

Review of the PhD thesis submitted by Petr Valenta

Laser-driven Source of Electrons and X-rays in Underdense Plasmas: Theory and Simulation

The submitted report has a clear logical structure. It is divided into four chapters, the first of which presents an introduction. The second chapter describes basis of theoretical approach used by the author in solving selected dissertation themes. The author's basic contributions to the development of the field are perfectly summarized in paragraph 3. The core of solution of this PhD thesis is based on four publications in Physics of Plasmas and Physical Review E in the years 2020 and 2021, which are included in Appendix B. P. Valenta is the first author of the three publications. The papers contain original solutions of 2 basic research topics: (1) laser-driven source of electrons and (2) X-rays emission from underdense plasmas interacting with high power laser beam. The essence of the solution is a detail theoretical description of interaction Langmuir wave with plasma electrons.

The fact, that all basic research results reported here as main PhD thesis contributions have been published in renowned magazines, greatly facilitated the role of the opponent.

The topic of this thesis was chosen following the research program of the laboratory ELI beam-lines which was the doctoral training unit. The theme It is extremely actual for high power laser laboratories in global scale. We can emphasize that it represents also a fundamental theoretical support to the proposed experiments (with laser wakefield acceleration of electrons driven by high power laser systems and moving plasma mirror) prepared at ELI Beamlines.

The research method applied by author is based on an exact relativistic description of the studied phenomena and on the creation of detail computer model which enables potential quantitative comparison of theoretical and experimental results.

Theoretical background, developed in chapter 2 for the purposes of this dissertation, is clearly presented and can be widely useful, especially for successors working in this research field.

The purpose of this PhD has been met, the results reasonably contribute to the research program of the laser wake-field acceleration of the electrons and generation of attosecond x-ray pulses in the research program of the ELI research laboratory and to general development of knowledge in the field.

All text of the submitted document has been prepared with extreme care. Its graphics level is high. No typos or omissions could be found.

The submitted report and number of publications cited in allow me to state that the amount of work and high scientific level of the results achieved during the PhD program of Petr Valenta significantly exceed the standard level of PhD students.

I recommend the thesis for the defense and the award of a PhD degree to the author

Kladno, April 25, 2022

Prof. Ing. Miroslava Vrbová, CSc.