Report on the Habilitation Dissertation of q Dr. Peter Kabáth.

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Plagiarism

I have gone through the originality check of the thesis done by the Turnitin system and accept the dissertation as an original work of the author.

Main Report

Petr Kabáth is a globally recognized researcher in the field of exoplanets, an expert in instrumentation, data analysis, and exoplanet discoveries, confirmation, and characterization. He has authored his habilitation theses on the topic of ground-based spectroscopic follow-up observations of exoplanets. The dissertation summarizes the potential of spectroscopic programs based on telescopes in the 2-4-meter size range, primarily focusing on confirmation programs, stellar characterization possibilities, and atmospheric studies. This overview is based on Petr Kabáth's previously published articles, which greatly support the feasibility of the outlined programs from a practical perspective, as well as significantly validate the efficiency of ongoing programs.

In the introduction of the dissertation, we encounter a historical overview of exoplanet discovery, focusing on comparing our knowledge before and after the era of space-based massive photometry. This narrative is intriguing and would merit further development in its finer details, potentially exploring significant milestones such as ground-based photometric survey programs, CoRoT, Kepler, K2, TESS, and CHEOPS, or considering temporally overlapping stages with their unique added value comprehensively. However, the present overview also serves as a foundation for establishing the narrative of the theses, as the primary subject therein is spectroscopic observations and follow-ups, for which the mentioned programs primarily provide background and context.

The core of the thesis focuses on ground-based follow-up of transiting planet candidates from space missions, particularly utilizing the OES spectrograph on the Perek 2m telescope in the Czech Republic. The PLATOSpec on La Silla will be an effective instruments to follow-up PLATO planets from La Silla (Kabáth et al. 2022).

The demonstration of the OES instrument (Kabath et al. 2020) in discriminating between binary and exoplanet-hosting stars is quantitatively sound and marks the results of a major hardware+software+science development work. 2-meter size telescopes are readily available for confirmation work, and at least pre-filtering of candidates that can go to 8-meter telescope programs later. To demonstrate the power of the project, Kabath et al. (2022) highlight significant gas giant discoveries with the OES, showcasing the potential of 2m-class telescopes with precise RV measurements, particularly the young and inflated planet TOI-2046b. Kabath (2022) reported on the confirmation of three hot Jupiters, including OES in the follow-up surveys. Kabath et al. (2019) represents the first attempt to detect chemistry in exoplanetary atmospheres with small telescopes, offering a framework for future observers, though pandemic disruptions may have affected follow-up plans.

The thesis also involves photometric studies (Furth et al. 2012, Caceres et al. 2014, many photometry aspects of most publications behind the thesis).

In other publications (Caceres et al. 2014, Sabotta et al. 2019, Zak et al. 2019) we read about the astrochemistry applications of 2-4 meter telescopes, and while this part lacks an all-around feasibility context, we see evidence for the concept in the form of successful transmission spectroscopy of selected close-in Jupiters (Zak et al. 2019, Caceres et al.2014). The concept is therefore valuable, especially because of its possible filler nature incorporated to the main science programs of the telescopes within the network.

Like many similar situations, assessing the Candidate's contribution to the results of scientific articles is more challenging when the Candidate is not the first author in these articles. Here, I missed a statement that would aid in determining the Candidate's contribution; although it is helpful to see Petr Kabáth as the second author in these cases, which ensures that the achievements reported in the paper are very much related to the candidate's work as well. If and when the Candidate's active supervisors are among the first authors, this also helps to understand the assessment; however, we do not receive information regarding this aspect (negative information can also be derived, for example, if the dissertation indicates the Candidate's supervisors).

Concerning the structure of the Theses, it was a bit confusing to see some preprints in the appendix (where the proper reference is problematic), and I think that the Content of the Theses should include a direct reference to the publications listed in the Table of Contents directly (in the form of continuously renumbered pages or simply numbered items) for the sake of easy searchability.

A final remark: the earliest report on the Neptune desert is by Szabó & Kiss (2011), called the sub-Jupiter desert there. Since then, there have been many (on the order of dozen) processes invoked to explain how the desert formed, which processes are summarized, e.g., in Szabó et al. 2023 (A& A 671, 132) here. The main line of the processes invoked here has significant aspects with atmospheric chemistry; therefore, the elaboration and feasibility demonstration of possible exoatmosphere projects related to the Neptune desert may also be a scope of further developments of the atmospheric studies.

Overall Conclusions

The results were inventive, original, significant, and highly valuable. The methodology behind the work is well elaborated and solid, and the results are conclusive.

Dr. Szab
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