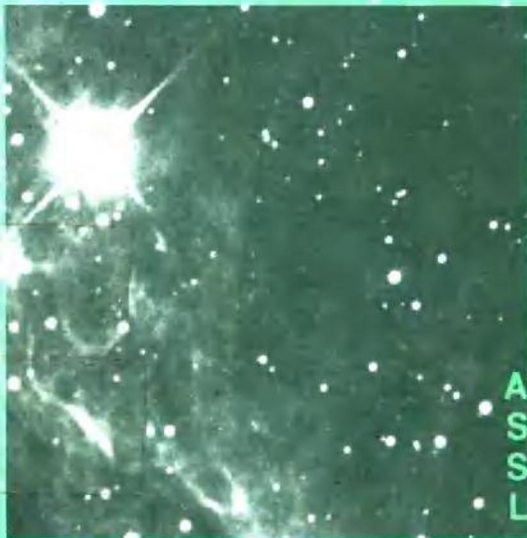


Morphological and Physical Classification of Galaxies

**G. Longo
M. Capaccioli
G. Busarello**

(editors)

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On the afternoon of January 5, 1992, our friend and highly esteemed colleague Jean-Luc Nieto met with a fatal accident while climbing the North face of Pic du Midi in the Pyrenees. Full of sorrow, we all dedicate this volume to his memory.

EDITORS' FOREWORD

The morphological scheme devised by Hubble and followers to classify galaxies has proven over many decades to be quite effective in directing our quest for the fundamental parameters describing the extragalactic manifold. This statement is however far more true for spirals than for ellipticals. Echoing the concluding remarks in Scott Tremaine's summary talk at the Princeton meeting on Structure and Dynamics of Elliptical Galaxies, *"the Hubble classification of spirals is useful because many properties of spirals (gas content, spiral arm morphology, bulge prominence, etc.) all correlate with Hubble time. By contrast, almost nothing correlates with the elliptical Hubble sequence E1 to E7."*

During the last few years much effort has been put into the search for a more meaningful classification of ellipticals than Hubble's. Concomitantly, forwarded by some provocative conjectures by R. Michard, the classical question of whether E galaxies form a physically homogeneous family has been brushed up once more. Results of these and other parallel studies look rather promising and point to suture part of the dichotomy between ellipticals and disk galaxies which had become popular in the early eighties, owing to dynamical arguments. At the same time it appears more and more clear that, besides the usual genetic varieties of galaxies, products of environmental evolution must also be contemplated in building our modern picture of the "reign of galaxies".

The above considerations prompted us to solicit Prof. Mario Rigutti, Director of the Capodimonte Astronomical Observatory (OAC), to devote the 5th OAC Conference at photographing the state of the art of this exciting transition process from the morphological to the physical "era" in classification of galaxies. The documentary role chosen for the meeting called for a structure in just invited and poster papers, with ample space for discussions. Three oral sessions were devised accordingly to the following scheme: Hubble classes, galaxy components, and physical parametrization.

We planned to gather a number of 'experts' in an isolated spot in order to favour interactions (and to discourage tours evasions). A suitable location was found in the hotel *O' Sole Mio* at the outskirts of Sant'Agata sui Due Golfi, a small village placed at 500 meters above sea-level at the tip of the splendid Sorrento peninsula. The answer from the community has been quite good. The attendance to the meeting, from the 2nd to the 6th of September of 1990, was of ~ 100 scientists coming from all over the world.

Practically all the invited speakers provided us with their written contributions, and some of them even within the theoretical deadline. These papers are included here together with the accompanying discussions and the written versions of the posters. They account on the scientific activity; happy hours are instead documented by the photographs with which we have filled up occasional blank space.

This meeting would not have been possible or just equally successful on the organizational ground without the help of Ing. P. Petillo of DIGITAL Equipment Corporation, Mr. F. Serino of OLIVETTI Computers, Dr. F. Bevilacqua of AERITALIA, and Dr. F. Simeoli of the municipality of Massa Lubrense. We also acknowledge the professionalism of Mss. G. Iaccarino and T. Ievolella as meeting secretaries, and the "southern" hospitality of M. Insigne, hotel manager, and his family.

Because of some “late deliveries”, these proceedings are sent to the printer quite a few months past the first *formal* and *strict* deadline. However, the domain of LaTeX and the dedication of Mss. E. Acampa and A. D’Orsi allowed to cut drastically the technical time for the preparation of the manuscript.

Gianni Busarello, Massimo Capaccioli, and Giuseppe Longo

Naples, December 21, 1991

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TABLE OF CONTENTS

EDITORS' FOREWORD	xiii
SCIENTIFIC AND LOCAL ORGANIZING COMMITTEE	xv
LIST OF PARTICIPANTS	xvii

INVITED PAPERS: *GALAXY TYPES*

MORPHOLOGY OF GALAXIES: AN OVERVIEW	
R. Buta	1
THE LUMINOSITY FUNCTIONS OF GALAXIES	
H. Jerjen, G.A. Tammann, B. Binggeli	17
ELLIPTICAL GALAXIES	
M. Franx	23
STRUCTURE AND KINEMATICS OF SPIRALS	
P.C. van der Kruit	39
BRIGHTEST CLUSTER MEMBERS	
J. Schombert	53
CENTRAL REGIONS OF EARLY—TYPE GALAXIES	
J.-L. Nieto	69
STELLAR CONTENT AND CHEMICAL EVOLUTION IN SPHEROIDAL POPULATIONS	
M. Rich	85

INVITED PAPERS: *GALAXIAN COMPONENTS*

STELLAR DISKS IN EARLY—TYPE GALAXIES	
M. Capaccioli, N. Caon	99
GASEOUS DISKS IN ELLIPTICAL GALAXIES	
F. Bertola	115
FORMATION AND MAINTENANCE OF SPIRAL STRUCTURE	
E. Athanassoula	127
DARK MATTER IN ELLIPTICAL GALAXIES	
T. de Zeeuw	139

DARK MATTER IN LATE-TYPE GALAXIES	
S.M. Kent	153
DARK MATTER IN DWARF GALAXIES	
C. Pryor	163
ELLIPTICAL GALAXIES IN X-RAYS	
L. Ciotti, A. D'Ercole, S. Pellegrini, A. Renzini	179
THE WARM COMPONENT OF THE ISM OF ELLIPTICAL GALAXIES	
F. Macchetto, W.B. Sparks	191
THE BAR COMPONENT IN DISK GALAXIES	
A. Bosma	207
PECULIAR KINEMATICS	
M. Balcells	221
COLD GAS IN ELLIPTICAL GALAXIES	
J. van Gorkom	233
COLD GAS IN LATE-TYPE GALAXIES	
R. Sancisi	239
ABUNDANCE GRADIENTS AND RELATED PROPERTIES IN GALAXIES	
F. Matteucci	245
STRUCTURE AND METALLICITY OF LOW-LUMINOSITY EARLY-TYPE GALAXIES	
P. Prugniel, E. Bica, D. Alloin	261

INVITED PAPERS: *ENVIRONMENT AND SYSTEMATICS*

INTERACTIONS: WEAK	
F. Combes	265
INTERACTIONS: STRONG	
J. Barnes	277
THE MORPHOLOGY OF BINARY GALAXIES	
J.W. Sulentic	293
INTRINSIC SHAPES OF ELLIPTICAL GALAXIES	
D. Merritt	309
ON UNDERSTANDING THE GLOBAL PROPERTIES OF GALAXIES	
D. Burstein	321
GALAXY MANIFOLDS AND GALAXY FORMATION	
G.S. Djorgovski	337
SUB-COMPONENTS IN ELLIPTICAL GALAXIES AND THEIR FORMATION	
R. Bender	357

**MORPHOLOGY AND CLASSIFICATION OF GALAXIES –
WHERE DO WE STAND?**

I.R. King	371
-----------------	-----

POSTER PAPERS

**DETAILED MORPHOLOGICAL CLASSIFICATION OF EARLY-TYPE
GALAXIES IN THE PERSEUS CLUSTER**

P. Poulain, J.-L. Nieto, E. Davoust	377
---	-----

PROPERTIES OF DWARF SPHEROIDALS

G. Djorgovski, R. de Carvalho	379
-------------------------------------	-----

BRIGHT CORES IN NEARBY SOUTHERN GALAXIES

O.R. Hainaut, B.J. Jarvis	381
---------------------------------	-----

SHELL FORMATION AND THICK DISKS IN ELLIPTICAL GALAXIES

R.C. Thomson	385
--------------------	-----

THE ORIGIN OF STRONG ISOPHOTAL TWISTS IN ELLIPTICAL GALAXIES

J.-L. Nieto, Ch. Lagoute	387
--------------------------------	-----

PHOTOMETRIC PROPERTIES OF DISKS IN ELLIPTICAL GALAXIES

C. Scorza, R. Bender	389
----------------------------	-----

ELLIPTICAL GALAXIES WITH DARK MATTER

G. Bertin, R.P. Saglia, M. Stiavelli	391
--	-----

NUCLEAR DUST-DISCS IN RADIO ELLIPTICALS

W. B. Sparks, F. Macchetto, D. Fraix-Burnet, R. Bender, M. Capaccioli, J.-L. Nieto	393
---	-----

EXTENDED H α FILAMENTS IN ELLIPTICAL GALAXIES

D. Fraix-Burnet, F. Macchetto, W.B. Sparks	395
--	-----

THE ORIGIN OF THE IONIZED GAS IN S0 GALAXIES

F. Bertola, L.M. Buson, W.W. Zeilinger	397
--	-----

LINE-STRENGTH GRADIENTS IN S0 GALAXIES

A. Paquet, R. Bender, W. Seifert	399
--	-----

ULTRAVIOLET SPECTRA OF EARLY TYPE GALAXIES

A. Danks, M. Perez	401
--------------------------	-----

ON THE NATURE OF THE COMPACT GALAXIES IN THE UGC

E. Davoust, S. Considère, Ph. Prugniel, N. Denis	403
--	-----

MORPHOLOGY OF GALAXIES SURROUNDING COMPACT GROUPS

G.C. Baiesi-Pillastrini, V. Tornatore, G.G.C. Palumbo	405
---	-----

MEAN SURFACE DENSITY AND MORPHOLOGICAL TYPE IN DISC-GALAXIES	
M. Prieto, A. Campos Aguilar, C. García	407
PECULIAR KINEMATICS IN INTERACTING ELLIPTICAL GALAXIES	
R. Madejsky	409
MORPHOLOGY AND KINEMATICS OF SPIRAL GALAXIES WITHOUT BAR: THE IMPORTANCE OF THE CENTRAL MASS	
G.C. Baiesi-Pillastrini	411
THE CORRELATION BETWEEN VELOCITY GRADIENTS AND ARM CLASSIFICATION IN SPIRAL GALAXIES	
A. Biviano, M. Girardi, G. Giuricin, F. Mardirossian, M. Mezzetti	413
OPTICAL LINE/RADIO LUMINOSITY CORRELATION AND THE EFFECTS OF THE INTERSTELLAR MEDIUM	
R. Morganti	415
THE LUMINOSITY-DIAMETER RELATION FOR DISK GALAXIES: A SEARCH FOR ENVIRONMENTAL EFFECTS	
M. Girardi, A. Biviano, G. Giuricin, F. Mardirossian, M. Mezzetti	419
GLOBAL PROPERTIES IN EARLY TYPE GALAXIES	
A. Rifatto	421
MASSES AND MASS-TO-LIGHT RATIOS OF ELLIPTICAL GALAXIES	
G. Busarello, G. Longo	423
ON THE PHOTOMETRIC SCALING LAWS FOR EARLY-TYPE GALAXIES	
N. Caon, M. Capaccioli	425
PROPERTIES OF BRIGHTEST CLUSTER MEMBERS	
S. Djorgovski, R. de Carvalho, I. Shlosman, J. Schombert	427
THE FUNDAMENTAL PLANE FOR EARLY-TYPE GALAXIES	
I. Jørgensen, P. Kjørgaard	429
ELLIPTICAL GALAXIES AND THE THICKNESS OF THE FUNDAMENTAL PLANE	
F. Simien, P. Prugniel	431
DISSIPATIONLESS FORMATION OF ELLIPTICAL GALAXIES	
M. Stiavelli, P. Londrillo, A. Messina	433
THE TWO-COMPONENT COLOUR-STRUCTURE OF THE gE GALAXY NGC 4472	
P. Surma, R. Bender, J.-L. Nieto	435
THE VELOCITY DISPERSION ANISOTROPY IN NGC 720	
R. van der Marel, P. Cinzano	437
NGC 205 AND THE NATURE OF COMPACT NUCLEI IN DWARF GALAXIES	
S. Djorgovski, O. Bendinelli, G. Parmeggiani, F. Zavatti	439

LIGHT AND COLOR DISTRIBUTION IN THE CORE OF M32	
R. Michard, J.-L. Nieto	441
NGC 3384 AND ITS "SATURN-LIKE" APPEARANCE	
M. Ferrario, M. Capaccioli	443
CIGALE OBSERVATIONS OF NGC 3198	
R.L.M. Corradi, J. Boulesteix, A. Bosma, M. Capaccioli, P. Amram, M. Marcelin	445
MAPPING THE STAR FORMATION IN NEARBY GALAXIES: THE MAGELLANIC IRREGULAR NGC 3109	
F. Bresolin, M. Capaccioli, G. Piotto	447
MM OBSERVATIONS OF THE MAGELLANIC CLOUDS FROM ANTARCTICA	
P. Calisse, G. Dall'Oglio, M.T. Di Bari, A. Iacoangeli, L. Martinis	449
SEYFERT GALAXIES WITH CLOSE COMPANIONS. A METHOD FOR IDENTIFICATION	
P. Rafanelli, P. Marziani	451
GLOBULAR CLUSTERS AS PROBES OF THE GALACTIC POTENTIAL	
M. Stiavelli, G. Piotto, M. Capaccioli	455
RELATION BETWEEN THE PROPERTIES OF GLOBULAR CLUSTER SYSTEM AND THE MASS DISTRIBUTION ON THE GALACTIC DISK	
V.G. Surdin	457
TOWARDS A PRECISE DEFINITION OF THE MORPHOLOGICAL STRUCTURES OF GALAXIES AS A BASIS FOR THEIR AUTOMATIC CLASSIFICATION	
A. Accomazzi, D. Delfini, M. J. Kurtz, P. Mussio	459
FOURIER ANALYSIS OF BARRED GALAXIES: A CONVENIENT ALTERNATIVE TO THE COMPONENT DECOMPOSITION	
P. Dubath, B. J. Jarvis, L. Martinet, D. Pfenniger	461
IMPROVEMENTS OF THE SIGNAL-TO-NOISE RATIO BY ADAPTIVE FILTERING	
H. Lorenz, G. Richter	465
INDEX OF OBJECTS	469

MORPHOLOGY OF GALAXIES: AN OVERVIEW

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ABSTRACT. Morphological classification has been and still is a very useful tool in modern extragalactic astronomy. In this overview, I discuss galaxy morphology with regard to the techniques and problems of classification, as well as recent advances in the field.

1 Introduction

Since Hubble's classification famous 1926 paper outlining his system, understanding galaxy morphology has been an important goal of extragalactic astronomy. For a long time, the subject was little more than descriptive because of a lack of basic data, but today morphology is very much more than a series of type codes and symbols. There is little doubt that morphology was a first logical step in approaching an understanding of galaxies. However, it is reasonable to ask where morphology has led us up to now. This is important to consider at a time when extragalactic astronomy is making great strides on both theoretical and observational fronts.

In this overview I will focus mainly on the fundamentals of morphological classification, both in theory and in practice. The subject is very broad and cannot cover all of the quantitative aspects which have been addressed in recent years. Nevertheless, an attempt is made to review advances in understanding specific types from research during the past 15 years.

2 Morphology: clues to formation and evolution

The principal goal of morphological studies has been to obtain insight into galaxy formation and evolution. Fundamental problems, such as the nature of S0 galaxies, the effects of environment, morphological segregation in clusters, the origin of bars, the driving mechanisms for spiral structure, the possibility of significant secular evolution of structure within a Hubble time, and the underlying factors which determined the various types at the time of galaxy formation, all require accurate knowledge of morphology in order to be addressed reliably. How effective morphology can be in addressing these problems depends on how well the relationships between the various types of galaxies