The de Vaucouleurs Atlas of Galaxies

The de Vaucouleurs Atlas of Galaxies is a comprehensive illustration of the morphology of normal, nearby galaxies, and how they are classified in the revised Hubble system developed in the 1950s by Gérard de Vaucouleurs. Using an image database of over 500 galaxies, the de Vaucouleurs classification is made more accessible and understandable so that astronomy researchers, students, and amateurs can apply the system with ease.

De Vaucouleurs's types are presented in a similar manner to previous galaxy atlases, but with a modern twist: the illustrations are based almost exclusively on digital images as opposed to photographic plates. Because much has been learned about the physical basis of galaxy morphology since de Vaucouleurs published his revision, the *Atlas* contains a comprehensive review of the recent literature, outlining how different morphological features are interpreted. This means that *The de Vaucouleurs Atlas of Galaxies* is not only a pictorial atlas, but an up-to-date reference on our understanding of the physical processes that underlie galaxy morphology.

GÉRARD DE VAUCOULEURS was one of the twentieth century's leading astronomers. He is famous for his knowledge of galaxies and his development in the 1950s, with Allan Sandage, of the scheme that forms the subject of this book. His legacy includes not only the galaxy classification system, but his pioneering studies of the Large Magellanic Cloud and of the photometric properties of galaxies, his establishment of the reality of the Local Supercluster, his work on the extragalactic distance scale, and the three *Reference Catalogues of Bright Galaxies* (1964, 1976, and 1991).

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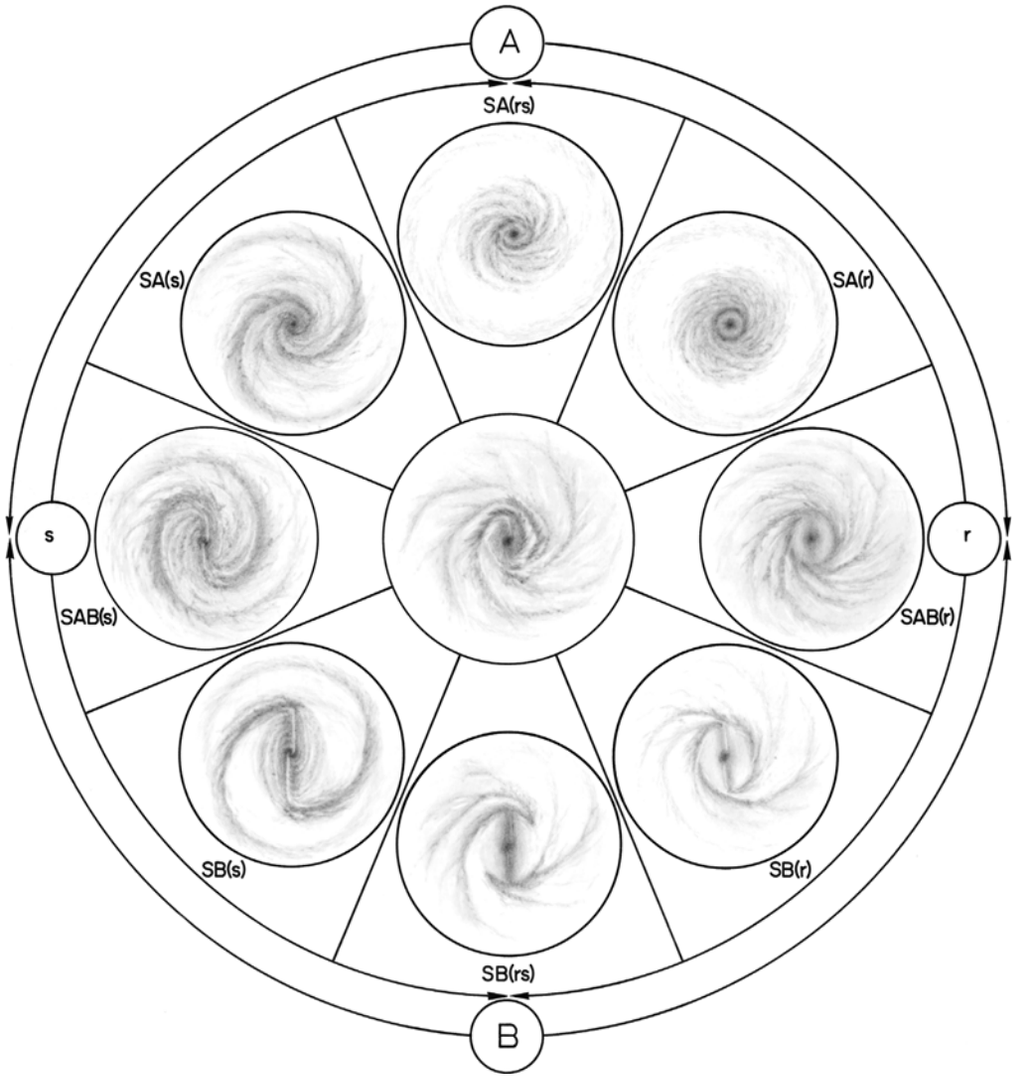

Cross section of revised classification near stage Sb.

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For Debe, Sarah, and Katie

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Preface

"The first essential of a classification scheme is to be well illustrated," commented Ivan King in his elegant summary of a meeting titled "Morphological and Physical Classification of Galaxies," held at the Osservatorio Astronomico di Capodimonte, Sant'Agata Sui Due Golfi, Italy in 1990. This is perhaps where the idea of an atlas designed to illustrate the de Vaucouleurs revised Hubble–Sandage classification system first took shape. King noted how well documented and illustrated the types in the *Revised Shapley–Ames Catalogue* (Sandage and Tammann 1981) were because of several atlases with high quality, well-reproduced photographs that had been prepared to illustrate these types. King believed that because of this, "the world is moving toward the classification scheme of the *Revised Shapley–Ames Catalogue*." King also noted that the "publication of the de Vaucouleurs *Third Reference Catalogue* will give classifications, in his system, of a much longer list of galaxies." Indeed, the *Third Reference Catalogue of Bright Galaxies*, published in 1991, included de Vaucouleurs types for nearly 18 000 galaxies, making the de Vaucouleurs revised Hubble–Sandage system the "most applied" visual galaxy classification. Yet, the de Vaucouleurs classification scheme, published in 1959, had never been "well illustrated," at least not in the form of a major atlas of uniform, high quality images as had been done for Hubble's own revision of his 1926 classification system (Sandage 1961), and for the Hubble–Sandage revision (Sandage and Bedke 1988, 1994).

Our goal with the present atlas is to do for the de Vaucouleurs revised Hubble system what Allan Sandage did so admirably for Hubble's own revision: illustrate the types and the meaning of the notation with large-scale images taken with large reflectors. Only we do this with a modern twist: we do not use photographic plate images, as had been exclusively done for the earlier atlases. Instead, we use modern digital images, all converted to the common unit of magnitudes per square arcsecond. We also view the types not from a 1950s frame of reference, but from a frame nearly 50 years after de Vaucouleurs published his point of view. So much has been learned about galaxies since that time that we need not limit the atlas to simple descriptions of the morphologies and the details that define the types. We can also interpret what the observed features mean or imply about specific galaxies and of galaxies in general. Thus, *The de Vaucouleurs Atlas of Galaxies* represents a joining of classical galaxy morphology with the modern era, an era of excitement that continues with each major advance in ground- and space-based instrumentation.

We hope that users of the *Atlas* will gain a greater appreciation of what de Vaucouleurs types mean, and especially how these types actually differ from Hubble–Sandage revised types. On the whole there is consistency, but significant differences are present. The *Atlas* brings attention to these differences, as well as to newly established types and morphological features that were not fully appreciated in the 1950s.

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In an attempt to tap talented amateurs for images of large galaxies, *Sky and Telescope* magazine published a short article about the *Atlas* in its February, 2004 issue. We thank Joshua Roth and Edwin L. Aguirre for their interest in helping us reach a broad audience of potential contributors. We are especially grateful to Adam Block, a dynamic amateur working at Kitt Peak National Observatory, for providing the excellent images of M31, M33, and NGC 2403 when we were desperate for suitable images of these large galaxies. We also thank amateurs Randy Brewer, Paul Downing, Rob Gendler, Robert A. Lang, J. Lapre, Christine Olson, Joe Petrick, John E. Pool, and Ted Wolfe for sending us images or for bringing our attention to possible image sources.

The totality of all images made available provided us with a database of over 500 galaxies to work with. Unfortunately, we were not able to find suitable images of the Magellanic Clouds that we could convert to *Atlas* Units. The Magellanic Clouds are much larger than the other galaxies and it was difficult to find images that were deep in blue light and at the same time covered the whole area of the galaxies.

We are very grateful to Allan Sandage, Carnegie Observatories, for providing us with historical background information on Gérard de Vaucouleurs's visits to Pasadena in the 1950s, and for his writing of two superb and well-timed essays on galaxy morphology and classification in his retirement. We are also grateful to David L. Block, University of the Witwatersrand, for hosting highly successful and productive galaxy morphology meetings in his home country of South Africa in 1999 and 2004, and for supporting RB's research visits in 2001 and 2003, which led to some of the work discussed in this *Atlas*.

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