

TABLE OF CONTENTS

The Organizing Committees	xii
Preface	xiii
Group Photograph	xv
List of Participants	xix
I. OBSERVATIONAL DATA ON NEBULAE	
<u>Invited presentations</u>	
Recent UV and Optical Observations of Planetary Nebulae <i>S. Torres-Peimbert</i>	1
Infrared Observations of Galactic Planetary Nebulae <i>A. Preite-Martinez</i>	9
Radio Images of Planetary Nebulae <i>Y. Terzian</i>	17
New and Misclassified Planetary Nebulae <i>L. Kohoutek</i>	29
Catalogues of Planetary Nebulae <i>A. Acker</i>	39
<u>Contributed presentations</u>	
Narrow Band Photometry and Mapping of the Planetary Nebulae NGC 6210 and NGC 7009 <i>E. E. Mendoza, C. Chavarría-K, and V. M. Arévalo</i>	49
New Observations of Planetary Nebulae S22 and YM29 <i>V. P. Arkhipova, T. A. Lozinskaya, E. I. Moskalenko, and T. G. Sitnik</i>	50
Two Southern Low Excitation Planetary Nebulae <i>H. Moreno, A. Gutiérrez-Moreno, and G. Cortés</i>	51
Spectroscopic Survey of Planetary Nebulae <i>A. Acker, J. Köppen, and B. Stenholm</i>	52
The Probable Low Excitation Planetary Nebula M3-44 <i>A. Gutiérrez-Moreno, H. Moreno, and G. Cortés</i>	53
Optical and Infrared Observations of the Peculiar Planetary Nebula He2-442 <i>V. P. Arkhipova, V. F. Yesipov, and B. F. Yudin</i>	54
The Photometric (<i>UBV</i>) Study of the Planetary Nebula Variability in 1968 - 1987 <i>E. B. Kostyakova</i>	55
The Photometric and Spectral Variability of the Planetary Nebula IC 4997 <i>E. B. Kostyakova</i>	56
Planetary Nebula He 2-467 Turned out to be the Symbiotic Star with a Period about 500 Days. <i>V. P. Arkhipova and R. I. Noskova</i>	57
Infrared Energy Distribution of Selected Planetary Nebulae <i>P. Persi, A. Preite-Martinez, and M. Ferrari-Toniolo</i>	57
Near Infrared Photometry of Compact Planetary Nebulae <i>M. Peña and S. Torres-Peimbert</i>	58
The Near Infrared Spectrum of NGC 7027 <i>J.-P. Baluteau and D. Pequignot</i>	59
A VLA Radio Continuum Survey of Planetary Nebulae <i>A. Zijlstra, S. R. Pottasch, and C. Bignell</i>	60
A New Planetary Nebula <i>E. Capellaro, M. Turatto, and F. Sabbadin</i>	61
Is NGC 2242 a New Planetary Nebula? <i>L. Jiying, H. Yongwei, and F. Xingchun</i>	62

Planetary Nebulae Near the Galactic Center I: Method of Discovery and Preliminary Results

S. R. Pottasch, C. Bignell, R. Olling, and A. A. Zijlstra

63

An Infrared Search for New Planetary Nebulae *S. R. Pottasch, C. Esteban, A. Manchado, and A. Mampaso*

63

II. NEBULAR PROPERTIES

Invited papers

Distances to Planetary Nebulae <i>J. H. Lutz</i>	65
Galactic Distribution, Radial Velocities and Masses of PN <i>W. J. Maciel</i>	73
The Shapes and Shaping of Planetary Nebulae <i>B. Balick</i>	83
Expansion Velocities and Characteristics of Galactic Planetary Nebulae <i>R. Weinberger</i>	93
Multiple Shell Planetary Nebulae <i>Y.-H. Chu</i>	105
Dust in Planetary Nebulae <i>P. F. Roche</i>	117
Molecules and Neutral Hydrogen in Planetary Nebulae <i>L. F. Rodríguez</i>	129
Abundances in Planetary Nebulae <i>R. E. S. Clegg</i>	139
Photoionization Models <i>J. P. Harrington</i>	157

Contributed papers

Planetary Nebulae and the Galactic Bulge <i>M. W. Feast, T. D. Kinman, and B. S. Lasker</i>	167
Spectroscopic Distances to Central Stars of Planetary Nebulae <i>R. H. Méndez, R. P. Kudritzki, A. Herrero, D. Husfeld, and H. G. Groth</i>	168
Investigation of two Planetary Nebulae and their Angular Vicinity in Cygnus <i>W. Sauer and R. Weinberger</i>	168
Structure and Morphology of NGC 6369 <i>T. K. Chatterjee and J. Campos</i>	169
H ₂ and H I Emission Line Imaging of the Ring Nebula NGC 6720 <i>M. A. Greenhouse, T. L. Hayward, and H. A. Thronson Jr.</i>	170
Deep Narrow Band Interference Filter Photographs of Selected Extended Planetary Nebulae <i>M. Rosado and M. Moreno</i>	171
CCD Images of Selected Planetary Nebulae <i>M. Turatto, E. Cappellaro, and F. Sabbadin</i>	172
CCD Images of Southern Hemisphere Planetary Nebulae <i>J. Lutz, N. J. Lame, and B. Balick</i>	173
IRAS Observations of Extended Planetary Nebulae <i>A. Leene and S. R. Pottasch</i>	174
Nebular Density Distributions; A Critical Look <i>R. C. Kirkpatrick</i>	175
The Temperature Structure of NGC 7027 <i>C. T. Daub and J. P. Basart</i>	176
The Display and Manipulation of PN Images on a IBM PC or Compatible <i>M. J. Hoey and D. Whelan</i>	177
Infrared Images and Line Profiles of Planetary Nebulae <i>M. G. Smith, T. R. Geballe, C. Aspin, I. S. McLean, and P. F. Roche</i>	178
NGC 2899: An Evolved Bipolar Planetary Nebula <i>J. A. López, L. H. Falcón, M. T. Ruiz, and M. Roth</i>	179
The Structure and Kinematics of Bipolar Planetary Nebulae <i>W. G. Weller and S. R. Heathcote</i>	180
Collimated Outflows in Planetary Nebulae <i>B. Balick, H. L. Preston, and V. Icke</i>	181
Kinematical Properties of Planetary Nebulae <i>L. Bianchi, M. Grewing, J. Barnstedt, and Chr. Diesch</i>	182
Kinematics of Abell 30 <i>G. H. Jacoby and Y.-H. Chu</i>	183
High Resolution Long Slit Spectroscopy of A78 <i>A. Manchado, S. R. Pottasch, and A. Mampaso</i>	184
The Structure and Velocity Field of A78 <i>P. Pismis, and M. A. Moreno</i>	185
Spatial Deconvolution of IRAS Observations of Planetaries <i>G. Hawkins and B. Zuckerman</i>	186

Evidence of Expansion Velocity in the Central Region of NGC 2346 <i>B. G. Anandaraao, J. N. Desai, S. K. Jain, and D. C. V. Mallik</i>	187
Unusual Emission Line Profiles of M 1-1 <i>K. Shibata and S. Tamura</i>	188
Emission Line Profiles in the Planetary Nebulae IC 4593 and NGC 6153 <i>D. P. K. Banerjee and B. G. Anandaraao</i>	189
A New Study of Some Galactic Planetary Nebulae <i>S. J. Meatheringham, P. R. Wood, and D. J. Faulkner</i>	189
Expansion Velocities of [N II] and [O III] from Compact Planetary Nebulae <i>K. Shibata and S. Tamura</i>	190
High and Low Resolution Spectra of Selected Planetary Nebulae <i>S. Cristiani, F. Sabbadin, and S. Ortolani</i>	191
The Planetary ESO 166 - PN21 <i>M. T. Ruiz, S. R. Heathcote, and W. G. Weller</i>	192
The Structure of NGC 2392 <i>M. J. Hoey</i>	193
High Velocity Outflows in Post-Main Sequence Nebulae <i>J. P. Phillips and A. Mampaso</i>	194
Long-Slit 2-Dimensional Spectra of the Giant Halos Around NGC 6543 and NGC 6826 <i>D. Middlemass, R. E. S. Clegg, and J. R. Walsh</i>	195
The Halos of NGC 6543 and NGC 6826 <i>A. Manchado, S. R. Pottasch, and A. Mampaso</i>	196
Expansion Velocities of Southern Planetary Nebulae <i>K. C. Sahu and S. R. Pottasch</i>	196
Detection of an Extended Optical Halo around IC 418 <i>D. J. Monk, M. J. Barlow, and R. E. S. Clegg</i>	197
Internal Motions of Faint PN Halos <i>Y.-H. Chu and G. H. Jacoby</i>	198
Spectroscopic Investigations of Halos of Planetary Nebulae <i>M. Bässgen, G. Bässgen, M. Grewing, S. Cerrato, and L. Bianchi</i>	199
Kinematic Structure and Chemical Composition of the Double Shell PN NGC 3242 <i>K. C. Sahu, S. R. Pottasch, B. G. Anandaraao, and J. N. Desai</i>	200
Thermal Infrared Emission by Dust in the Planetary Nebula NGC 3918 <i>J. P. Harrington, D. J. Monk, and R. E. S. Clegg</i>	201
The Dust Content of Planetary Nebulae with Neutral Halos <i>M. G. Hoare</i>	202
Spatially Resolved Observations of the Unidentified Dust Features in BD+30°3639 <i>C. H. Smith, D. K. Aitken, and P. F. Roche</i>	203
Observations of CO and HCN (J=1-0) in NGC 2346 and NGC 7293 with the Nobeyama 45m Telescope -- <i>J. R. Walsh, R. E. S. Clegg, and N. Ukita</i>	204
A Young Planetary Nebula with OH Molecules: NGC 6302 <i>H. E. Payne, J. A. Phillips, and Y. Terzian</i>	205
CO in the Bipolar Nebula NGC 2346 <i>A. P. Healy and P. J. Huggins</i>	205
Fluorescent H ₂ Emission in the Planetary Nebulae BD+30°3639 and Hb 12 <i>H. L. Dinerstein, J. S. Carr, P. M. Harvey, and D. F. Lester</i>	206
Molecular Hydrogen Emission from Cold Condensations in NGC 2440 <i>N. K. Reay, N. A. Walton, and P. D. Atherton</i>	207
The Systematics and Distribution of Molecular Hydrogen in Planetary Nebulae <i>P. W. Payne, J. W. V. Storey, B. L. Webster, M. A. Dopita, and S. J. Meatheringham</i>	208
Detection of OH Maser Emission at 1667 MHz from IC 4997 <i>S. Tamura and I. Kazes</i>	209
OH Maser Emission from Young Planetary Nebulae <i>A. Zijlstra, S. R. Pottasch, P. te Lintel, and C. Bignell</i>	210
Helium Abundances in Gaseous Nebulae <i>R. E. S. Clegg and J. P. Harrington</i>	211
Collisional Excitation of the 10830 He I Line and the Population of the 2 ³ S He I State in Gaseous Nebulae <i>M. Peimbert and S. Torres-Peimbert</i>	212
Planetary Nebulae and the Pregalactic Helium Abundance <i>W. J. Maciel</i>	213
N/O Abundances in Planetary Nebulae from Far-Infrared Line Observations <i>H. L. Dinerstein and M. W. Werner</i>	214
Investigations of DDDM-1; The Fourth Halo Planetary Nebula <i>A. Yu. Shchelkanova</i>	215

The Peculiar Planetary Nebula M1-78	<i>S. R. Pottasch, A. A. Zijlstra, N. Ukita, A. Manchado, and M. Ratag</i>	216
Oxygen Depletion Variations in Planetary Nebulae and Shells Ejected from Luminous Population I Stars	<i>R. J. Dufour</i>	216
Magnesium Abundances in Planetary Nebulae and Interstellar Absorption of Mg II λ 2800 Å	<i>D. Middlemass</i>	217
Abundances of C, N and O in Planetary Nebulae	<i>A. A. Nikitin, A. F. Kholtygin, A. A. Sapar, and T. H. Feklistova</i>	218
Some Statistics of Nebular Chemical Compositions	<i>L. H. Aller and C. D. Keyes</i>	219
Electron Densities in Planetary Nebulae	<i>L. Stanghellini and J. B. Kaler</i>	220
Low Resolution Spectroscopy of 13 Low Surface Brightness PN's	<i>A. Manchado, S. R. Pottasch, and A. Mampaso</i>	220
Effect of Density Variations on Elemental Abundance Determinations in Gaseous Nebulae	<i>R. H. Rubin</i>	221
A Possible Subdivision of Type II Planetary Nebulae	<i>M. Faúndez-Abans and W. J. Maciel</i>	222
Observations and Models of the "Helix" Nebula NGC 7293	<i>R. E. S. Clegg and J. R. Walsh</i>	223
A Photoionization Model Study of NGC 7027	<i>R. B. Gruenwald and D. Pequignot</i>	224
Emission Lines of C I and N II in Planetary Nebulae	<i>V. Escalante</i>	225
The Continuum Emission from Planetary Nebulae	<i>S. M. Viegas-Aldrovandi</i>	226
Comparison of Different Treatments of the Radiation Transfer in Model Calculations of Planetary Nebulae	<i>G. Bässgen, M. Bässgen, and M. Grewing</i>	227
The Spatial Distribution of Line Ratio O III/O II in High Excitation Planetary Nebulae	<i>A. Noriega-Crespo and M. McCall</i>	228
III. CENTRAL STARS		
<u>Invited papers</u>		
Magnitudes, Spectra and Temperatures of Planetary Nuclei	<i>J. B. Kaler</i>	229
Wind Features and Wind Velocities	<i>M. Grewing</i>	241
Close-Binary and Pulsating Central Stars	<i>H. E. Bond</i>	251
Binarity and Intrinsic Variability in Central Stars of PN	<i>R. H. Méndez</i>	261
Model Atmospheres and Quantitative Spectroscopy of Central Stars of Planetary Nebulae	<i>R. P. Kudritzki and R. H. Méndez</i>	273
Mass Loss Rates in Central Stars of Planetary Nebulae	<i>M. Perinotto</i>	293
<u>Contributed papers</u>		
The Central Star of NGC 7027	<i>N. A. Walton, S. R. Pottasch, N. K. Reay, and T. Spoelstra</i>	301
Magnitude Measurements of Central Stars of Planetary Nebulae	<i>R. Gathier and S. R. Pottasch</i>	302
Stromgren Photometry of the Central Stars of Planetary Nebulae	<i>R. Costero and J. Echevarría</i>	302
New Identifications of Faint Central Stars in Extended PN	<i>K. B. Kwitter and G. H. Jacoby</i>	303
Einstein X-ray Observations of Planetary Nebulae and their Implications	<i>S. P. Tarafdar and K. M. V. Apparao</i>	304
The Origin of the Zanstra Discrepancy: UV Excess in the Central Star Continuum?	<i>R. B. C. Henry and H. L. Shipman</i>	305
Are Zanstra Temperatures Always Real?	<i>L. H. Aller</i>	306
Temperatures and Luminosities of Planetary Nebulae Nuclei	<i>L. Bianchi, E. Recillas, and M. Grewing</i>	307
Broad Baseline Flux Distributions of Planetary Nuclei	<i>S. Heap and A. V. Torres</i>	308

Photometric and Spectroscopic Observations of Peculiar Nuclei of Planetary Nebulae G. Jasniewicz and A. Acker	309
HFG1: A Planetary Nebula with a Close-Binary Nucleus T. A. Fleming, and A. D. Grauer	310
Nonradial Pulsational Analyses of the Pulsating Central Stars of Planetary Nebulae S. Starrfield and A. N. Cox	311
A Search for Cool Companions of Planetary Nebula Nuclei A. F. Bentley	312
A Case Study of a WC Nucleus J. B. Kaler, R. A. Shaw, and W. A. Feibelman	313
The Nature of the Hot Companion of the G8 IV Nucleus of Abell 35 M. Grewing and L. Bianchi	314
V605 Aquilae - The Most Extreme Hydrogen-Poor Object W. C. Seitter	315
Echelle Spectra of a Large Sample of Planetary Nebula Nuclei J. K. McCarthy	316
The Metal-Line Spectra of Central Stars of Planetary Nebulae M. Roth, A. Herrero, R. H. Méndez, R. P. Kudritzki, K. Butler, and H. G. Groth	317
Revisited Mass-Loss Rates of Planetary Nebula Nuclei Observed with IUE D. Hutsemékers and J. Surdej	317
Quantitative Investigations on Mass Outflow from Planetary Nebulae Nuclei S. Cerrato, L. Bianchi, M. Grewing, M. Bässgen, and G. Bässgen	318
IV. EXTRAGALACTIC NEBULAE	
<u>Invited papers</u>	
Planetary Nebulae in the Magellanic Clouds M. J. Barlow	319
Planetary Nebulae in Galaxies Beyond the Local Group H. C. Ford, R. Ciardullo, G. H. Jacoby, and X. Hui	335
<u>Contributed papers</u>	
A Survey of Planetary Nebulae in the SMC and M31 N. Meyssonier, M. Azzopardi, J. Lequeux, and R. Gathier	351
The Kinematics of the Planetary Nebulae in the Large Magellanic Cloud S. J. Meatheringham, M. A. Dopita, H. C. Ford, and B. L. Webster	352
N 66: A High Excitation N Rich Planetary Nebula in the LMC M. Peña and M. T. Ruiz	353
Chemical Abundances in Magellanic Cloud Planetary Nebulae D. J. Monk, M. J. Barlow, and R. E. S. Clegg	354
Central Star and Nebular Masses for Magellanic Cloud Planetary Nebulae. D. J. Monk, M. J. Barlow and R. E. S. Clegg	355
Evolution of Magellanic Cloud Planetary Nebulae S. J. Meatheringham, M. A. Dopita, P. R. Wood, B. L. Webster, D. H. Morgan, and H. C. Ford	356
Planetary Nebulae as Standard Candles for Extragalactic Distances G. Jacoby, H. Ford, and R. Ciardullo	357
V. ORIGIN OF PLANETARIES	
<u>Invited papers</u>	
OH/IR Stars and other IRAS Point Sources and Progenitors of Planetary Nebulae H. J. Habing, P. te Lintel Hekkert, and W. E. C. J. van der Veen	359
Carbon Stars as Planetary Nebula Progenitors G. R. Knapp	381
Thermal Pulses and the Formation of Planetary Nebula Shells A. Renzini	391
Progenitors of Planetary Nebulae S. Kwok	401
Models of Planetary Nebulae: Generalisation of the Multiple Winds Model F. D. Kahn	411

Stellar Evolution and the Planetary Nebulae Formation Rate	<i>J. P. Phillips</i>	425
<u>Contributed papers</u>		
The Proto-Planetary Nebula Vy 2-2	<i>R. E. S. Clegg, M. G. Hoare, and J. R. Walsh</i>	443
The Optically Resolved Planetary Nebula/OH Maser Vy 2-2	<i>R. Falomo and F. Sabbadin</i>	444
New IR-Observations of Post AGB Stars and Proto-Planetary Nebulae	<i>W. E. van der Veen, H. J. Habing, and T. R. Geballe</i>	445
IRAS 17516-2525: The Birth of a Planetary Nebula?	<i>W. E. van der Veen, H. J. Habing, and T. R. Geballe</i>	446
The Shocking Truth About some "Proto-PN"	<i>R. W. Goodrich and L. Bianchi</i>	447
New OH/IR Stars: Proto-Planetary Nebulae?	<i>J. Eder, B. M. Lewis, and Y. Terzian</i>	448
Infrared Photometry of OH/IR Stars	<i>M. Peña and J. Fierro</i>	449
The Presence of Water Masers in Color Selected IRAS Sources	<i>B. M. Lewis and D. Engels</i>	450
Some Dependences for Long-Period Variables and a Possible Scheme of their Evolution.	<i>I. L. Andronov, L. S. Kudashkina, and G. M. Rudnitskij</i>	451
Proto-Planetary Nebulae: Models and IRAS Observations	<i>K. Volk and S. Kwok</i>	452
HCN The First Strong Maser in Carbon-Rich Stars	<i>A. Omont, S. Guilloteau, and R. Lucas</i>	453
Lower Limit for NPN's Masses	<i>A. Harpaz</i>	454
Some Hypothesized Observational Aspects of Magnetic Fields in Protoplanetary Nebulae	<i>G. Pascoli</i>	455
Stalled Winds: Interactions Between Nebulae and Stellar Winds	<i>J. B. Kaler, W. A. Feibelman, R. A. Shaw, and H. Henrichs</i>	456
Optically Thick Wind from Post-AGB Stars and Formation of Planetary Nebulae	<i>M. Kato</i>	457
Direct Evidence for a Bipolar Stellar Wind in NGC 2392	<i>C. R. O'Dell</i>	458
Two-Dimensional Hydrodynamical Models of Planetary Nebulae (PNe)	<i>I. V. Igumenshchev, B. M. Shustov, and A. V. Tutukov</i>	459
The Spatial Structure of Planetary Nebulae with Binary Central Stars	<i>I. G. Kolesnik and L. S. Plyugin</i>	460
Morphologies of Planetary Nebulae with Close-Binary Nuclei	<i>H. E. Bond, M. Livio, and M. Meakes</i>	461
CCD Images of Three Planetary Nebulae with Binary Nuclei	<i>J. Lutz and N. J. Lame</i>	462
VI. EVOLUTION		
<u>Invited papers</u>		
Evolutionary Tracks for Central Stars of Planetary Nebulae	<i>D. Schönberner</i>	463
The Distribution of Planetary Nebula Nuclei in the log L - log T Plane: Inferences from Theory	<i>R. E. Shaw</i>	473
The Position of the Central Stars of PN on the HR Diagram	<i>S. R. Pottasch</i>	481
Initial Masses	<i>D. C. V. Mallik</i>	493
Binary Stars and Planetary Nebulae	<i>I. Iben Jr. and A. V. Tutukov</i>	505
The Evolution of the Common Planetary Nebula	<i>J. Köppen</i>	523
Planetary Nebulae with Massive Central Stars	<i>R. Tylenda</i>	531
<u>Contributed papers</u>		
A New Method for Observational Testing of the Planetary Nebulae Nuclei Evolution	<i>R. Szczerba</i>	539
Mass Distribution and Birth Rate of Central Stars of Planetary Nebulae: Comparison with White Dwarfs, and Influence of Selection Effects	<i>V. Weidemann</i>	540

Common Envelope Evolutions of Binary System and Formation of Planetary Nebulae <i>I. Hachisu and M. Kato</i>	541
Theoretical Models for the Evolution of Planetary Nebulae Nuclei Tested by Observations <i>R. Tylenda and G. Stasińska</i>	542
Snapshots of Evolving Model Planetary Nebulae <i>G. Stasińska</i>	542
Evolution of Planetary Nebulae: A comparison with Observed Central Stars <i>M. Schmidt-Voigt</i>	543
VII. PLANETARIES AND WHITE DWARFS	
<u>Invited papers</u>	
White Dwarfs and Planetary Central Stars <i>J. Liebert</i>	545
Properties and Evolution of White Dwarf Stars <i>H. L. Shipman</i>	555
VIII. SUMMARIES AND A VIEW TO THE FUTURE	
<u>Invited papers</u>	
Summarizing Remarks on the Structure and Evolution of Planetary Nebulae and Properties of their Central Stars <i>L. H. Aller</i>	567
Comments on the Applications of Planetary Nebulae Research <i>M. Peimbert</i>	577
Author index	589
Object Index	593
Subject Index	603