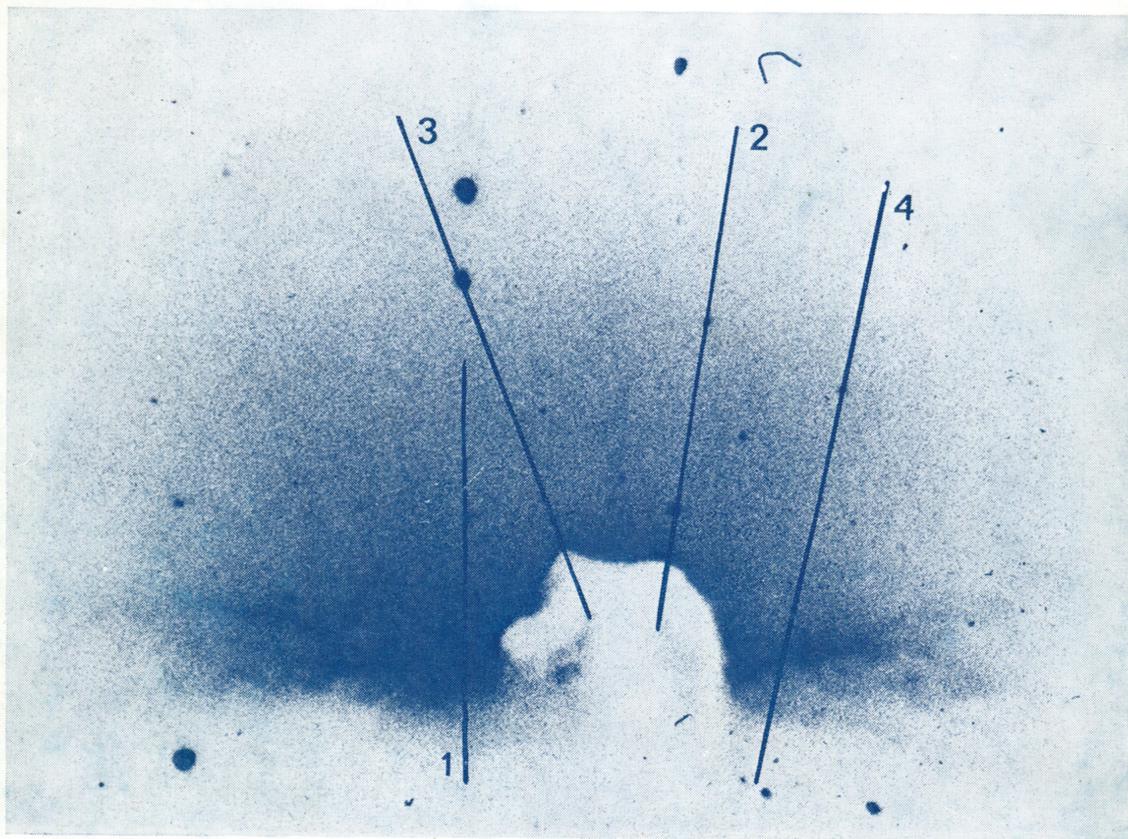


INTERNATIONAL ASTRONOMICAL UNION

SYMPOSIUM No. 52

INTERSTELLAR DUST AND RELATED TOPICS

Edited by J. M. GREENBERG and H. C. VAN DE HULST



INTERNATIONAL ASTRONOMICAL UNION

D. REIDEL PUBLISHING COMPANY

DORDRECHT-HOLLAND / BOSTON-U.S.A.

INTERSTELLAR DUST AND RELATED TOPICS

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

SYMPOSIUM No. 52

HELD AT THE STATE UNIVERSITY OF NEW YORK AT ALBANY,
ALBANY, N.Y., U.S.A.

INTERSTELLAR DUST AND RELATED TOPICS

EDITED BY

J. MAYO GREENBERG

State University of New York at Albany and Dudley Observatory, U.S.A.

AND

H. C. VAN DE HULST

Sterrewacht, Leiden, The Netherlands



D. REIDEL PUBLISHING COMPANY

DORDRECHT-HOLLAND / BOSTON-U.S.A.

1973

First printing: December 1973

*Published on behalf of
the International Astronomical Union
by
D. Reidel Publishing Company, P.O. Box 17, Dordrecht, Holland*

*All Rights Reserved
Copyright © 1973 by the International Astronomical Union*

*Sold and distributed in the U.S.A., Canada, and Mexico
by D. Reidel Publishing Company, Inc.
306 Dartmouth Street, Boston,
Mass. 02116, U.S.A.*

Library of Congress Catalog Card Number 72-88590
Cloth edition: ISBN 90 277 0396 5
Paperback edition: ISBN 90 277 0397 3

*No part of this book may be reproduced in any form, by print, photoprint, microfilm,
or any other means, without written permission from the publisher*

Printed in The Netherlands by D. Reidel, Dordrecht

TABLE OF CONTENTS

PREFACE	XI
LIST OF PARTICIPANTS	XIII

PART I / EXTINCTION

J. M. GREENBERG / Some Scattering Problems of Interstellar Grains (<i>A Prologue</i>)	3
S. ISOBE / Variations of Interstellar Ultra-Violet Absorption	11
B. D. SAVAGE / OAO-2 Observations of the Near Ultraviolet Extinction Feature	21
J. H. LUTZ / The Ratio of Total to Selective Absorption in the Directions of Selected Planetary Nebulae	29
D. H. HARRIS / The Ratio of Total to Selective Absorption from the Cluster Diameter Method	31
S. TAPIA / The <i>U</i> , <i>B</i> , <i>V</i> , <i>R</i> , and <i>I</i> Extinctions in Four Areas of the Southern Coalsack	43
A. N. WITT / Interstellar Dust: Observations in the Ultraviolet and Their Interpretations	53
R. Y. CHIAO, M. J. FELDMAN, and P. T. PARRISH / A Kramers-Kronig Analysis of Interstellar Extinction (<i>Presented by M. J. Feldman</i>)	59

PART II / DIFFUSE FEATURES

T. P. SNOW, JR. and G. WALLERSTEIN / A Search for Diffuse Interstellar Features in Stars with Circumstellar Dust Shells (<i>Presented by T. P. Snow, Jr.</i>)	65
G. E. BROMAGE and K. NANDY / Diffuse Interstellar Features in the Spectra of Dust-Embedded Stars (<i>Presented by K. Nandy</i>)	71
K. NANDY and H. SEDDON / Polarization Profile Near the 4430 Band (<i>Presented by K. Nandy</i>)	79
D. S. HAYES, G. E. MAVKO, R. R. RADICK, K. H. REX, and J. M. GREENBERG / Broadband Structure in the Interstellar Extinction Curve (<i>Presented by D. S. Hayes</i>)	83
C.-C. WU / A Study of the Interstellar Diffuse Absorption Features	91

PART III / REFLECTION NEBULAE AND DIFFUSE GALACTIC LIGHT

R. D. WOLSTENCROFT / Surface Polarimetry of the Milky Way	99
B. ZELLNER / Dust Grains in Reflection Nebulae	109
C. F. LILLIE and A. N. WITT / The Ultraviolet Surface Brightness of Reflection Nebulae and the Albedo of Interstellar Grains (<i>Presented by C. F. Lillie</i>)	115
S. VAN DEN BERGH and R. RACINE / Southern Reflection Nebulae (<i>Presented by S. van den Bergh</i>)	123
V. VANÝSEK and M. ŠOLC / Depolarization Effect in Reflection Nebulae (<i>Presented by V. Vanýsek</i>)	127
TH. SCHMIDT / Elliptical Polarization by Light Scattering by Submicron Spheroids	131
J. STAUDE, K. WOLF, and TH. SCHMIDT / A Surface Polarization Survey of the Milky Way and the Zodiacal Light (<i>Presented by Th. Schmidt</i>)	139

PART IV / INTERSTELLAR POLARIZATION

K. SERKOWSKI / Interstellar Polarization (<i>Review</i>)	145
P. J. TREANOR, S.J. / Development of Photographic Techniques for Photometry and Polarimetry of Faint Stars in the <i>R-IR</i> Region	153
P. G. MARTIN / Interstellar Circular Polarization and the Composition of Interstellar Dust	161
P. G. MARTIN, R. ILLING, and J. R. P. ANGEL / Discovery of Interstellar Circular Polarization in the Direction of the Crab Nebula (<i>Presented by P. G. Martin</i>)	169
J. C. KEMP / Interstellar Circular Polarization of Upper Scorpius Stars	181
P. CUGNON / Alignments of Dust Grains by Magnetic Relaxation: A Comparison Between Results Obtained by Two Different Methods	187
T. MAIHARA, H. OKUDA, and S. SATO / A Search for Infrared Polarization in the Galactic Center (<i>Presented by H. Okuda</i>)	191
L. W. KING and M. O. HARWIT / Photon and Magnetic Alignment of Interstellar Dust Grains (<i>Presented by L. W. King</i>)	197
S. LLOYD and M. O. HARWIT / The Differential Polarization of Starlight as a Function of Distance (<i>Presented by S. Lloyd</i>)	203
A. ELVIUS / Polarization of Light by Dust in Galaxies	209

PART V / DISTRIBUTION OF DUST AND GAS

H. M. JOHNSON / Dust Near the Nucleus of M31	215
L. O. LODÉN / A Study of the Distribution of Interstellar Matter	219
S. C. SIMONSON, III / Dust and Neutral Hydrogen in the Region of IC 1396	227

E. BRAUNSFURTH and K. ROHLFS / The Association of Dust and H I Gas (<i>Presented by K. Rohlfs</i>)	231
J. H. CAHN and R. D. NOSEK / Galactic Dust Distribution in the Solar Neighborhood (<i>Presented by J. H. Cahn</i>)	237
G. R. KNAPP / Observations of Atomic Hydrogen in Dense Interstellar Dust Clouds	243
E. B. JENKINS and B. D. SAVAGE / The Correlation of Interstellar Reddening and $\text{L}\alpha$ Absorption (<i>Presented by E. B. Jenkins</i>)	247
R. D. DAVIES / Gas and Dust in Interstellar Clouds	251
F. H. SHU / On the Genetic Relation Between Interstellar Clouds and Dust Clouds	257
A. G. D. PHILIP / Interstellar Reddening at High Galactic Latitudes	263
Y. K. MINN and J. M. GREENBERG / The 4830 MHz Formaldehyde Line Observations of Dark Clouds in IC 1795 (W3) (<i>Presented by Y. K. Minn</i>)	269
H. R. DICKEL / Molecular Distributions in Galactic Sources	277

PART VI / PHYSICAL PROCESSES, THEORY AND EXPERIMENT

S. HAYAKAWA / Cosmic X-Rays and Interstellar Dust	283
D. R. HUFFMAN and J. L. STAPP / Optical Measurements on Solids of Possible Interstellar Importance (<i>Presented by D. R. Huffman</i>)	297
R. F. WILLIS, B. FEUERBACHER, and B. FITTON / Optical and Photoemission Properties of Graphite Grains (<i>Presented by R. F. Willis</i>)	303
K. L. DAY / The Thermal Accommodation Coefficient of Graphite	311
F. M. JOHNSON, D. T. BAILEY, and P. A. WEGNER / Spectroscopic Simulation of Diffuse Interstellar Lines and a Laboratory Model for Interstellar Chemical Synthesis (<i>Presented by F. M. Johnson</i>)	317
F. KAMIJO, Y. NAKADA, T. IGUCHI, M. FUJIMOTO, M. TAKADA, and S. TAKAJO / A Laboratory Experiment on the Nucleation of Interstellar Dusts (<i>Presented by F. Kamijo</i>)	323
J. D. MCCULLOUGH, G. R. FLOYD, R. H. PRINCE, and W. W. DULEY / Optical and Chemical Studies on Simulated Interstellar Grain Materials (<i>Presented by J. D. McCullough</i>)	327
W. D. WATSON / Photoelectric Emission from Interstellar Grains	335
P. A. AANNSTAD / Destruction of Dirty Ice Mantles by Sputtering	341
N. C. WICKRAMASINGHE / Ejection of Grains from Cool Stars	345

PART VII / MOLECULES, THEORY AND OBSERVATIONS

L. E. SNYDER, JR. / Some Implications of the Distribution of Interstellar Molecules (<i>Review</i>)	351
---	-----

E. E. SALPETER and W. D. WATSON / Abundances of Interstellar Molecules and Their Formation on Grain Surfaces (<i>Presented by E. E. Salpeter</i>)	363
J. M. GREENBERG and A. J. YENCHA / Exploding Interstellar Grains and Complex Molecules (<i>Presented by J. M. Greenberg</i>)	369
C. HEILES and M. A. GORDON / The Surprising Constancy of Relative Chemical Abundances in Different Regions of Interstellar Space – Particularly for Formaldehyde (<i>Presented by C. Heiles</i>)	375
M. MORRIS, P. PALMER, B. E. TURNER, and B. ZUCKERMAN / Cyanoacetylene: New Lines and Sources in the Galaxy (<i>Presented by P. Palmer</i>)	381
E. W. CHAPELLE, B. D. DONN, W. A. PAYNE, JR., and L. J. STIEF / Chemical Evolution of Dense Clouds (<i>Presented by E. W. Chappelle</i>)	387
P. HARTECK, A. BEAUDOIN, and R. REEVES / Formation Mechanism for Interstellar Molecules (<i>Presented by R. Reeves</i>)	395
H. D. BREUER / The Distribution of Interstellar Molecules in Dust Clouds as Derived from Laboratory Experiments	399
M. SHIMIZU / Stellar Atmospheres: The Sources of Interstellar Molecules	405
L. T. GREENBERG / Photodesorption from Interstellar Dust Grains	413

PART VIII / DUST AND H II REGIONS

R. D. DAVIES / Interferometric Studies of OH Sources Associated with H II Regions and IR Objects	423
S. ISOBE / Dust, Star, and Hydrogen Distributions in the Orion Association	433
V. PETROSIAN / Dust in H II Regions	445
C. D. SWIFT, F. C. WITTEBORN, E. F. ERICKSON, L. J. CAROFF, G. C. AUGASON, A. J. MORA, L. W. KUNZ, and L. P. GIVER / Low Resolution Spectrum of the Orion Nebula in the 60–300 μ Range (<i>Presented by F. C. Witteborn</i>)	453
C. G. WYNN-WILLIAMS, E. E. BECKLIN, and G. NEUGEBAUER / New Infrared Sources Associated with H II Regions (<i>Presented by C. G. Wynn-Williams</i>)	459
R. LOUISE and C. SAPIN / Physical Study of a Bright Rim in the Horsehead Nebula (<i>Presented by R. Louise</i>)	465
H. M. JOHNSON / Dust in the Large Magellanic Cloud	471
M. C. LORTET-ZUCKERMANN / The Mixing of Neutral Gas and Dust with the Ionized Gas of H II Regions	477

PART IX / CIRCUMSTELLAR DUST

N. J. WOOLF / Circumstellar Infrared Emission. I: The Circumstellar Origin of Interstellar Dust (<i>Review</i>)	485
A. D. CODE / Radiative Transfer in Circumstellar Dust Clouds	505
D. P. GILRA / Dust Particles and Molecules in the Extended Atmospheres of Carbon Stars	517

K. VOELCKER and H. ELSÄSSER / Infrared Observations of Stars in the Association Cyg OB2 (<i>Presented by K. Voelcker</i>)	529
---	-----

PART X / MISCELLANEOUS

L. G. TAFF and M. P. SAVEDOFF / A Statistical Model for the Cloud Structure of the Interstellar Medium (<i>Presented by L. G. Taff</i>)	537
A. G. W. CAMERON / Interstellar Grains in Museums?	545
D. MCNALLY / Dust and Star Formation	549
J. L. PIPHER / Rocket Measurements of the Galactic Background at 100μ	559

CONCLUDING REMARKS

H. C. VAN DE HULST / A Quick Review of Interstellar Grains	569
--	-----

DISCUSSIONS	575
-------------	-----