the formation length of this process. We show that the LCFA fails quantitatively and qualitatively in the lower energy region of the emitted photon spectrum even at large values of the classical intensity parameter $\xi = a_0 = |e| E_0/m\omega c \gg 1$. In addition, we provide an explicit and simple implementation of an improved expression of the nonlinear Compton scattering differential probability that solves the main shortcomings of the LCFA in the lower energy region of the emitted photon spectrum and is suitable for background electromagnetic fields with arbitrary spacetime structure such as those occurring in PIC simulations. Finally, we show that effects beyond the LCFA can be measured in a compact fully-optical setup at existing and future high-power laser facilities.

Pausa caffè

Polarized Laser-WakeField-Accelerated Kiloampere Electron Beams

High-flux polarized particle beams are of critical importance for the investigation of spin-dependent processes, such as in searches of physics beyond the standard model, as well as for scrutinizing the structure of solids and surfaces in material science. Here we demonstrate that kiloampere polarized electron beams can be produced via laser-wakefield acceleration from a gas target. A simple theoretical model for determining the electron beam polarization is presented and supported with self-consistent three-dimensional particle-in-cell simulations that incorporate the spin dynamics. By appropriately choosing the laser and gas parameters, we show that the depolarization of electrons induced by the laser-wakefield-acceleration process can be as low as 10%. Compared to currently available sources of polarized electron beams, the attainable flux is increased by 4 orders of magnitude.