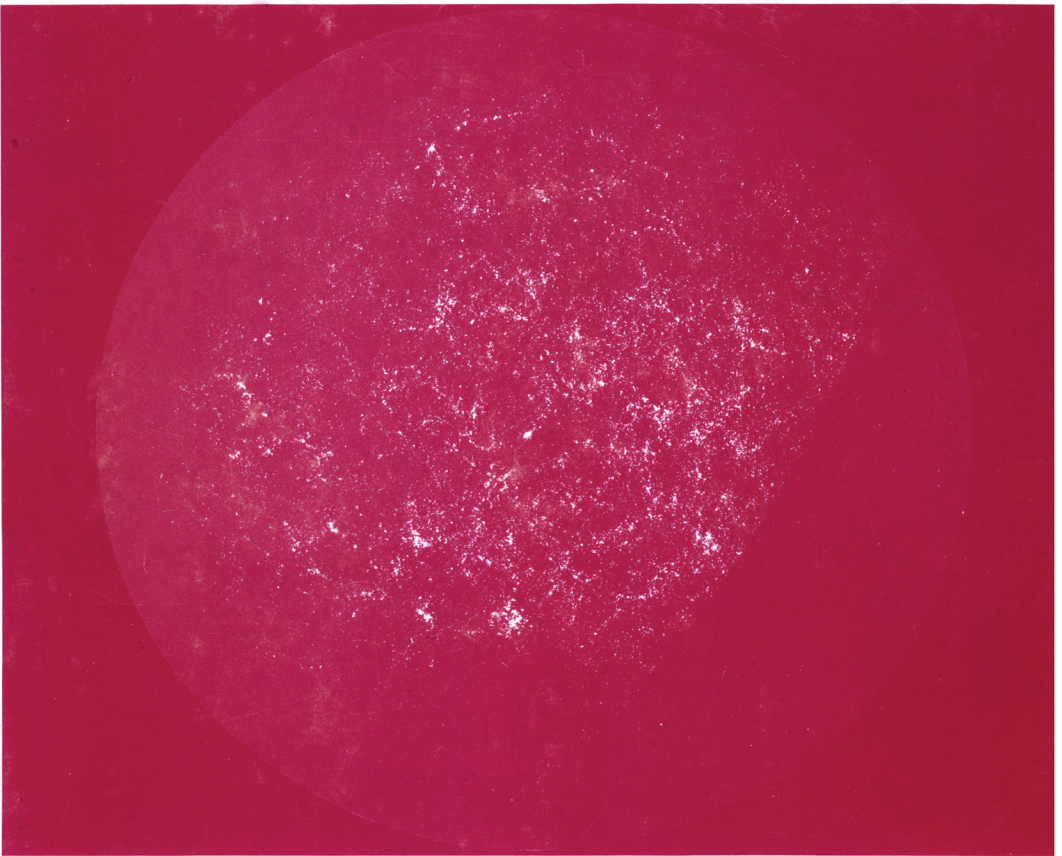


INTERNATIONAL ASTRONOMICAL UNION

SYMPOSIUM No. 79

THE LARGE SCALE STRUCTURE OF THE UNIVERSE

Edited by M. S. LONGAIR and J. EINAUTO



INTERNATIONAL ASTRONOMICAL UNION

D. REIDEL PUBLISHING COMPANY

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

THE LARGE SCALE STRUCTURE OF THE UNIVERSE

SYMPOSIUM No. 79

The subject of the symposium included systems of galaxies of all scales from binary galaxies through groups, clusters, superclusters to the very largest structures in the observable Universe. The conference was divided into five sections in which the following subjects were treated in depth: 1. galaxies in small groups, 2. clusters of galaxies, 3. large scale systems, 4. observational evidence for cosmological evolution, and 5. the formation of structure in the Universe. In the first three sections the theory of these systems was discussed in the context of the most recent observational data. The direct observational evidence for cosmological evolution of large scale structures is still sparse, but related studies of the evolution of quasars and radio sources were discussed, as well as future observations which will advance understanding of this problem. A wide range of theories of the origin of structure in the Universe were described.

The symposium indicated how there is now considerable agreement among observers about the essential features of the large scale structure of the Universe. The problem areas were highlighted and the directions for future research outlined.

Cover: Picture of the Northern Galactic Hemisphere from *Astronomical Journal* 82, p. 249. Reproduced by permission.

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

THE LARGE SCALE STRUCTURE OF THE UNIVERSE

INTERNATIONAL ASTRONOMICAL UNION
UNION ASTRONOMIQUE INTERNATIONALE

SYMPOSIUM No. 79

HELD IN TALLINN, ESTONIA, U.S.S.R., SEPTEMBER 12 - 16, 1977

THE LARGE SCALE
STRUCTURE
OF THE UNIVERSE

EDITED BY

M. S. LONGAIR

*Mullard Radio Astronomy Observatory,
Cavendish Laboratory, Cambridge, England*

AND

J. EINASTO

W. Struve Astrophysical Observatory of Tartu, Tõravere, Estonia, U.S.S.R.



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

1978

Library of Congress Cataloging in Publication Data

Main entry under title:

The large scale structure of the universe.

(Symposium – International Astronomical Union; no. 79)

Bibliography: p.

Includes index.

1. Cosmology – Congresses. 2. Galaxies – Congresses. 3. Stars – Clusters – Congresses. I. Longair, M. S., 1941– II. Einasto, Jaan. III. Series: International Astronomical Union. Symposium; no. 79.

QB981.L3 523.1 78-7032

ISBN 90-277-0895-9

ISBN 90-277-0896-7 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
Organising Committees	xiii
List of Participants	xv

In the table of contents Invited Lectures are shown in block capitals, Contributed Papers in lower case, and Short Communications in indented lower case format.

I. GALAXIES IN SMALL GROUPS

B. A. VORONTSOV-VELYAMINOV: THE PHOTOGRAPHY OF GROUPS OF GALAXIES	3
I. D. KARACHENTSEV: VELOCITY DISPERSION IN SMALL SYSTEMS OF GALAXIES	11
E. L. TURNER: OPTICAL STUDIES OF SMALL GROUPS OF GALAXIES	21
R. B. TULLY and J. R. FISHER: NEARBY SMALL GROUPS OF GALAXIES	31
W. K. Huchtmeier: Observations of high velocity HI clouds in the Local Group	49
J. EINASTO: HYPERGALAXIES	51
J. R. GOTT, III: N-BODY SIMULATIONS AND THE VALUE OF Ω	63
G. A. TAMMANN and R. KRAAN: THE GALACTIC NEIGHBOURHOOD	71
J. Materne: Three dimensional analysis of groups of galaxies	93
D. J. Hegyi: Detection of an optical halo surrounding the spiral galaxy NGC 4565	95
J. Einasto: The scatter in mass-to-luminosity ratios	96
L. M. Ozernoy and M. Reinhardt: Stabilization of systems of galaxies by subclustering	98
C. Casini and J. Heidmann: Morphological investigation of pairs containing Markarian galaxies	100

K.-H. Schmidt: Cluster membership of Seyfert galaxies	101
A. Tomov: The results of observations of double galaxies in the UBV system	102
I. Pronik and L. Metik: On the origin and evolution of pairs of galaxies that have different physical and kinematic characteristics	103
E. Khachikian: Markarian galaxies with double and multiple nuclei	105
W. Högner and N. Richter: Equidensitometric determination of angular diameters and mean surface magnitudes of compact galaxies	105
A. TOOMRE: INTERACTING SYSTEMS	109
B. Vorontsov-Velyaminov: On the tidal origin of M51-type systems	117
V. Dostal and V. Metlov: The frequency of ring galaxies and the probability of their formation by collisions	117
P. Biermann and R. Wielen: Encounters of spherical galaxies: N-body simulations and comparison with theoretical predictions	121
D. LYNDEN-BELL: ON THE MAGELLANIC STREAM, THE MASS OF THE GALAXY AND THE AGE OF THE UNIVERSE	123
W. E. Kunkel: The stellar component of the Magellanic Stream	130
A. G. D. Philip and A. G. Davis: Fine structure in the Magellanic Stream	131
II. CLUSTERS OF GALAXIES	
J. Melnick, S. White and J. Hoessel: Photoelectric surface photometry of the Coma Cluster	135
C. LARI and G. C. PEROLA: RADIO PROPERTIES OF ABELL CLUSTERS	137
R. D. EKERS: RADIO OBSERVATIONS OF CLUSTERS OF GALAXIES: THE TAIL SOURCES	149
E. A. Valentijn and H. van der Laan: Extended radio emission in clusters of galaxies: recent Westerbork observations	153
R. Wielebinski: Clusters with extended radio emission at high frequencies	157

V. L. Ginzburg: Radio haloes around galaxies and in clusters	161
J. L. CULHANE: X-RAY OBSERVATIONS OF CLUSTERS OF GALAXIES	165
J. SILK: GAS IN GALAXY CLUSTERS	179
S. J. AARSETH: COMPUTER SIMULATIONS OF GALAXY CLUSTERING	189
G. Paál: An analogy between simulated and actual clusters of different kinds	197
F. W. Baier: Structures and number-density distributions in clusters of galaxies	198
J. Burczyk and A. Zieba: Mathematical approach to the problem of clustering	199
A. Michalec and J. Machalski: Radio emission of Abell clusters in the GB and GB2 regions	200

III. LARGE SCALE SYSTEMS

G. DE VAUCOULEURS: THE LOCAL SUPERCLUSTER	205
R. B. Tully and J. R. Fisher: A tour of the Local Supercluster	214
P. J. E. PEEBLES: LARGE SCALE CLUSTERING IN THE UNIVERSE	217
L. Grishchuk: The isotropy of the universe on scales exceeding the horizon	226
K. RUDNICKI and S. ZIEBA: RESULTS ON THE LARGE SCALE DISTRIBUTION OF EXTRAGALACTIC OBJECTS OBTAINED BY THE METHOD OF STATISTICAL REDUCTION	229
M. JÓEVEER and J. EINASTO: HAS THE UNIVERSE THE CELL STRUCTURE?	241
G. O. ABELL: THE PHYSICAL PROPERTIES OF LARGE SCALE SYSTEMS FROM OPTICAL OBSERVATIONS	253
M. Tarenghi, W. G. Tifft, G. Chincarini, H. J. Rood and L. A. Thompson: The structure of the Hercules supercluster	263
W. G. Tifft and S. A. Gregory: Observations of the large scale distribution of galaxies	267
J. Huchra: The field luminosity function and nearby groups of galaxies	271

M. A. Arakelian: Markarian galaxies in the vicinity of the Coma cluster	274
P. Flin and M. Urbanik: Remarks on the angular distribution of Markarian galaxies	275
M. Kalinkov, V. Dermendjiev, B. Staikov, I. Kaneva, B. Tomov and K. Stavrev: Superclustering of galaxies	276
B. I. Fessenko: On the methods of discovering groups and clusters of galaxies	279
S. Phillipps: The autocorrelation analysis of deep galaxy samples	280
DISCUSSION OF METHODS ON DETERMINING THE MEAN MATTER DENSITY OF THE UNIVERSE	281
IV. OBSERVATIONAL EVIDENCE FOR COSMOLOGICAL EVOLUTION	
M. SCHMIDT: QUASARS AND COSMOLOGICAL EVOLUTION	289
J. G. BOLTON and A. SAVAGE: THE SURFACE DENSITY OF QUASARS	295
H. Lorenz: A survey programme for QSO and related objects	303
M. S. LONGAIR: THE LARGE SCALE DISTRIBUTION OF RADIO SOURCES	305
Y. N. PARIJSKIJ: SEARCH FOR PRIMORDIAL PERTURBATIONS OF THE UNIVERSE: OBSERVATIONS WITH RATAN-600 RADIO TELESCOPE	315
P. E. BOYNTON: THE QUEST FOR FINE-SCALE ANISOTROPY IN THE RELICT RADIATION	317
H. GURSKY: COSMOLOGICAL INFORMATION FROM X-RAY OBSERVATIONS	327
I. D. Karachentsev and A. I. Kopylov: Counts of faint galaxies	339
B. M. TINSLEY: THE EVOLUTION OF GALAXIES: EVIDENCE FROM OPTICAL OBSERVATIONS	343
J. P. OSTRIKER: ON THE DYNAMICAL EVOLUTION OF CLUSTERS OF GALAXIES	357
B. J. T. JONES and M. J. REES: THE EPOCH OF GALAXY FORMATION	377
B. A. Peterson: QSO absorption lines and intergalactic hydrogen clouds	389

R. A. SUNYAEV: FLUCTUATIONS OF THE MICROWAVE BACKGROUND RADIATION	393
A. A. Kurskov and L. M. Ozernoy: Constraints on the mean density of the Universe which follow from the theories of adiabatic and whirl perturbations	404
P. Boynton: Recent advances in microwave cosmology	405
V. THE FORMATION OF STRUCTURE IN THE UNIVERSE	
YA. B. ZELDOVICH: THE THEORY OF THE LARGE SCALE STRUCTURE OF THE UNIVERSE	409
A. G. Doroshkevich, E. M. Saar and S.F. Shandarin: The internal structure of protoclusters and the formation of galaxies	423
L. M. OZERNOY: THE WHIRL THEORY OF THE ORIGIN OF STRUCTURE IN THE UNIVERSE	427
A. D. Chernin: Origin of protogalactic eddies	439
M. Davis: Evidence for the gravitational instability picture in a dense Universe	441
E. M. Kellogg: Primeval clusters of galaxies and the X-ray background	445
R. D. Davies: Observational limits on neutral hydrogen in primordial protoclusters	447
J. Jaaniste and E. Saar: Orientation of spiral galaxies as a test of theories of galaxy formation	448
A. M. Fridman: Non-linear effects in flat gravitating systems	450
M. S. LONGAIR: PERSONAL VIEW—THE LARGE SCALE STRUCTURE OF THE UNIVERSE	451
AUTHOR INDEX	463