Contribution ID: **172** Type: **Oral presentation**

Particles Deflection, Focusing and Collimation in Optical Lattices

Wednesday, 26 September 2018 18:40 (1 hour)

Charged particles interaction with high-intensity optical lattice is often referred to as channeling. Indeed, as was shown previously, charged particles could be trapped, guided, focused or collimated with channels of effective potential, formed in non-uniform laser field [1].

On the one hand, beams shaping and control techniques, based on charged particles channeling in optical lattice, requires high power lasers to deal with tasks easily performed by nowadays tools of accelerator physics, e.g. to turn a sub-GeV electron on a mrad angle one needs a laser of power more than 1e16 W/cm^2! So there is no foreseeable perspective of replacing all the beam optics with laser formed optical lattices.

On the other hand, using field to turn, guide and shape charged particle beams involves no beam-matter interaction, purging most of inelastic components from the process. Moreover, a number of distinctive features of optical lattice makes it a promising tool for particles colliders. For example, the fact that unlike crystal channels, channels in optical equally affect both positively and negatively charged particles [2, 3, 4], which could be used to increase luminosity for electon-positron colliders of the future.

In this report those possible applications will be discussed and illustrated by numerical simulations with the newly created code. The main focus of current report are examples close to real conditions found in experiments. For that reason non-uniform (e.g. Gaussian profile) finite laser beams are considered to form optical lattice. Feasible laser intensities and electron beam energies have been chosen to exemplify the phenomena of interest.

[1] A. Andreev, S. Akhmanov, Channeling, collimation, and
radiation of relativistic electrons in ultrastrong nonuniform optical
fields, Zh. Eksp. Teor. Fiz. (Pis'ma), 1991, 53, 18-21

[2] S.B. Dabagov, A.V. Dik, E.N. Frolov, Channeling of electrons in a crossed laser field Physical Review Special Topics - Accelerators and Beams, American Physical Society (APS), 2015, 18

[3] P.W. Smorenburg, J.H.M. Kanters, A.Lassise et al., Polarization-dependent ponderomotive gradient force in a standing wave, Phys. Rev. A, 2011, 83 063810.

[4] A.L. Pokrovsky, A.E. Kaplan, Relativistic reversal of the ponderomotive force in a standing laser wave, Phys. Rev. A, 2005, 72, 043401.

Summary

Particles deflection, focus and collimation in optical lattice.

Charged particles interaction with high-intensity optical lattice is often referred to as channeling. Indeed, as was shown previously, charged particles could be trapped, guided, focused or collimated with channels of effective potential, formed in non-uniform laser field.

In this report those possible applications will be discussed and illustrated by numerical simulations with the newly created code.

Primary author: Mr FROLOV, Evgenii (LPI RAS and NR TPU)

Co-authors: Mr DIK, Alexey (Lebedev Physical Institute of Russian Academy of Science); Prof. DABAGOV, Sultan (LNF)

Presenter: Mr FROLOV, Evgenii (LPI RAS and NR TPU)

Session Classification: PS2 - Poster session