

WHITE DWARFS AND VARIABLE DEGENERATE
STARS

IAU Colloquium No. 53

edited by

L.M. Van Horn and V. Weidemann

White Dwarfs And Variable Degenerate Stars

IAU Colloquium No. 53
Edited by H. M. Van Horn and V. Weidemann

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

Colloquium No. 53

WHITE DWARFS
AND
VARIABLE DEGENERATE STARS

Held in Rochester, New York, U.S.A., 30 July - 2 August, 1979

* * * * *

Fourth Annual Workshop

on

NOVAE, DWARF NOVAE

AND

OTHER CATAclysmic VARIABLES

Held in Rochester, New York, U.S.A., 3 August, 1979

* * * * *

EDITED BY

H.M. VAN HORN
Department of Physics
and Astronomy and
C.E. Kenneth Mees Observatory
University of Rochester
Rochester, N.Y. U.S.A.

and

V. WEIDEMANN
Institut für Theoretische
Physik und
Sternwarte der Universität
Kiel University
Kiel, F.R. Germany

Published by
The University of Rochester
1979

TABLE OF CONTENTS

Dedication	ii
Jesse L. Greenstein	iii
Editor's Preface	v
Introduction	vi
The Organizing Committees	ix
List of Participants	x
Table of Contents	xiii

COLLOQUIUM SESSION I

Masses, Radii, Temperatures, Luminosities, and Surface Compositions of White Dwarfs, J.L. GREENSTEIN	1
Evolution of White Dwarfs and Their Physics, G. SHAVIV	11
Gravity Indicators in DB White Dwarfs, D.T. WICKRAMASINGHE	35
Masses of DB Degenerate Dwarfs, V. TRIMBLE	41
Improved Secular Stability Limits for Rotating White Dwarfs, R.H. DURISEN and J.N. IMAMURA	43
Evolution of a Degenerate Component in a Close Binary System, E.V. ERGMA	48
Collapse of White Dwarfs in Close Binary Systems, R. CANAL and J. ISERN	52
Collapse of Accreting White Dwarf to Form a Neutron Star, K. NOMOTO, S. MIYAJI, D. SUGIMOTO, and K. YOKOI	56
Metal Abundances in Hot White Dwarfs: Predictions of the Diffusion Theory, G. VAUCLAIR and S. VAUCLAIR	61

COLLOQUIUM SESSION II

Extreme Ultraviolet Observations of Hot White Dwarfs, S. BOWYER	66
Spectra of White-Dwarf Stars at Wavelengths $< 3000\text{\AA}$: A Theoretical Perspective, H.L. SHIPMAN	86
IUE Observations of White Dwarfs and Hot Subdwarfs, J.E. OKE	107
Middle- and Far-Ultraviolet Observations of Hot White Dwarfs, S.B. PARSONS, J.D. WRAY, and K.G HENIZE	109
The Energy Distribution of Sirius B, E. BÖHM-VITENSE	114
Spectrophotometry of Hot White Dwarfs from the Palomar- Green Survey, R.F. GREEN and J.W. LIEBERT	118
Some Properties of Hot, High-Gravity, Pure Helium Atmospheres, F. WESEMAEL and H.M. VAN HORN	125
New Model Atmospheres for DB White Dwarfs and Comparison with Observations, D. KOESTER	130
Hard X-Ray Properties of Cataclysmic Variables, J. SWANK	135
Spectroscopy of WZ Sagittae, C.C. BRUNT and J.A.J. WHELAN	139
Effects of Nuclear Burning on X-Ray and UV Emission from Accreting Nonmagnetic Degenerate Dwarfs, G.J. WEAST, R.H. DURISEN, J.N. IMAMURA, N.D. KYLAFIS, and D.Q. LAMB	140
Simultaneous Ultraviolet and Optical Spectrophotometry of Dwarf Novae, G.T. BATH J.E. PRINGLE, and J.A.J. WHELAN	145

COLLOQUIUM SESSION III

The Luminosity Function and Evolution of Cool White Dwarfs, J. LIEBERT	146
Metal Abundances in Cool White Dwarfs and the Diffusion Theory, G. VAUCLAIR	165
The Spectra and Colors of Cool White Dwarfs, M.S. BESSELL, D.T. WICKRAMASINGHE, and P.L. COTTRELL	179

Spectrum Analysis of the Cool White Dwarfs G128-7 and G165-7, R. WEHRSE and J. LIEBERT	184
"Carbon-Rich" White Dwarfs, I. BUES	186
Carbon in the Envelopes of White Dwarfs, F. D'ANTONA	188
Diffusion Coefficients in Dense Plasmas, G. FONTAINE and G. MICHAUD	192
Diffusion in White Dwarfs, D. MUCHMORE	197
Diffusion of Heavy Ions in Convective Envelopes, with Implications for the Masses of White Dwarfs, C. ALCOCK	202
COLLOQUIUM SESSION IV	
Origin and Distributions of White Dwarfs, V. WEIDEMANN	206
Structure and Composition of White Dwarf Atmospheres and Convection Zones, K.-H. BOHM	223
Statistical Investigations of the Luminosity Distribution of the Spectroscopic White Dwarf Sample, E.M. SION	245
Four Color Photometry of DB White Dwarfs, G. WEGNER	250
The Eclipsing Binary System LB 3459, D. KILKENNY, A.E. LYNAS-GRAY, and R.W. HILDITCH	255
White Dwarf Candidates in the Globular Cluster NGC 6752, H.B. RICHER	259
Close Binary (and Pulsating) Nuclei of Planetary Nebulae, H.E. BOND	266
Hydrogen and Helium Burning in the Degenerate Envelopes of C-O Dwarfs, E.V. ERGMA and A.V. TUTUKOV	269
On the Time-Scale for Turn-Off of a Nova After the Outburst, S. STARRFIELD	274
General Theory for Shell Flash and Nova Explosion of Accreting White Dwarfs, D. SUGIMOTO, M.Y. FUJIMOTO, K. NARIAI, and K. NOMOTO	280
Helium Shell-Flashes in Accreting White Dwarfs, M.Y. FUJIMOTO and D. SUGIMOTO	285

Nova Outburst Due to Accretion of H-Rich Matter onto White Dwarfs, G.S. KUTTER and W.M. SPARKS	290
Nova Outbursts Due to Accretion from Rotating H-Rich Disks Onto White Dwarfs, W.M. SPARKS and G.S. KUTTER	294

COLLOQUIUM SESSION V

The Magnetic Fields of Single White Dwarfs, J.D. LANDSTREET	297
Magnetic White Dwarfs with Strong Fields and the Origin of Magnetism in White Dwarfs and Neutron Stars, J.R.P. ANGEL	313
On the Spectrum of Feige 7, D.T. WICKRAMASINGHE and B. MARTIN	317
The Quadratic Zeeman Effect for CI Lines - Application to the Spectrum of EG 129, I. BUES	322
Photometry of AM Her Stars - Line and Continuum Emission, P. SZKODY	324
Observational Characteristics of Circular and Linear Polarization of AM Herculis Objects as Detected in the Optical Region, S. TAPIA	329
"Two New States" of VV Puppis, N. VISVANATHAN and D.T. WICKRAMASINGHE	330
Absorption by Cyclotron Harmonics in the Optical Spectrum of VV Puppis, H.S. STOCKMAN, J. LIEBERT, and H.E. BOND	334
Cyclotron Emission from the Shock-Heated Region of AM Herculis, G. CHANMUGAM	341

COLLOQUIUM SESSION VI

The Observational Properties of the ZZ Ceti Stars, E.L. ROBINSON	343
Vibrational Instabilities and Pulsational Properties of Cool White Dwarfs, W. DZIEMBOWSKI	359
Spectra of Variable White Dwarfs, J.L. GREENSTEIN	374
Historical Records of ZZ Ceti Variables, M.H. LILLER and J.E. HESSER	376

PG 1159-035: A New, Hot, Non-DA Pulsating Degenerate, J.T. MCGRAW, S.G. STARRFIELD, J. LIEBERT, and R. GREEN	377
Radial Pulsation Analyses of DA Dwarfs, S. STARRFIELD, A.N. COX, and S.W. HODSON	382
Instability of g-Mode Oscillations in White Dwarf Stars, D.A. KEELEY	388
The Location of the ZZ Ceti Stars on the Hertzsprung- Russell Diagram, J.P. COX and C. J. HANSEN	392
Non-Radial Oscillations in Rotating White Dwarfs, J. PAPALOIZOU and J.E. PRINGLE	397
Analysis of the Soft X-Ray Pulsations of Dwarf Novae, F.A. CORDOVA	398
Quasi-Periodic and Periodic Oscillations in the Dwarf Nova AH Her, J.G. DUTHIE and R.S. McMILLAN	403
Theory and Observations of Accretion Disk Spectra, S.K. MAYO, D.T. WICKRAMASINGHE, and J.A.J. WHELAN	404
Two-Fluid Calculations with Conduction of X-Ray Emission from Accreting Nonmagnetic Degenerate Dwarfs, J.N. IMAMURA, R.H. DURISEN, D.Q. LAMB, and G.J. WEAST	406
The Accretion Disk in DQ Her, J.A. PETERSON	412

COLLOQUIUM SESSION VII

White Dwarfs in Cataclysmic Binaries, B. WARNER	417
The Formation of White Dwarfs in Close Binary Systems, R.F. WEBBINK	426
IUE Ultraviolet Spectra of V Sagittae, R.H. KOCH, M.J. SIAH, and M.N. FANELLI	448
The Orbital Period of G 61-29, R.E. NATHER, E.L. ROBINSON, and R.J. STOVER	453
WZ Sge: Recent Observations Leading to a Model for Superhump Phenomena, R.L. GILLILAND and E. KEMPER	458
CH Cygni - A White Dwarf and M-Giant Binary with Transient Accretion Disk, L. LUUD	459

Radiative Transfer in Nova Envelopes, R.P. HARKNESS	464
Theoretically Inferred Masses of the White Dwarf Components of Common Nova Systems, J.W. TRURAN	469
Comments on the Evolution and Origin of Cataclysmic Binaries, C.A. WHYTE and P.P. EGGLETON	474
The Equilibrium of Degenerate Configurations, Z.F. SEIDOV	478
X-Ray Emission from Degenerate Dwarfs, N.D. KYLAFIS, D.Q. LAMB, and A.R. MASTERS	483
Radial Velocities of SS Cygni, R.J. STOVER	489

* * * *

ABSTRACTS OF WORKSHOP PAPERS ON DWARF NOVAE

The Parallaxes of U Gem Variables, K.W. KAMPER	494
A Spectroscopic Survey of Cataclysmic Variables, H.E. BOND	495
SS 433 - The Ultimate Cataclysmic Variable?, J. FAULKNER, R.L. GILLILAND, and E. KEMPER	496
Observations of Southern Dwarf Novae, N. VOGT	497
Polarization of Dwarf Novae and Novalike Variables, P. SZKODY, J. MICHALSKY, and G. STOKES	498
Z Cam at Standstill and in Eruption, A.L. KIPLINGER	499
Radial Velocity Variations of the Secondary Star in U Geminorum, R.A. WADE	500
A Diagnostic for Models of U Geminorum, B. PACZYNSKI, A. SCHWARZENBERG-CZERNY, and C. ALCOCK	501
An Analysis of the Light Curves of Z Cha, J. SMAK	502
Z Cha - Another Case of Gravitational Radiation?, H. RITTER	503
Minimum Orbital Period of Cataclysmic Variables, B. PACZYNSKI and W. KRZEMINSKI	504
Dwarf Nova EX Hydrae, N. VOGT, W. KRZEMINSKI, and C. STERKEN	505

AAVSO's Astronomical Data Bank, J. A. MATTEI	506
Soft X-Ray Observations of Cataclysmic Variable Stars, F. CORDOVA	507
X-Ray Emission from Cataclysmic Variables, D.Q. LAMB	508
A Possible Identification of the Quasi-Periodic Oscillations in Dwarf Novae, D.E. WINGET, F. WESEMAEL, and H.M. VAN HORN	509
Time-Dependent Accretion Disks in Dwarf Novae, G.T. BATH and J.E. PRINGLE	510
Rapid Oscillations in DQ Her and UX U Ma, J.A. PETERSON	518
A Rapidly Rotating White Dwarf in AE Aquarii, J. PATTERSON	519

ABSTRACTS OF WORKSHOP PAPERS ON NOVAE

Problems in Common Envelope Evolution as a Pre-Stage of Cataclysmic Variables, F. MEYER and E. MEYER-HOFMEISTER	520
What Determines the Speed Class of a Nova?, M.M. SHARA, D. PRIALNIK, and G. SHAVIV	521
Ultraviolet Studies of Novae, M. FRIEDJUNG and B. ROCCA	522
Interpretation of Radio Observations of FH Serpentis, M. FRIEDJUNG	523
Can We Identify Pre-Novae?, V. TRIMBLE	524
Recurrence of Nova Explosions, K. NARIAI and K. NOMOTO	525
He ³ as the Recurrent Nova Trigger Mechanism, M.M. SHARA	526
Radiation Pressure in Nova Ejecta, J.W. YOUNGER	527
Magnetic Guiding of Mass Flow in Eruptions of Cataclysmic Variables, F. MEYER	528
Nova Explosion of Mass Accreting White Dwarfs, K. NOMOTO, K. NARIAI, and D. SUGIMOTO	529
Accreting Double Shell Source Degenerate Stars, E.M. SION	530
The Effect of a Close Binary Companion on a Nova Outburst, J. MACDONALD	531

Defining Characteristics of Fast Novae, J.W. TRURAN	532
Nucleosynthesis During Nova Explosions and Grain Formations in Ejected Envelopes, M.Y. FUJIMOTO	533
Is the Outburst of U Scorpii an Accretion Event?, R.F. WEBBINK	534