

HABILITATION THESIS REVIEWER'S REPORT

Masaryk University	
Faculty	Faculty of Science
Procedure field	Theoretical Physics and Astrophysics
Applicant	Ernst Paunzen, Dr.rer.nat
Applicant's home unit, institution	Institute of Theoretical Physics and Astrophysics, Masaryk University
Habilitation thesis	<i>The Δa photometric system</i>
Reviewer	Dr. Martin Stift, Associate Professor, retired
Reviewer's home unit, institution	Universitat Wien, A-1010 Wien Kuffner Sternwarte, A-1160 Wien

This habilitation thesis is an impressive piece of work, almost encyclopedic in its scale, carefully compiled, thoroughly argued, featuring an excellent bibliography and -- especially gratifying for the reader -- well presented. For someone mainly familiar with the early days of the Δa photometric system, it is amazing to realize how this system has evolved over more than 4 decades, maturing from a tool initially intended only for the study of galactic CP2 stars to a system useful for different types of stars, among them λ Bootis, Be, Herbig Ae/Be stars, Blue Stragglers etc. A fair number of scientists has contributed to these advances, but arguably Dr. Paunzen has played a special role at the side of Prof. H.-M. Maitzen (the inventor of the Δa system) in the development and better understanding of this valuable astrophysical tool.

Beginning at the start of the century, using CCD based Δa photometry, Dr. Paunzen embarked on a program aimed at detecting peculiar stars in galactic open clusters with the goal to improve statistics and among others to understand the relationship between stellar age and peculiarity. Following the first photometric detection of classical CP stars in the Magellanic Clouds (MC) by Maitzen, Paunzen et al. successfully extended this investigation, increasing the sample, detecting not only CP stars but also Be/Ae stars. The occurrence of magnetic CP stars in the LMC was shown to be only about half of that in the Milky Way. Not restricting himself to photometry, back in 2011 Paunzen carried out the first spectroscopic verification of an extragalactic classical CP star. Later he demonstrated how to establish B[e] candidate stars in the MC and he was able to show that AGB stars in the MC can easily be detected on the basis of their Δa index; he also pioneered Δa observations of globular clusters.

In the context of this dedication to CP stars, Dr. Paunzen has worked on a number of connected problems such as theoretical isochrones for the Δa system to derive parameters like age, reddening and distance modulus for open clusters. He has been involved in synthetic Δa photometry, has looked at the effect of microturbulence on the color-magnitude diagram, established an empirical temperature calibration for the Δa system ..., indicating a healthy interest in both observations *and* theory.

All of this remarkable activity, past and present, is appropriately reflected in the habilitation thesis. We find extensive discussions of the numerous observational results in our Galaxy and the Magellanic Clouds. There are sections dealing with the detection probabilities for CP1 to CP4 stars, Be/shell stars and supergiants, various simulations concern the effects of individual abundance patterns or of magnetic line blanketing on the Δa index, different Δa -like photometric systems are explored with the help of spectrophotometry. Whatever one could possibly want to know about the Δa system can be readily found in this habilitation thesis with its overwhelming amount of information put together -- in highly readable form -- for the first time. Adding to this the fact that according to the SAO/NASA Astrophysics Data System (ADS), some 130 refereed papers by Dr. Paunzen have been published in the MNRAS and in A&A, about 50 of which feature him as first author, there can be no doubt that Dr. Paunzen's work in general and this habilitation thesis meet the highest astronomical standards

Reviewer's questions for the habilitation thesis defence (number of questions up to the reviewer)

no questions

Conclusion

The habilitation thesis entitled "*The Δa photometric system*" by Dr. Ernst Paunzen **fulfils** the requirements expected of a habilitation thesis in the field of Theoretical Physics and Astrophysics.

01.03.2021

