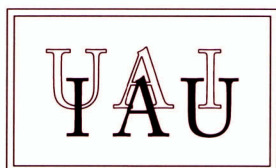
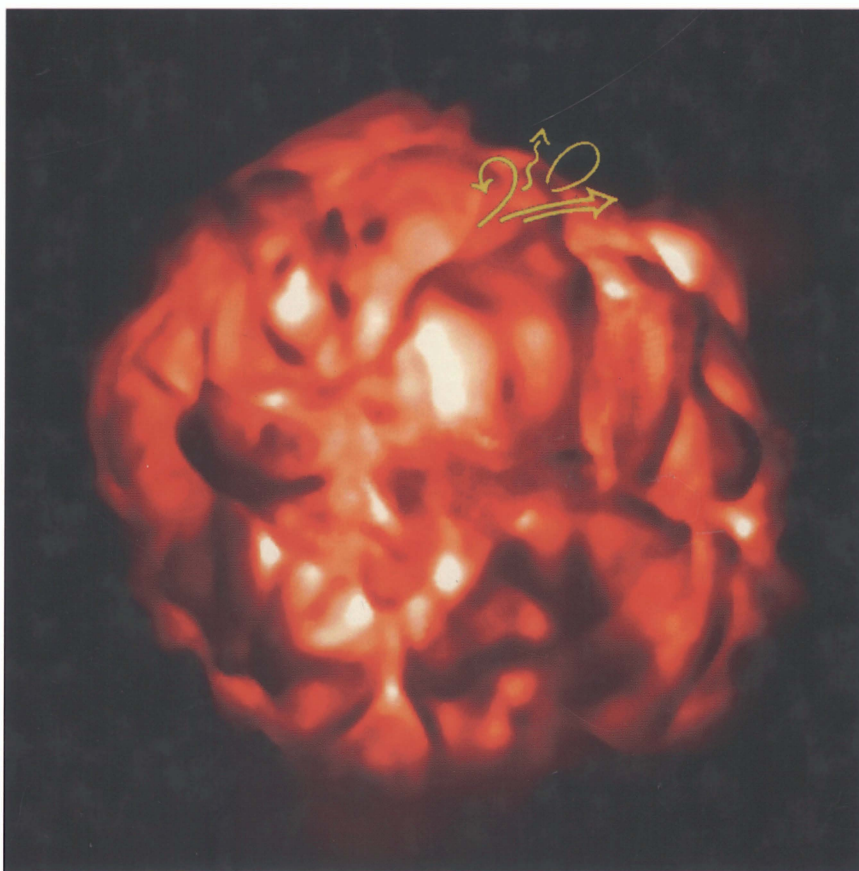


INTERNATIONAL ASTRONOMICAL UNION

SYMPOSIUM NO. 210

MODELLING OF STELLAR ATMOSPHERES

Edited by: N. PISKUNOV, W. W. WEISS and D. F. GRAY



INTERNATIONAL ASTRONOMICAL UNION

PUBLISHER
ASTRONOMICAL SOCIETY OF THE PACIFIC

MODELLING OF STELLAR ATMOSPHERES

IAU SYMPOSIUM VOLUME 210

COVER ILLUSTRATION:

Cover figure represents intensity image of a 3D model of Betelgeuse (courtesy of Bernd Freytag and Susanne Höfner)

ASTRONOMICAL SOCIETY OF THE PACIFIC

390 Ashton Avenue – San Francisco – California – USA 94112-1722

Phone: (415) 337-1100

E-Mail: catalog@astrosociety.org

Fax: (415) 337-5205

Web Site: www.astrosociety.org



ASP-CS VOLUMES & IAU PUBLICATIONS - EDITORIAL STAFF

Managing Editor: D. H. McNamara

Production Manager: Enid L. Livingston

PO Box 24463, Room 211 - KMB, Brigham Young University, Provo, Utah, 84602-4463

Phone: (801) 422-2111 Fax: (801) 422-0624 E-Mail: pasp@byu.edu

LaTeX-Computer Consultant: T. J. Mahoney (Spain) – tjm@ll.iac.es

**A listing of all other IAU Volumes published by
the Astronomical Society of the Pacific, is cited at the back of this volume**

INTERNATIONAL ASTRONOMICAL UNION

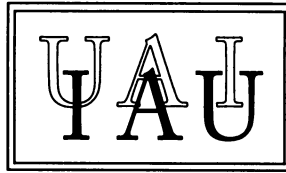
98bis, Bd Arago – F-75014 Paris – France

Tel: +33 1 4325 8358

E-mail: iau@iap.fr

Fax: +33 1 4325 2616

Web Site: www.iau.org



MODELLING OF STELLAR ATMOSPHERES

Proceedings of the 210th Symposium
of the International Astronomical Union held at
Uppsala University, Uppsala, Sweden
17-21 June 2002

Edited by

N. Piskunov

Uppsala University, Uppsala, Sweden

W. W. Weiss

University of Vienna, Vienna, Austria

and

D. F. Gray

University of Western Ontario, London, Ontario, Canada

© 2003 by International Astronomical Union All Rights Reserved

No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means – graphic, electronic, or mechanical including photocopying, taping, recording or by any information storage and retrieval system, without written permission from the IAU.

Library of Congress Cataloging in Publication Data
Main entry under title

LOC #: 2003115044
ISBN: 1-58381-160-5

IAU Publications - First Edition

Published on behalf of IAU by: The Astronomical Society of the Pacific

Printed in United States of America by Sheridan Books, Ann Arbor, Michigan

Contents

| | |
|---------------------------------|------|
| Preface | ix |
| Conference Photograph | x |
| Participants | xiii |

Session A. Current Status of Modelling

| | |
|---|----|
| The Current Status in the Modelling of Stellar Atmospheres | 3 |
| <i>B. Gustafsson</i> | |
| Highlights of Stellar Modeling with PHOENIX | 19 |
| <i>E. Baron, P. H. Hauschildt, F. Allard, E. J. Lentz, J. Aufdenberg, A. Schweitzer and T. Barman</i> | |
| Stratified NLTE Model Atmospheres for Hot Stars | 33 |
| <i>S. Dreizler and S. L. Schuh</i> | |
| A Few Things We Do Not Know About Stars and Model Atmospheres | 45 |
| <i>R. L. Kurucz</i> | |
| Round Table Summary: Problems in Modelling Stellar Atmospheres | 47 |
| <i>F. Castelli</i> | |

Session B. Radiative Transfer

| | |
|--|-----|
| 3D NLTE Radiative Transfer – Current Status and Future Prospects | 51 |
| <i>M. Carlsson</i> | |
| NLTE Line-Blanketed Model Stellar Atmospheres | 67 |
| <i>T. Lanz, I. Hubeny and S. R. Heap</i> | |
| NLTE Radiative Transfer and Model Atmospheres of Hot Stars . . . | 81 |
| <i>K. Werner</i> | |
| NLTE Radiative Transfer in the Extended Atmospheres and Winds of Cool Stars | 93 |
| <i>P. D. Bennett, G. M. Harper, A. Brown and J. L. Linsky</i> | |
| Round Table Summary: Radiative Transfer Problems | 107 |
| <i>N. Piskunov</i> | |

Session C. Convection

| | |
|---|-----|
| Energy Transport, Overshoot, and Mixing in the Atmospheres of Very Cool Stars | 113 |
| <i>H.-G. Ludwig</i> | |
| Modelling Stellar Magnetoconvection | 127 |
| <i>N. O. Weiss</i> | |
| Non-local Convection Models for Stellar Atmospheres and Envelopes | 143 |
| <i>F. Kupka</i> | |
| Simulation of Solar Magnetoconvection | 157 |
| <i>A. Vögler, S. Shelyag, M. Schüssler, F. Cattaneo, T. Emonet and T. Linde</i> | |
| Solar Surface Magnetoconvection | 169 |
| <i>R. F. Stein and Å. Nordlund</i> | |
| Convection and the Relevant Problems of Stellar Structure, Evolution and Oscillations | 181 |
| <i>D. R. Xiong and L. Deng</i> | |

Session D. Atmospheric Inhomogeneities

| | |
|---|-----|
| A New View of the Magnetic Sun | 195 |
| <i>A. Title</i> | |
| Statistical Properties of Magnetic CP Stars | 209 |
| <i>S. Bagnulo</i> | |
| Dynamical Behavior of the Upper Solar Photosphere | 221 |
| <i>R. J. Rutten</i> | |
| Helical Surface Structures | 233 |
| <i>A. Brandenburg and E. G. Blackman</i> | |
| Astrophysical Spectropolarimetry and Magnetic Field Diagnostics . | 243 |
| <i>J. Trujillo Bueno</i> | |

Session E. Comparison with Observations

| | |
|---|-----|
| Atomic Physics Data for Stellar Atmospheres Research | 261 |
| <i>C. R. Cowley, S. J. Adelman and D. J. Bord</i> | |
| Stellar Abundance Analyses in the Light of 3D Hydrodynamical Model Atmospheres | 273 |
| <i>M. Asplund</i> | |
| Stellar Photospheres: Success, Failure, Ambiguity, & Ambition . . . | 287 |
| <i>D. F. Gray</i> | |
| Observational Evidence for the Stratification of Chemical Abundances in Stellar Atmospheres | 301 |
| <i>T. Ryabchikova, G. A. Wade and F. LeBlanc</i> | |

| | |
|---|-----|
| Round Table Summary: Stellar Interferometry as a Tool to Investigate Atmospheres and to Compare Observations with Models <i>M. Wittkowski</i> | 313 |
| Round Table Summary: Comparison of Different NLTE Codes and the Role of Atomic Input Data <i>I. Kamp, S. Korotin, L. Mashonkina, N. Przybilla and S. Shimansky</i> | 323 |
| Round Table Summary: Instrumentation and Data Processing . . . <i>S. J. Adelman, I. Bikmaev, A. F. Gulliver and B. Smalley</i> | 337 |
| Session F. Winds – Cool and Pulsating Stars | |
| Dynamical Atmospheres and Winds of AGB stars <i>S. Höfner, C. Sandin, B. Aringer, A. C. Andersen, U. G. Jørgensen, R. Gautschy–Loidl, W. Nowotny and J. Hron</i> | 353 |
| Interferometric Observations of Mira Variables <i>G. van Belle, R. R. Thompson, M. J. Creech-Eakman</i> | 367 |
| Maser Observations of Cool Stars <i>E. M. L. Humphreys</i> | 377 |
| Modelling the Mass Loss of Cool AGB Stars <i>P. Woitke</i> | 387 |
| Round Table Summary: Winds and Pulsating Stars <i>L. A. Willson</i> | 403 |
| Closing Remarks <i>J. D. Landstreet</i> | 413 |
| List of Posters | 423 |
| Author Index | 433 |
| Subject Index | 437 |
| Object Index | 441 |