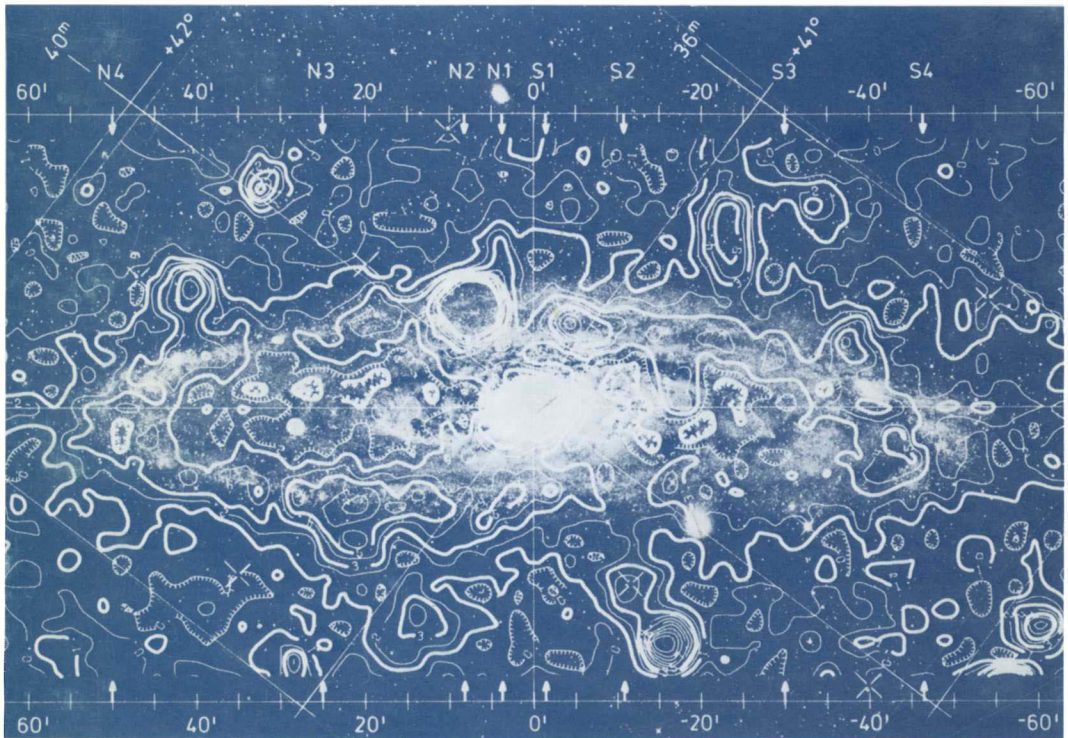


INTERNATIONAL ASTRONOMICAL UNION

SYMPOSIUM No. 77

STRUCTURE AND PROPERTIES OF NEARBY GALAXIES

Edited by ELLY M. BERKHUIJSEN and RICHARD WIELEBINSKI



INTERNATIONAL ASTRONOMICAL UNION

D. REIDEL PUBLISHING COMPANY

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

STRUCTURE AND PROPERTIES OF NEARBY GALAXIES

SYMPOSIUM No. 77

The Symposium Proceedings bring together contributions and discussions by leading investigators in the field of research of nearby galaxies and provides many up-to-date results. The book interrelates radio observations, optical data and theoretical interpretations in order to give the reader an overall picture of this rapidly expanding subject. For instance: very deep optical photographs and deep radio maps show that galaxies extend much further than was previously thought. Computer simulations as well, have become increasingly important for the understanding of the dynamics of galaxies.

The main topics discussed in this book are: I. The smooth background: large scale kinematics, observational evidence for massive haloes. II. Spiral structure and star formation: confrontation of theory with observations, molecular line observations. III. M31 and M33: detailed investigations leading to many new results. IV. Nearby active galaxies and their nuclei: properties of nuclei in various types of galaxies, correlations with other properties of galaxies, significance of nuclei for the large scale structure. V. The outskirts of galaxies: distortions in the outer parts, warps, tails and interacting galaxies.

D. REIDEL PUBLISHING COMPANY
DORDRECHT : HOLLAND / BOSTON : U.S.A.

STRUCTURE AND PROPERTIES OF NEARBY GALAXIES

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

SYMPOSIUM No. 77

HELD IN BAD MÜNSTEREIFEL, F.R.G., AUGUST 22-26, 1977

STRUCTURE
AND PROPERTIES OF
NEARBY GALAXIES

EDITED BY

ELLY M. BERKHUIJSEN AND RICHARD WIELEBINSKI

Max-Planck-Institut für Radioastronomie, Bonn, F.R.G.



D. REIDEL PUBLISHING COMPANY

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

1978

Library of Congress Cataloging in Publication Data

Main entry under title:

Structure and properties of nearby galaxies.

(Symposium—International Astronomical Union: No. 77.)

Bibliography: p.

Includes index.

1. Galaxies—Congresses. i. Berkhuijsen, Elly M., 1937–
- ii. Wielebinski, R. iii. International Astronomical Union. iv. Series: International Astronomical Union. Symposium No. 77.

QB857.S863 523.1:12 78-7292

ISBN 90-277-0874-6

ISBN 90-277-0875-4 pbk.

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

*All Rights Reserved
Copyright © 1978 by the International Astronomical Union*

*Sold and distributed in the U.S.A., Canada, and Mexico
by D. Reidel Publishing Company, Inc.
Lincoln Building, 160 Old Derby Street, Hingham,
Mass. 02043, U.S.A.*

*No part of the material protected by this copyright notice may be reproduced or utilized
in any form or by any means, electronic or mechanical, including photocopying, recording
or by any informational storage and retrieval system, without written permission from
the publisher*

Printed in The Netherlands

TABLE OF CONTENTS

FOREWORD	xi
LIST OF PARTICIPANTS	xiii
INTRODUCTION / J.H. Oort	xvii
I THE SMOOTH BACKGROUND	1
I.1 THE DISTRIBUTION OF LIGHT IN GALAXIES / K.C. Freeman	3
DISCUSSION I.1	10
Problems in galactic dynamics studied by means of three-dimensional simulations / R.H. Miller	11
The kinematics of the lenticular galaxies NGC 1291 and NGC 1326 / U. Mebold	14
The dwarf-spheroidal galaxies near M31 / T.D. Kinman	14
I.2 THE PAST HISTORY OF STAR FORMATION IN GALAXIES / B.M. Tinsley	15
DISCUSSION I.2	19
Multi-colour observations of NGC 5128 = Centaurus A / S. van den Bergh	20
I.3 ROTATION CURVES IN THE OUTER PARTS OF GALAXIES FROM HI OBSERVATIONS / E.E. Salpeter	23
DISCUSSION I.3	27
HI sizes and rotation curves of some edge-on galaxies / R. Sancisi	27
The kinematics of a sample of about twenty spiral galaxies / A. Bosma	28
New optical rotation curve of M101 / G. Comte	30
I.4 THE LARGE-SCALE RADIO CONTINUUM STRUCTURE OF SPIRAL GALAXIES / P.C. van der Kruit	33
DISCUSSION I.4	45
The thermal content of IC 342 / R. Wielebinski	47
Deconvolved single-dish radio observations of NGC 6946 / J. Pfleiderer	47

I.5	THE LARGE-SCALE DISTRIBUTION OF RADIO CONTINUUM IN E AND SO GALAXIES / R.D. Ekers	49
DISCUSSION I.5		51
	The gas content of lenticular galaxies / H. van Woerden	52
	HI observations of a large sample of elliptical galaxies / F.J. Kerr	53
	HI in NGC 1052 and NGC 4636 / J.S. Gallagher	54
	The discontinuity between elliptical and disk galaxies / M. Capaccioli	55
I.6	GLOBAL DYNAMICS OF THE INTERSTELLAR GAS, MAGNETIC FIELD, AND COSMIC RAYS / E.H. Levy	57
DISCUSSION I.6		62
	Comments on the radio continuum emission from normal disk galaxies / R.J. Allen	63
	On the nature of a galactic boundary layer flow / A.M. Waxman	64
	Optical polarization in galaxies / A. Elvius	65
II	SPIRAL STRUCTURE AND STAR FORMATION	67
II.1	THE EVOLUTION OF DISK GALAXIES / S.E. Strom and K.M. Strom	69
DISCUSSION II.1		92
	Drift and broadening of ageing spiral arms / R. Wielen	93
	Comments on NGC 3312, NGC 1291 and NGC 1079 / J.S. Gallagher	94
II.2	SOME COMMENTS ON RADIO OBSERVATIONS OF SPIRAL ARMS / W.W. Shane and J. Bystedt	97
DISCUSSION II.2		103
II.3	THE DYNAMICS OF THE SPIRAL GALAXY M81 / H.C.D. Visser	105
DISCUSSION II.3		112
II.4	A CONFRONTATION OF DENSITY WAVE THEORIES WITH OBSERVATIONS / A.J. Kalnajs	113
DISCUSSION II.4		125
	Discrete spiral modes in disk galaxies / J.W.-K. Mark	127
	Growth of spiral waves in disk galaxies / G. Bertin	128
	Galactic shocks in open-armed normal spirals and barred spirals / W.W. Roberts	129

II.5	RADIO OBSERVATIONS OF MOLECULES IN NEARBY GALAXIES / J.B. Whiteoak	131
DISCUSSION II.5		137
	A first step toward the radial distribution of CO in M31 / L. Weliachew	137
II.6	HOT GAS IN THE GALAXY: HOW EXTENSIVE IS IT? / F.H. Shu	139
DISCUSSION II.6		145
III	NEARBY GALAXIES OF LARGE ANGULAR SIZE	147
III.1	RADIO CONTINUUM OBSERVATIONS OF M31 AND M33 / E.M. Berkhuijsen	149
DISCUSSION III.1		155
	Variation of spectral index across M31 / R. Beck	156
	M31 at 49 cm wavelength / J. Bystedt	157
III.2	VELOCITY DISPERSION IN THE BULGE OF M31; DYNAMICAL MODEL / G. Monnet, A. Pellet and F. Simien	159
III.3	THE SPIRAL STRUCTURE OF M31 / E. Athanassoula	163
DISCUSSION III.3		166
III.4	THE KINEMATICS WITHIN M31 / M.S. Roberts, R.N. White- hurst and T.R. Cram	169
DISCUSSION III.4		172
	HI survey of M31 / T. Landecker	173
III.5	THE THREE-DIMENSIONAL DISTRIBUTION OF NEUTRAL HYDROGEN IN M31 / R.N. Whitehurst, M.S. Roberts and T.R. Cram	175
DISCUSSION III.5		179
	Anomalous motions of spiral arms in M31 / W.W. Shane	180
III.6	A WARP IN THE HI DISTRIBUTION AT THE EXTREME NE AND SW OF M31 / D.T. Emerson and K. Newton	183
DISCUSSION III.6		187
	New outer HI arms in M31 / R.D. Davies	188
III.7	THE LARGE-SCALE DISTRIBUTION OF HI IN M33 AND IC 342 / J.E. Baldwin	191
DISCUSSION III.7		195

III.8	A SENSITIVE SINGLE-DISH HI SURVEY OF THE GALAXY M33 / W.K. Huchtmeier	197
DISCUSSION III.8		200
	Supernova remnants in M33 / S. D'Odorico	201
IV	NEARBY ACTIVE GALAXIES AND THEIR NUCLEI	203
IV.1	RADIO PROPERTIES OF ACTIVE NEARBY SPIRAL GALAXIES / A.G. de Bruyn	205
DISCUSSION IV.1		216
	The nucleus of NGC 1275 at 2.8 cm wavelength / E. Preuss	217
	HI in NGC 4258 / G.D. van Albada	218
IV.2	RADIO PROPERTIES OF THE NUCLEI IN ELLIPTICAL, SO AND SPIRAL GALAXIES / R.D. Ekers	221
DISCUSSION IV.2		223
	Compact components in active spiral and Seyfert galaxy nuclei and galaxy interactions / J.B. Carlson (presented by F.J. Kerr)	224
IV.3	INFRARED, OPTICAL, AND X-RAY PROPERTIES OF THE NUCLEI OF NEARBY GALAXIES / G. Burbidge	227
DISCUSSION IV.3		236
IV.4	EMISSION FROM THE NUCLEI OF NEARBY GALAXIES: EVIDENCE FOR MASSIVE BLACK HOLES? / M.J. Rees	237
DISCUSSION IV.4		242
V	THE OUTSKIRTS OF GALAXIES	245
V.1	GALAXY HALOES AND THE MISSING MASS PROBLEM / S. van den Bergh	247
DISCUSSION V.1		263
	Sensitive observations of HI envelopes of late-type galaxies / W.K. Huchtmeier	264
V.2	ON PERIPHERAL DYNAMICS / A. Toomre	267
DISCUSSION V.2		267
V.3	INTERACTING GALAXIES: THE KINEMATICS OF NGC 4038/39 AND THE HI BRIDGE BETWEEN M81 AND NGC 3077 / J.M. van der Hulst	269
DISCUSSION V.3		274
	Distributed HI in small groups of galaxies / R.D. Davies	274

Tidal interaction and accretion in the galaxy pair NGC 1512 and 1510 / H. van Woerden	274
Tidal interactions within the NGC 4631 group of gal- axies / F. Combes	275
HI observations of the M51 system / R. Giovanelli	276
Gas distribution and velocity field of the barred spiral galaxy NGC 5383 / R. Sancisi	276
V.4 GALAXIES WITH LONG TAILS / F. Schweizer	279
DISCUSSION V.4	285
V.5 MATERIAL IN THE VICINITY OF GALAXIES / B.F. Burke	287
DISCUSSION V.5	291
V.6 HIGH-VELOCITY CLOUDS: GALACTIC OR EXTRAGALACTIC? / R. Giovanelli	293
DISCUSSION V.6	297
High-velocity clouds and warping of the Galactic plane / J. Einasto	297
Fine structure in the Magellanic Stream / I.F. Mirabel	298
V.7 DISCUSSION ON IRREGULAR GALAXIES	299
HI observations of dwarf galaxies / T.D. Kinman	299
Gas distribution, motions and dynamics for some dwarf- irregular galaxies / R.B. Tully	299
Mass of clumps in the irregular galaxy Markarian 296 / J. Heidmann	300
HI observations of the irregular galaxy NGC 4214 / T.L. Landecker	300
Radio recombination lines in M82 / E.R. Seaquist	301
Preliminary results from an H α -[NII] line spectroscopic study of M82 / G. Comte	302
A dust-scattering model of M82 / S.M. Scarrott	302
INDEX OF GALAXIES AND CLUSTERS OF GALAXIES	305

With the publisher's permission the following figures have been reproduced from "*Astronomy and Astrophysics*":

Figures 1, 2, 3 and 4 in Paper I.4 by P.C. van der Kruit;

Figure 2 in Paper III.1 by E.M. Berkhuijsen;

Figures 1, 2, 3, 4 and 5 in Paper IV.1 by A.G. de Bruyn.