

**Supervisor's statement upon Ph.D. thesis "*Nonlinear laser absorption under high-energy-density conditions*" submitted by Sviatoslav Shekhanov**

The doctoral research of Mr. Sviatoslav Shekhanov was devoted to theoretical and simulation studies of interactions of intense laser beams with targets relevant for inertial confinement fusion for energy production (IFE). For his simulations, he used code SMILEI based on the Particle-In-Cell method. His research was directed by Professor Vladimir Tikhonchuk and myself. The thesis consists of two parts.

The first part is devoted to investigation of the possibilities to control stimulated Brillouin (SBS) and stimulated Raman (SRS) scatterings in long hot plasma corona at relatively high intensities typical for the regime of shock ignition of inertial fusion. The key problem of shock ignition scheme is to suppress energy loss by SBS backscattering and to reach high laser absorption without generation of too energetic hot electrons. The thesis shows that SBS may be suppressed by using ablator with multiple sorts of ions and also due to corona expansion. SRS is then enhanced and it leads to favorable hot electron spectrum that can boost the generated shock wave. The candidate's results were partly published in the journal High Power Laser Science and Engineering in 2019 and mainly in the journal Plasma Physics and Controlled Fusion in 2021.

The second part of the thesis is devoted to analytic studies and particle simulations of microscopic aspects of laser interaction with low-density solid porous materials that can be used as the outer layer of inertial fusion targets and also for other applications. Modeling of the interaction is very difficult due the very different scale lengths involved in the problem. Existing simplified models are not satisfactory, partly because of absence of the detailed laser interaction description. The candidate's research filling this gap was published in January 2023 in the journal Physics of Plasmas. His results were also used as a part of newly constructed multiscale model of laser interactions with low-density porous materials that has already been accepted for publication in Physics of Plasmas.

Mr. Sviatoslav Shekhanov is a young talented scientist with a very good background in mathematics and theoretical physics. He is also capable of carrying out large scale numerical simulations. He can formulate and setup up problems for numerical simulations, interpret the results and draw important conclusions. He has also ability to formulate and solve simplified analytical models providing valuable insights into physics problems. The submitted thesis clearly demonstrates his ability to conduct independent scientific research.

According to my opinion, the PhD thesis is well organized and written at high scientific and language levels. I strongly recommend the thesis to the defense. According to my opinion, Ph.D. degree should be awarded to Mr. Shekhanov after successful defense of the submitted thesis.

Prague, March 20, 2023

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