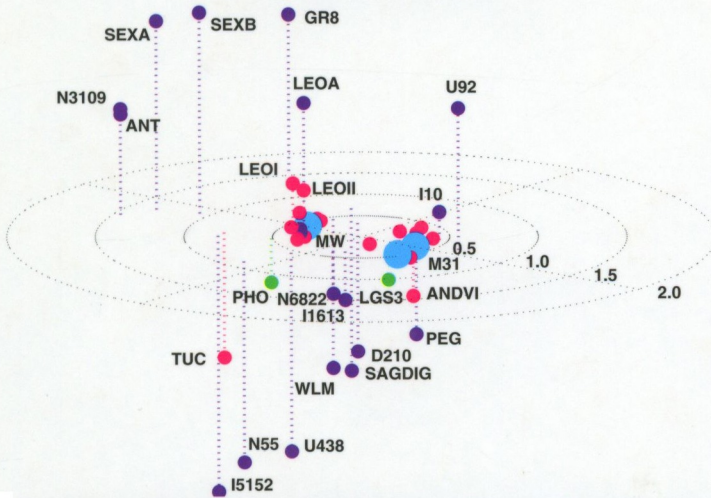




VARIABLE STARS IN THE LOCAL GROUP IAU Colloquium 193



Edited by
Donald W. Kurtz and Karen R. Pollard

VARIABLE STARS IN THE LOCAL GROUP

IAU Colloquium 193

COVER ILLUSTRATION:

The top image of the cover illustration is a color diagram of the Local Group of Galaxies (see this volume, Antonio Aparicio, pages 19-30, Figure 2).

The bottom image of the cover photograph shows the location of Mt. John University Observatory, operated by the University of Canterbury, Christchurch, New Zealand. The Observatory is sited above the township of Lake Tekapo and the lake of the same name. There are currently three telescopes at the Observatory: one with an aperture of 1.0-m and two with apertures of 0.6-m. The photo was taken by Glen Coates of Kahu Publishing (www.kahupublishing.co.nz).

**A SERIES OF BOOKS ON RECENT DEVELOPMENTS IN
ASTRONOMY AND ASTROPHYSICS**

Publisher

THE ASTRONOMICAL SOCIETY OF THE PACIFIC

390 Ashton Avenue, San Francisco, California, USA 94112-1722
Phone: (415) 337-1100 E-Mail: orders@astrosociety.org
Fax: (415) 337-5205 Web Site: www.astrosociety.org

ASP CONFERENCE SERIES - EDITORIAL STAFF

Managing Editor: D. H. McNamara
Associate Managing Editor: J. W. Moody
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

ASP CONFERENCE SERIES PUBLICATION COMMITTEE:

Joss Bland-Hawthorn
George Jacoby
James B. Kaler
J. Davy Kirkpatrick

**A listing of all of the ASP Conference Series Volumes and IAU Volumes
published by the ASP may be found at the back of this volume**

**ASTRONOMICAL SOCIETY OF THE PACIFIC
CONFERENCE SERIES VOLUMES**



Volume 310

VARIABLE STARS IN THE LOCAL GROUP
IAU Colloquium 193

Proceedings of a Colloquium held at
University of Canterbury, Christchurch, New Zealand
6-11 July 2003

Edited by

Donald W. Kurtz

*Centre for Astrophysics, University of Central Lancashire
Preston PR1 2HE, United Kingdom*

*Laboratoire d'Astrophysique, Observatoire Midi-Pyrénées
14 avenue Edouard Belin, 31400 Toulouse, France*

and

Karen R. Pollard

*Department of Physics and Astronomy, University of Canterbury
Private Bag 4800, Christchurch, New Zealand*

© 2004 by Astronomical Society of the Pacific. 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 Astronomical Society of the Pacific .

Library of Congress Cataloging in Publication Data
Main entry under title

Card Number: 2004101206
ISBN: 1-58381-162-1

ASP Conference Series - First Edition

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

Contents

Preface	xiv
Participants	xvii
Conference Photograph	xxv
Part 1. Introductory reviews	
New theoretical developments in stellar pulsation	3
<i>Jørgen Christensen-Dalsgaard (Keynote speaker)</i>	
The Nature of the Local Group	19
<i>Antonio Aparicio (Keynote speaker)</i>	
Part 2. What variable stars tell us about the Local Group, including the distance scale	
The DIRECT Project	33
<i>Lucas M. Macri (Invited speaker)</i>	
Using Local Group galaxies to investigate the influence of blending on Cepheid distances and the cosmological distance scale	41
<i>Barbara J. Mochejska, Lucas M. Macri, Dimitar D. Sasselov, Krzysztof Z. Stanek</i>	
Long Period Variables in the Magellanic Clouds: the OGLE/MACHO/2MASS/DENIS view	46
<i>Martin Groenewegen</i>	
Period- <i>K</i> magnitude relations of variable stars in the LMC	50
<i>Yoshifusa Ita, Toshihiko Tanabé, Noriyuki Matsunaga, Yoshikazu Nakada, The IRSF/SIRIUS team</i>	
Red variables in the OGLE-II database: first results for the LMC	55
<i>L.L. Kiss, T.R. Bedding</i>	

Distance scale, variable stars and stellar populations in Local Group galaxies	60
<i>G. Clementini, L. Baldacci, A. Bragaglia, E. Carretta, L. Di Fabrizio, R.G. Gratton, C. Greco, M. Gullieuszik, E.V. Held, M. Maio, M. Marconi, F. Matonti, Y. Momany, E. Poretti, L. Rizzi, I. Saviane, E. Taribello</i>	
Variable stars in M31 from the MEGA survey	65
<i>David R. Alves, Edward A. Baltz, Arlin Crotts, Alex Bergier, Patrick Cseresnjés, Alan Gersch</i>	
Variable star monitoring in local group dwarf irregular galaxies	70
<i>Jan Snigula, Claus Gössl, Ulrich Hopp, Heinz Barwig</i>	
New results on OGLE Cepheids and PL relations in the LMC and SMC	75
<i>A. Udalski (Invited speaker)</i>	
Variable stars from two surveys of microlensing in M31	83
<i>Arlin P.S. Crotts, Richard P. Boyle, Christopher J. Corbally, and the MEGA Collaboration</i>	
The Araucaria project – improving stellar distance indicators	87
<i>Grzegorz Pietrzyński, Wolfgang Gieren</i>	
NGC 6822: short period variable stars, stellar population and distance scale	91
<i>Lara Baldacci, Luca Rizzi, Gisella Clementini, Enrico V. Held</i>	
An application of Bayesian statistics to the extragalactic Cepheid distance scale	95
<i>Thomas G. Barnes III, Thomas J. Moffett, W.H. Jefferys, Amy D. Forestell</i>	
Radial velocities, metallicities, and distances of Cepheids in M31 and M33	99
<i>Amy D. Forestell, Thomas G. Barnes III, Christopher Sneden, Thomas J. Moffett</i>	
Light curves and absolute magnitudes of four recent fast LMC novae . .	103
<i>J.B. Hearnshaw, C.M. Livingston, A.C. Gilmore, P.M. Kilmartin</i>	
Dust enshrouded AGB stars in the LMC	107
<i>Kenneth H. Hinkle, Richard R. Joyce, Tuan Do</i>	
Part 3. Variable stars as tracers of different stellar populations – galactic and globular clusters, LMC/SMC and Local Group galaxies	
RR Lyrae variables in globular clusters and nearby galaxies	113
<i>M. Catelan (Invited speaker)</i>	
Multiperiodic RR Lyrae stars in the Galactic Bulge and the SMC	124
<i>Tomasz Mizerski</i>	
The kinematics and zero point of the $\log P - \langle M_K \rangle$ relation for galactic field RR Lyrae variables via statistical parallax	128
<i>A.K. Dambis, O.V. Vozyakova</i>	

Short and long period variable stars in the Carina dwarf Spheroidal galaxy	133
<i>M. Monelli, A.R. Walker, G. Bono, R. Buonanno, F. Caputo, M. Castellani, V. Castellani, C.E. Corsi, M. Dall’Ora, L. Pulone, M. Marconi, V. Ripepi, M. Nonino, H.A. Smith, P.B. Stetson</i>	
AGB maser stars as tracers of stellar populations	138
<i>H.J. Habing (Invited speaker)</i>	
AGB variables in globular clusters	144
<i>T. Lebzelter, P. Wood, K.H. Hinkle, R. Joyce, F. Fekel</i>	
AGB stars in the Magellanic Clouds and in other members of the Local Group	149
<i>Maria-Rosa L. Cioni</i>	
A census of AGB stars in the Milky Way and M31 subgroups of dwarf-spheroidal galaxies	153
<i>F. Kerschbaum, B. Heiling, W. Nowotny, Ch. Spindler, H. Olofsson, H.E. Schwarz</i>	
Age dependence of the vertical distribution of Cepheids	158
<i>A.K. Dambis</i>	
A Variable Star Survey of the Open Cluster NGC 2126	162
<i>A. Derekas, L.L. Kiss, T.R. Bedding, A. Gáspár, K. Sárnecky, Gy.M. Szabó, M. Váradi, S. Kaspi, Cs. Kiss</i>	
Double-radial-mode SX Phoenicis stars in the globular clusters NGC 5466 and M71	166
<i>Young-Beom Jeon, Myung Gyoon Lee, Seung-Lee Kim, Ho Lee</i>	
The effect of stellar evolution on the light curves’ shapes of RR Lyrae stars in M3	171
<i>Johanna Jurcsik</i>	
WWW-Based Fourier coefficient database – A status report	176
<i>Siobahn M. Morgan</i>	
The distance to the Large Magellanic Cloud from first overtone RR Lyrae variables	180
<i>A.V. Muzzin, C.M. Clement, D.R. Alves, & The MACHO Collaboration</i>	
The distribution of novae in the Magellanic Clouds	184
<i>Raquel Yumi Shida, William Liller</i>	
Near-Infrared photometry of the LMC cluster Reticulum	189
<i>M. Dall’Ora, G. Bono, J. Storm, V. Ripepi, V. Testa, G. Andreuzzi, R. Buonanno, F. Caputo, V. Castellani, C.E. Corsi, S. Degl’Innocenti, G. Marconi, M. Marconi, M. Monelli</i>	

Part 4. Early-type stars: B, A and F pulsators

<i>g</i> -mode pulsations in slowly pulsating B stars	195
<i>P. De Cat (Invited speaker), J. Daszyńska-Daszkiewicz, M. Briquet, M.-A. Dupret, R. Scuflaire, J. De Ridder, E. Niemczura, C. Aerts</i>	

Latitude distribution of nonradial pulsations in rapidly rotating B stars	204
<i>S. Jankov, P. Mathias, A. Domiciano de Souza Jr., K. Uytterhoeven, C. Aerts</i>	
Pulsational velocity fields in the atmospheres of two roAp stars HR 1217 and γ Equ	208
<i>M. Sachkov, T. Ryabchikova, O. Kochukhov, W.W. Weiss, P. Reegen, J.D. Landstreet</i>	
Pulsating white dwarfs as astrophysical tools	212
<i>Denis J. Sullivan (Invited speaker)</i>	
Asteroseismology of the β Cep star ν Eri: initial results	221
<i>G. Handler, C. Aerts, and an international team of 50 astronomers</i>	
β Cephei and SPB stars in the Large Magellanic Cloud	225
<i>Z. Kołaczkowski, A. Pigulski, I. Soszyński, A. Udalski, M. Szymański, M. Kubiak, K. Zeburń, G. Pietrzyński, P.R. Woźniak, O. Szewczyk, L. Wyrzykowski (the OGLE team)</i>	
Multisite spectroscopic and photometric observations of the pulsating sdB star PG 1605+072	230
<i>S.J. O'Toole, S. Falter, U. Heber, C.S. Jeffery, S. Dreizler, S.L. Schuh, the MSST and WET teams</i>	
HST/STIS observations of sdBV stars: testing diffusion and pulsation theory	234
<i>S.J. O'Toole, U. Heber, P. Chayer, G. Fontaine, D. O'Donoghue, S. Charpinet</i>	
First results of Mercator observations of variable B stars	238
<i>P. De Cat, J. De Ridder, K. Uytterhoeven, G. Davignon, G. Raskin, J. Cuypers, C. Schoenaers, J. Daszyńska-Daszkiewicz, C. Aerts, H. Van Winckel, M. Ausseloos, E. Broeders, W. De Meester, J. Vanautgaerden, R. Van Malderen, B. Vandebussche, B. Acke, G. Decin, L. Decin, K. Kolenberg, T. Maas, S. De Ruyter, M. Reyniers, T. Reyniers, C. Van Kerckhoven, C. Waelkens</i>	
Pulsating stars in the open cluster NGC 1817	242
<i>T. Arentoft, L.M. Freyhammer, M.Y. Bouzid, C. Sterken, S. Frandsen</i>	
Short-term instabilities in γ Velorum: a search for strange modes in variable stars	247
<i>John Bentley, P.L. Cottrell</i>	
The periods of the β Cephei star κ Scorpii as observed by WIRE	251
<i>J. Cuypers, D. Buzasi, K. Uytterhoeven</i>	
On application of multi-colour photometry of δ Scuti stars	255
<i>J. Daszyńska-Daszkiewicz, W.A. Dziembowski, A.A. Pamyatnykh</i>	
Chemical abundances of β Cephei stars from low- and high-resolution UV spectra	259
<i>Jadwiga Daszyńska-Daszkiewicz, Ewa Niemczura</i>	

First results of Mercator observations of variable A and F stars	263
<i>J. De Ridder, J. Cuypers, P. De Cat, K. Uytterhoeven, C. Schoenaers, G. Davignon, G. Raskin, J. Vanautgaerden, E. Broeders, W. De Meester, R. Van Malderen, S. De Ruyter, B. Vandenbussche, T. Maas, K. Kolenberg, M. Reyniers, G. Decin, B. Acke, M. Ausseloos, C. Aerts, H. Van Winckel, C. Waelkens</i>	
Mode Selection Mechanism in B-Type Pulsators: Observational Clues	267
<i>Mikołaj Jerzykiewicz</i>	
Nonadiabatic observables in main sequence δ Scuti stars	271
<i>A. Moya, R. Garrido, M.A. Dupret</i>	
Spectroscopy of southern δ Scuti stars	275
<i>Malcolm Cropp, Karen R. Pollard, Jovan Skuljan</i>	
Re-classification of ROTSE-I δ Scuti stars	279
<i>H. Jin, S.-L. Kim, C.-U. Lee, D.-J. Lee, K.-S. Kim</i>	
Direct detection of multiple periods in variable stars	283
<i>C. Schoenaers, J. Cuypers</i>	
Line profile variations in γ Equ: A puzzle	287
<i>Hiromoto Shibahashi, Don Kurtz, Eiji Kambe, Douglas Gough</i>	
Part 5. Red Giants, Miras, post-AGB stars and proto-planetary nebulae	
Properties of AGB variables in the intermediate-age cluster NGC 419 in the SMC	295
<i>Toshihiko Tanabé (Invited speaker), Yoshifusa Ita, Noriyuki Matsunaga, Yoshikazu Nakada, IRSF/SIRIUS team</i>	
AGB variables as distance indicators	304
<i>Michael Feast (Invited speaker)</i>	
Metallicity effects in Mira variables: a model study	313
<i>M. Scholz, P.R. Wood</i>	
Red supergiants in the Small Magellanic Cloud: The effects of metallicity on narrow-band classification indices	317
<i>Robert F. Wing, Kyle M. Walker, D. Jack MacConnell, Edgardo Costa</i>	
The long secondary periods in semi-regular variables	322
<i>P.R. Wood, A.E. Olivier, S.D. Kawaler</i>	
Interferometry of pulsating red giants from 0.65 to 3.5 microns	327
<i>Michael Ireland, Peter Tuthill, Gordon Robertson, Timothy Bedding, Andrew Jacob, John Monnier, William Danchi</i>	

Observational properties of red variables in the LMC	332
<i>M. Takeuti, S. Noda, F. Abe, I.A. Bond, R.J. Dodd, J.B. Hearnshaw, M. Honda, M. Honma, J. Jugaku, Y. Kan-ya, Y. Kato, P.M. Kilmartin, Y. Matsubara, K. Masuda, Y. Muraki, T. Nakamura, K. Ohnishi, M. Reid, N.J. Rattenbury, To. Saito, Y. Saito, H. Sato, M. Sekiguchi, J. Skuljan, D.J. Sullivan, T. Sumi, R. Yamada, T. Yanagisawa, P.C.M. Yock, M. Yoshizawa</i>	
Time variations of IR spectra and dust properties in carbon-rich Mira variables	336
<i>Hyun-il Sung, Sang-gak Lee</i>	
Spectroscopic and photometric properties of red stars in the bar of the Large Magellanic Cloud	340
<i>Tom Lloyd Evans</i>	
Spectra of RV Tauri stars in the Large Magellanic Cloud	344
<i>Tom Lloyd Evans, Karen R. Pollard</i>	
Multiperiodicity in pulsating red giants	348
<i>J.R. Percy, A.G. Bakos, G. Besla, D. Hou, V. Velocci, G.W. Henry</i>	
Spectroscopic and photometric monitoring of southern post-AGB stars	353
<i>D.J. Pooley, P.L. Cottrell, K.R. Pollard, M.D. Albrow</i>	
Period Changes in Miras	357
<i>Chris Koen, Fred Lombard</i>	
Part 6. Binary stars and pulsation	
Eclipsing binaries in local group galaxies: Physical properties of the stars and calibration of the zero-point of the cosmic distance scale	363
<i>Edward F. Guinan, Ignasi Ribas, Edward L. Fitzpatrick</i>	
An overtone Cepheid variable in an LMC eclipsing binary	372
<i>D. Lepischak, D.L. Welch</i>	
Cepheid Masses: FUSE Observations of S Mus	377
<i>Nancy Remage Evans, Derck Massa, Alexander Fullerton, George Sonneborn, Rosina Iping</i>	
Pulsating white dwarfs in cataclysmic variables: The marriage of ZZ Cet and dwarf nova	382
<i>Brian Warner, Patrick A. Woudt</i>	
The Be star omicron Cassiopeiae	387
<i>Pavel Koubský, Hasan Ak, Petr Harmanec, Stephenson Yang, Hrvoje Božić</i>	
Precessing accretion discs in binary systems	391
<i>Alon Retter, Alexander Liu, Marc Bos</i>	
High resolution spectroscopy of the triple system 20 Leo	395
<i>Y. Frémat, P. Lampens, H. Hensberge, T. Arentoft, P. De Cat, R. Garrido, L. Parrao, J.H. Peña, P. Mathias, P. Van Cauteren</i>	

Preliminary photometric study of a pulsating component in the eclipsing binary AB Per	399
<i>S.-L. Kim, S.-G. Kwon, D.J. Lee, C.-U. Lee, H. Jin, J.W. Lee</i>	
A spectroscopic study of southern binary Cepheids	403
<i>O.K.L. Petterson, Michael D. Albrow, P.L. Cottrell, A. Fokin</i>	
Photometry of eclipsing binary stars in the Large and Small Magellanic Clouds	407
<i>Glenn P. Bayne, W. Tobin, J.D. Pritchard, K.R. Pollard, M.D. Albrow</i>	
 Part 7. Chemical composition of variable stars	
Element stratification in main sequence stars and its effect on stellar oscillations	413
<i>Sylvie Vauclair (Invited speaker)</i>	
Seismic tests of accretion in central stars of planetary systems	422
<i>Michaël Bazot, Sylvie Vauclair</i>	
The effect of metallicity on the Cepheid period-luminosity relation . . .	426
<i>Martino Romaniello, Francesca Primas, Marta Mottini, Martin Groenewegen</i>	
The chemical composition and circumstellar environment of the variable star QY Sge	430
<i>Aruna Goswami, N. Kameswara Rao, D.L. Lambert</i>	
Determining the metallicity of Cepheid stars in the SMC, LMC and the Galaxy	435
<i>Marta Mottini, Francesca Primas, Martino Romaniello, Martin Groenewegen</i>	
Decoupling of helium in the winds of chemically peculiar stars	439
<i>Jiří Kubát, Jiří Krtička</i>	
 Part 8. New theoretical developments in stellar pulsation and variability	
Theory of magneto-acoustic modes in roAp stars	445
<i>Lionel Bigot (Invited speaker)</i>	
Nonlinear radial pulsations for hot 20- M_{\odot} models	453
<i>Benjamin A. Austin, Joyce A. Guzik, Kate M. Despain, Matthew R. Templeton</i>	
Non-adiabatic asteroseismology of near-main sequence variable stars . .	458
<i>M.-A. Dupret</i>	
Does extreme mixing improve frequency agreement for δ Scuti stars? . .	462
<i>Joyce A. Guzik, Benjamin A. Austin, Paul A. Bradley, Arthur N. Cox</i>	

Mode identification using photometry and spectroscopy	466
<i>Joris De Ridder, Conny Aerts, Marc-Antoine Dupret</i>	
Non-adiabatic seismic study of the thin convective envelope of δ Scuti stars	470
<i>M.-A. Dupret, A. Grigahcène, R. Garrido, J. Montalbán, M. Gabriel, R. Scuflaire</i>	
The first theoretical γ Doradus instability strip	474
<i>Anthony B. Kaye, Phillip B. Warner, Joyce A. Guzik</i>	
Eigenfunctions of axisymmetric p-modes in the presence of a dipole magnetic field: Observational consequences	478
<i>Hideyuki Saio, Alfred Gautschy</i>	
Application of the Riccati Method to the adiabatic oscillations of stars .	483
<i>M. Takata, W. Löffler</i>	
Part 9. Evolutionary and pulsation properties of variable stars	
Evolutionary properties of intermediate-mass stars	489
<i>Santi Cassisi (Invited speaker)</i>	
Nonradial pulsations in classical Cepheids of the Magellanic Clouds . .	498
<i>Paweł Moskalik, Zbigniew Kołaczkowski, Tomasz Mizerski</i>	
The Period-Radius relation: Classical Cepheids and RR Lyrae stars . .	502
<i>M. Marconi, G. Bono, T.E. Nordgren</i>	
Analysis of Long-Term Single-Site Observations of the Pulsating DB White Dwarf GD 358	506
<i>P.A. Bradley</i>	
R Coronae Borealis stars	511
<i>Ljiljana Skuljan (Invited speaker), Peter L. Cottrell</i>	
VINCI/VLTI interferometric observations of Cepheids	520
<i>N. Nardetto, P. Kervella, D. Mourard, D. Bersier, V. Coudé du Foresto</i>	
The luminosities of horizontal branches and RR Lyrae stars in globular clusters	525
<i>D.H. McNamara, M.B. Rose, P.J. Brown, D.I. Ketcheson, J.E. Maxwell, K.M. Smith, R.C. Wooley</i>	
Magellanic Cloud novae and the peak magnitude vs rate-of-decline relationship	530
<i>William Liller, Raquel Yumi Shida</i>	
Magnetic models can not explain the Blazhko effect in RR Lyrae stars .	535
<i>M. Chadid, G.A. Wade, S.L.S. Shorlin, J.D. Landstreet</i>	
A multi-site study of the extreme helium star V2076 Oph	539
<i>D.J. Wright, P.L. Cottrell, A.E. Lynas-Gray, D. Kilkeny, R. Shobbrook</i>	
Dynamical phasing of Type II Cepheids	543
<i>J.A. McSaveney, K.R. Pollard, P.L. Cottrell</i>	

The Galactic Cepheid Period-Luminosity relation from Hipparcos parallaxes and proper motions	547
<i>William D. Heacox</i>	
Part 10. Our future in space	
Asteroseismology with COROT	553
<i>Gérard Vauclair (Invited speaker)</i>	
The study of δ Scuti stars in the transition era from ground-based to space photometry	560
<i>Rafael Garrido, Ennio Poretti</i>	
Preparing the COROT space mission: Building a photometric and variability database of stars in its field of view	564
<i>P.J. Amado, R. Garrido, E. Poretti, E. Michel</i>	
Part 11. Data analysis and reduction techniques	
The reliability of echelle spectroscopy in hot rotating star research . . .	571
<i>Petr Škoda, Miroslav Šlechta</i>	
HRSP – A dedicated echelle reduction software package for Hercules . .	575
<i>Jovan Skuljan</i>	
Part 12. Meeting Summary	
IAU Colloquium 193 - A personal view	581
<i>S.D. Kawaler (Invited review speaker)</i>	
Author Index	590
Object Index	594