HUMBOLDT-UNIVERSITÄT ZU BERLIN

Report on the PhD thesis of Marek Liška

In this dissertation, the PhD candidate Marek Liška presents the core of the research and results developed during his doctoral studies. I find it relevant to highlight that the candidate has achieved more results in additional research projects during this period, showing the quality and productivity of the candidate.

The dissertation summarized the results in the exploration of how thermodynamics can shed some light on the structure of the theory of gravity and the underlying quantum theory of gravity. After setting the historical background in thermodynamics of spacetime in the introduction, the first chapter is devoted to reviewing an alternative theory of gravity (Weyl transverse gravity) that in on an equal footing as general relativity as regards the physical solution and construction from a field theory perspective. After the detailed review, it is presented the original work in constructing a covariant formalism for this theory that results in a consistent formulation of thermodynamics in that framework. In the second chapter the original results on finding the gravitational dynamics from thermodynamics tools are presented, showing the affinity of these results with Weyl transverse gravity in comparison with general relativity. In the third chapter, the semiclassical analysis of gravity from thermodynamics is extended to show new results on the phenomenology of quantum gravity in a completely general framework, to end up in the last chapter showing the first results of this phenomenology when applied to a cosmological model.

The approach of this research project is not only very original but also points toward a new research direction that is gaining attention in the field and showing wide and ambitious future perspectives. Thus marking a turning point with this research work. As the supervisor of this PhD project, I also want to remark that Marek Liška has accomplished achievements far beyond expectations. He has performed very hard work, getting complex mathematical skills a deep knowledge of the topic and growing very fast his independence as a researcher. He also not only developed the proposed project but also came up with new ideas and research directions, leading the work in some of the international collaborations he established during this period.

With all of this, I consider Marek Liška an excellent PhD candidate and researcher and his presented PhD thesis at the very top of high-quality dissertations.

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