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Supervisor's report on the PhD thesis by Petr Kotlařík

The PhD thesis by Petr Kotlařík deals with the fields of stationary black holes, thin discs and rings in classical general relativity. It mainly focuses on computing the total field of a black hole encircled by a disc or a ring. Despite clear astrophysical motivation by accreting black holes, the thesis rather concerns mathematical methods, specifically on how to obtain the solution in a closed form (rather than in terms of infinite series). In a static setting, the metric is described by two metric functions, the first representing the gravitational potential and the second given by integration from the potential's gradient. The thesis demonstrates that *both* functions can be obtained in closed form in certain important cases. In a stationary setting, the problem is more involved and a perturbation approach has been employed, both on the level of metric and on the level of curvature (the method of Debye superpotential applied to the Teukolsky equation).

Petr studied theoretical physics and always belonged to the best students of his class. He already contributed to several papers as a master student. Still, at the beginning of PhD, he hesitated whether to embark on an academic carrier, given its "excellence emphasis", somewhat stressing competitiveness and general uncertainty. I felt it as a breaking point when he took, independently of my suggestions, one of my older papers (on thin

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discs with power-law radial density profiles) and solved the problem in a much more elegant way. From that moment, he has performed as one of our best students ever. Petr started collaborating with my younger colleague David Kofroň, which has already brought several valuable results. The collaboration had also been the core of a GACR project which was given high marks by the referees (yet finally was not supported due to the limited GACR budget).

Besides writing –or contributing to– research papers, Petr presented his results at international meetings and seminars many times. In December 2023 he received one of the outstanding-presentation awards at the 32nd Japanese Workshop on General Relativity and Gravitation (JGRG32, 2023, Nagoya University). In 2021-2023 Petr was the PI of the prestigious START student grant, within which he very succesfully coordinated the work of four other PhD students (of whom Lukáš Polcar and Viktor Skoupý are now postdocs at our Institute). Petr helped younger students, most notably with the Mathematica software in which he has become an expert. Parallel to his PhD work, he also taught physics at a secondary school.

As a summary, I may just say it has been great pleasure to be supervising Petr Kotlařík's PhD study. He has significantly contributed to the investigation of stationary sources of gravitation, in particular black holes, discs and rings. I have no doubt that his PhD thesis deserves to be defended successfully, and that Petr has shown sufficient scientific maturity to be awarded the PhD title.

Oldřich Semerák
supervisor