

IAU Symposium

301

19–23 August 2013

Wroclaw, Poland

Proceedings of the International Astronomical Union

# Precision Asteroseismology

*Edited by*

Joyce A. Guzik

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ISSN 1743-9213

International Astronomical Union



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# PRECISION ASTEROSEISMOLOGY

IAU SYMPOSIUM No. 301

## *COVER ILLUSTRATION:*

Photograph of Wojtek Dziembowski taken in August 2010 by science historian and journalist Dr. Andrzej M. Kobos. Dr. Kobos conducted an interview with Wojtek as one of a series of interviews of members of the Polish Academy of Arts and Sciences (in Polish: Polska Akademia Umiejętności, PAU, <http://pau.krakow.pl/index.php/en/>) published by Kobos.

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INTERNATIONAL ASTRONOMICAL UNION  
UNION ASTRONOMIQUE INTERNATIONALE

International Astronomical Union



# PRECISION ASTEROSEISMOLOGY

PROCEEDINGS OF THE 301st SYMPOSIUM OF  
THE INTERNATIONAL ASTRONOMICAL UNION  
HELD IN WROCLAW, POLAND  
AUGUST 19–23, 2013

Edited by

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UNIVERSITY PRESS

CAMBRIDGE UNIVERSITY PRESS  
The Edinburgh Building, Cambridge CB2 2RU, United Kingdom  
32 Avenue of the Americas, New York, NY 10013 2473, USA  
10 Stamford Road, Oakleigh, Melbourne 3166, Australia

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First published 2014

Printed in the United Kingdom by CPI Group (UK) Ltd, Croydon, CR0 4YY

Typeset in System L<sup>A</sup>T<sub>E</sub>X 2 $\epsilon$

*A catalogue record for this book is available from the British Library*

*Library of Congress Cataloguing in Publication data*

This journal issue has been printed on FSC-certified paper and cover board. FSC is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. Please see [www.fsc.org](http://www.fsc.org) for information.

ISBN 9781107045170 hardback  
ISSN 1743-9213

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## Preface

The IAU Symposium 301 on *Precision Asteroseismology* was held in Wrocław, Poland, from the 19th to the 23rd of August 2013. This was also the 21st pulsation meeting, and the first to receive the status of an IAU Symposium. These meetings started in Los Alamos in 1971, and very quickly became a regular tradition for the stellar pulsation community. The Astronomical Institute of Wrocław University took great pleasure in hosting this conference, in particular because it was also an opportunity to celebrate the scientific opus of Wojtek Dziembowski.

The science motivation of this conference centred around seismic studies of pulsating stars which, in the era of high-precision data, is one of the most rapidly developing branches of astrophysics. Owing to photometric observations made by space missions such as *MOST*, *CoRoT*, and *Kepler*, and to high-resolution, high-signal-to-noise spectroscopic observations from the ground, the numbers of known oscillation frequencies of distant stars have increased by orders of magnitude, and new classes of pulsators have become available for seismic studies.

The program of the Symposium was divided into seven sessions: the five main sessions, a special session and a splinter session. Each session was accompanied by interesting and fruitful discussions. The program consisted of 35 invited talks, 28 contributed talks and 75 posters. The Symposium gathered 145 participants from 26 countries all over the world. There were 56 women, i.e., almost 40% of participants.

This conference discussed what physics is missing from stellar structure and evolution theory, and how analysis of stellar oscillation data provides insights to improve our models of stars. In particular the following questions/problems were addressed: How can we make best use of rich, but irregular, oscillation spectra? Where do limits to the application of asteroseismology lie, and what inferences can be made on the underlying physics? How will these data help to solve the problems and uncertainties in stellar physics? How far are we from unravelling the mode-selection mechanism? Are we still missing something from predictions of astrophysical opacities (an announcement of the new opacity bump near  $\log T = 5.06$  was made at the meeting)?

The other vital subject raised during the Wrocław Symposium was the efficiency of convection and its interaction with pulsation. Moreover, the most recent understanding of the role of rotation, magnetic fields and element mixing in pulsation excitation was presented. During the last day, the synergies between helio- and asteroseismology were discussed as well as the prospects for seismic studies of planet-hosting stars.

From the observational side, we heard about the results on pulsating variables from the massive ground-based surveys, OGLE, ASAS and Araucaria, as well as recent seismic results from three space missions, *MOST*, *CoRoT* and *Kepler*. At the time of the meeting, some preliminary results from two new asteroseismic projects were also presented. The first is the *BRITE* mission, a Canadian-Austrian-Polish project of six nanosatellites aiming to obtain for the first time two-colour space photometry of bright pulsating stars. The second project is SONG, a network of telescopes that will collect Doppler velocity data for asteroseismology (and also detect planets by gravitational lensing).

The symposium honoured Wojtek Dziembowski, one of the world's leaders in the study of solar and stellar pulsations. He is a pioneer in the research of non-radial oscillations of stars and in carrying out non-adiabatic calculations of such oscillations. Twenty years ago he succeeded in explaining pulsations in main-sequence B-type stars, which resolved a long-standing problem for the field. On the second day of the Symposium, we held a



special session devoted to Wojtek. There were talks by colleagues recalling previous collaborations and highlights: “*Some memories of collaboration with Wojtek*” by Phil Goode and Alexander Kosovichev and on “*Ups and downs in understanding stellar variability*” by Wojtek Dziembowski. After that, a very interesting discussion took place between Wojtek and the audience, titled “*Questions, Answers & Advice*”. It was a great pleasure and privilege to have such a special opportunity to celebrate the great scientific opus of Wojtek.

On the third day of the Symposium, we held a splinter session on “*Asteroseismology, standard candles and the Hubble Constant: what is the role of asteroseismology in the era of precision cosmology?*” This session was proposed and chaired by Hilding Neilson. There were several presentations highlighting progress in the field and setting the stage for open discussion on how asteroseismology can advance our understanding of the distance scale and help to measure the Hubble constant.

The Symposium was also a forum for two public lectures to disseminate the knowledge of asteroseismology and to communicate its role for understanding our place in the Universe. These public talks were given by two of the best speakers within the pulsation community: Joyce Guzik on “*The origin and fate of the Sun and helioseismology*”, and Don Kurtz on “*Planets and pulsations: The new Keplerian revolution*”.

In closing, we would like to thank once again all the participants for coming and making this Symposium possible. Many thanks to all invited speakers for giving impressive and engrossing talks as well as to the participants who delivered contributed talks or presented posters that helped to broaden the scientific exchange at the meeting. The members of the Scientific Organizing Committee are acknowledged for their work on setting the conference program and important comments on the proposal for the IAU Symposium. Special thanks are also due to Gerald Handler for his significant contribution to the preparation of the IAU Symposium proposal. Finally, we are very grateful to the members of the Local Organizing Committee for their huge efforts on organizing the Wrocław Symposium.

Post-symposium thanks go to all authors for their contributions and to the editors of the proceedings of the IAU Symposium 301 for their hard work. We believe that for many of us this volume will be an important memento for many years.

*Jadwiga Daszyńska-Daszkiewicz & Hiromoto Shibahashi, SOC chairs*

*Wrocław, Tokyo, November 4, 2013*

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### Acknowledgements

The symposium is sponsored and supported by the IAU Division G (Stars and Stellar Physics); and by the IAU Commissions No. 27 (Variable Stars) and No. 35 (Stellar Constitution).

The Local Organizing Committee operated under the auspices of the Instytut Astronomiczny, Uniwersytet Wrocławski.

Funding by the  
International Astronomical Union,  
Ministerstwo Nauki i Szkolnictwa Wyższego  
and  
Fundacja Astronomii Polskiej im. M. Kopernika,  
is gratefully acknowledged.

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