
PROF. DR. WOLF-RAINER HAMANN
Institut für Physik und Astronomie
Astrophysik
Telefon: 0331/977-1053
Telefax: 0331/977-5935
Email: wrh@astro.physik.uni-potsdam.de
Universität Potsdam * Campus Golm, Haus 28 * 14476 Potsdam * Germany



17. September 2013

Prof. Dr. Mikulasek
Masaryk University
Department of Theoretical Physics and Astrophysics
Kotlarska 2
CZ-61137 Brno
Tschechien

Subject: Habilitation Dr. J. Kubát - reader's report

Dear Prof. Mikulasek,

I have carefully read the Habilitation Thesis by Dr. Jiří Kubát entitled

Hot stars and their atmospheres

According to the *Astrophysical Data System* (ADS), Dr. Kubat has so far published – as first author or as co-author – 169 papers in total. 69 of these papers appeared in refereed journals. 21 papers, nearly all of them published in the high-impact european journal *Astronomy and Astrophysics*, have been selected for this cumulative habilitation thesis. In 13 of these papers, Dr. Kubát is the first or even the only author. Since these papers have passed the critical assessments of international referees, their scientific relevance and quality is already independently confirmed.

The thesis consists of an introductory text and an accumulation of 21 publications which appeared between 1994 and 2012. While these papers are re-printed here in chronological sequence, the introductory text puts them into their scientific context.

The main emphasis of Dr. Kubát's work is on stellar atmospheres of hot stars, i.e. under conditions where thermodynamical equilibrium is not a valid approximation (non-LTE). The basic equations and algorithms are nicely summarized in, e.g., Paper 19. More details on Kubat's own non-LTE-code are published in Papers 1, 3, 7, and 11.

A major problem in calculating non-LTE model atmospheres is the consistent solution of the energy equation. Neither the integral form (i.e. the local energy balance) nor the differential form (flux conservation) leads to a numerically stable algorithm. As an alternative, Kubát suggested to employ the "thermal balance" method (Paper 8) where the energy conservation is applied to the pool of the free electrons. From my point of view, this paper is a very important contribution to the field.

A couple of papers study properties and effects that were encountered in the theoretical model calculations, for instance the effects of spherical symmetry versus plane-parallel symmetry in different types of stars (Papers 2,5, and 9), the impact of different hydrogen-to-helium ratios (Paper 6), the absence of metals in Population III stars (Paper 21), or the irradiation effect in binaries (Hadrava and Kubát 2003 - not among the selected papers).

Dr. Kubát is involved in large number of papers devoted to the *application* of his non-LTE models for the analysis of observed stellar spectra. Remarkably, many of these works are based on observations which were obtained at the 2m-telescope in Ondřejov. Among the studied objects are, e.g., Be stars (Paper 16, 18, and others not in this compilation) and multiple systems (Paper 4, 20, and others).

The atmospheres of hot stars often show dynamic phenomena, such as disks and winds. In a couple of papers, mainly done together with his students, Dr. Kubát studied the non-LTE radiative transfer in multi-dimensional geometries (e.g. Papers 15 and 17). In radiation-driven stellar winds, the radiative transfer must be treated together with the hydrodynamical problem. Various aspects of these complex questions have been studied in Papers 10, 12, 13, and 14. The effects of additional X-ray sources in such winds and of wind inhomogeneities have been investigated in recent publications which are not included in the present habilitation theses.

In the last section of his introductory text, Dr. Kubát comments on the astrophysical curriculum at the University Brno. This show that he is also an engaged and experienced teacher. A remarkable number of his students continued their carreer in astrophysics.

Summarizing, Dr. Kubát documented in his habilitation thesis his impressive scientific work. He is also known to lead a productive group. I was actually surprised to learn that he still has to pass this habilitation, because I thought that he is working on a Professor's level since long.

I have no doubts that the thesis presented by Dr. Jiří Kubát meets the standard requirements for a habilitation in the field of Theoretical Physics and Astrophysics.

Sincerely,



(Prof. Dr. Wolf-Rainer Hamann)