

## New regimes of the laser acceleration of charged particles and photons

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The development of the ultra-intense laser continues to open up new fields of physics.

The laser accelerator development is now entering a new matured stage at which it becomes possible to manipulate in a controllable way the parameters of accelerated charged particle beams.

The electron injection by breaking wake waves left by the laser pulse in underdense plasmas results in the quasi-mono-energetic beam production.

The tailored multi-layer foil targets provide conditions for the high quality ion beam acceleration.

Nonlinear interaction of co- and counter-propagating laser pulses in an underdense plasma can lead to superintense electromagnetic pulse generation.

A number of prominent applications are cited, including the hadron therapy, the charged particle injectors, the high energy physics, the bright sources of hard electromagnetic radiation and positrons.