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Habilitations thesis Dr. Ondrej Pejcha

Dear Prof. Zdenek Dolezal: October 26, 2021

With this letter I am responding to your request, dated September 16, 2021, to act as referee for the Habilitations thesis submitted by Dr. Ondrej Pejcha and evaluate the scientific quality and impact of his work. With great pleasure I have read Dr. Ondrej Pejcha's habilitations thesis.

Summarising the content of my letter, I am pleased to write you that I judge the thesis very positively. Dr. Ondrej Pejcha has made very valuable and original scientific contributions to our field. I thus very enthusiastically recommend a positive evaluation. I will try to substantiate my reasoning below.

The thesis is a very impressive and extensive set of papers that the candidate produced during his time his employment at Charles University and earlier during his time at the Department of Astrophysical Sciences, Princeton University. The papers have been published in well respected and high quality journals that are considered high impact and high quality in our field. Overall the papers have made a large impact. The numbers of citations are high for theoretical studies by the standards of our field.

The main theme of the thesis concerns the physics of how stars live their lives and die. This is a particular hot topic at the moment in our field with many urgent unsolved questions. Renewed interest in these open questions was seeded by the recent direct detection of gravitational waves. It also accelerated by developments on the observational side. Several new telescopes and instruments are now probing the transient phenomena discussed in this thesis, the violent final explosions and exotic stellar mergers studied by Dr. Pejcha.

A large amount of progress occurred on the observational side, but a small number of scientists have been able to push forward the development of the theory. Dr. Pejcha is one of them and he is widely respected in the field for his contributions.

The first chapter of the thesis summarises several original and important contributions by Dr. Pejcha on how massive stars die and explode. They cover a variety of aspects of the problem, ranging from the role of neutrinos, the consequences for the black hole mass function and chemical yields. It also discusses consequences for what can be observed in the light curves of these supernovae. Of particular interest are those supernovae that interact with circum-stellar matter which can lead to enhanced brightening.

The second chapter discusses topics that relate to the the fascinating processes that can occur when two stars form a binary system where the stars can interact, exchange mass and change each others fate forever. In particular, it addresses what happens when two stars are so close and so large that one or both fill the critical volume called the Roche volume. This can lead to a situation where two stars share a common envelope. Many aspects of the physics of this are not yet understood, but Dr. Pejcha has made some very important contributions to this problem.

I am particularly excited by Dr. Pejcha's work on transients that can be produced in binary systems. This can either be, as Dr. Pejcha showed, cool and luminous events when the two stars merge or bright events when one of the stars explodes as a supernovae interacting with material previously ejected by the binary system.

I have reviewed the outcome of the plagiarism check and I see absolutely no problems there. The high percentage of coincidence in this check is simply due to the fact that Dr. Pejcha's dissertation is a collection of reprints of several published papers previously and co-authored by Dr. Pejcha.

Therefore, after reading his papers and considering the quality and impact of his work, I can only strongly recommend a positive evaluation of the habilitation thesis.

Yours sincerely,

Selma E. de Mink
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p.s. You kindly addressed me with the title of professor. I am scientific director at the Max Planck Institute for astrophysics. As we are a pure research institution and not an university department, I do not currently formally hold the title of professor. I only hold the title of Dr. at this moment. I thought it may be best to mention this in case this matters for the evaluation procedure at your university.