



**ICFO - The Institute of Photonic Sciences**  
Attoscience and Ultrafast Optics

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Barcelona, 14. September 2022 JB

**Evaluation of Habilitation entitled “Stimulated inelastic interactions between free electrons and light.”**

Dear Members of the Committee,

I very much enjoyed reading the habilitation of Dr. Kozak, which includes a methodical description of his scientific journey, since his doctorate, in trying to realize the old dream to control and accelerate electrons with intense coherent light fields.

Dr. Kozak has picked an exciting and crowded research topic: the strong field control over charged particles, in this case, electrons, based on well-controlled light waves. Specifically, it is possible to use near field effects to shape an electron wave packet in energy and momentum space, compress it, or accelerate it. Long-term applications would be direct participle acceleration, generation of x-ray pulses, or direct usage for time-space microscopy of condensed matter. The Habilitation thesis starts by describing the underlying physics very nicely, highlighting the issues in realizing light wave control over electrons. Dr. Kozak then describes a first experiment that showed some level of light wave manipulation of an electron beam. Exciting and impactful is the demonstration of transverse streaking of the electron pulse based on a nanostructure since it is a clear demonstration of near-field manipulation of the electron’s phase space. Equally exciting is his result that demonstrated attosecond signatures on the electron pulse in Ref. A8. While there is still some way to go to develop this method into an attosecond electron diffraction or imaging system, these are forefront results that raised lots of interest in the community. I especially liked the forward-looking approach to overcoming ubiquitous limitations of material damage by intense light fields. Especially intriguing is his idea to use noncollinear Compton scattering to place the interaction far from the surface, into the far field.

I judge the scientific level of the work of Dr. Kozak as excellent and forward-looking. Aside from my quick summary of the most impressive aspects of his thesis, I like to add that he has managed to make a real impact. This allows him to create a mark in this exciting field further. His work is very intriguing for real-world applications, particle acceleration, and sensing. It may very well have implications even for plasma accelerators.

The number of publications is appropriate and, as expected, for a habilitation in experimental physics, which requires the buildup of complex setups. The mentioned Turnitin plagiarism check is of no concern considering the cumulative type of submitted thesis. Overall, Dr. Kozak has a bright future ahead of himself, with manifold possibilities to bring exciting new

science to whatever place he chooses to work at. The research topic provides ample opportunities for high-impact science and further international collaborations. This research requires significant funding, but the subject also offers various opportunities to apply for calls or to form consortia.

In summary, it is with pleasure that I recommend that the Habilitation of the Faculty of Mathematics and Physics of Charles University be awarded to Dr. Kozak. I wish him all the best for an undoubtedly successfully continuing career.

Yours sincerely,



Prof. Dr. Jens Biegert

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