

Preface

The last three decades have seen an enormous surge of activity in the study of dwarf galaxies. To give a measure of that, the number of publications in the year 1981 containing both words “dwarf” and “galaxy” in the title was only 19. This number has grown almost monotonically over the following two decades, and in 2010 it was 243. As of 19.10.2011 already 238 publications on dwarf galaxies have been put in the preprint archive.

The reason for this growing interest is quite obvious: advanced ground-based and space-born observatories allow to observe dwarf galaxies over a wide spectral window to an unprecedented level of detail. The advent of the HST has permitted sharp insights into the formation history of stellar populations of dwarf galaxies in the Local Group and its close vicinity back to the epoch of the cosmic reionization. Early-type dwarfs in galaxy clusters, at first glance featureless and deceptively simple, now turn out to have a rich “biography”, as witnessed by the variety of structural and kinematical patterns recently discovered in them. Galaxy clusters as gigantic cosmic factories of galaxy evolution are now being studied in considerable detail, unraveling spectacular dwarf galaxy transformation processes driven by the hot intra-cluster medium and the mutual interaction between thousands of galaxies. On the other hand, comparatively unevolved dwarfs residing close to the boundaries of voids suggest that the “cosmic clock” ticks slower in these largely unexplored pristine environments.

The intriguing diversity of the dwarf galaxy population, further enriched by the discovery of ultra-faint and ultra-compact systems, and of tidal dwarf galaxies in the outskirts of colliding galaxy pairs, poses new challenges both to observers and theoreticians. The starburst phenomenon in low mass galaxies both in the nearby universe and out to intermediate redshift continues confronting us with fundamental yet poorly resolved questions. These pertain to, e.g. the origin of starbursts and their role on the dwarf galaxy buildup, the synchronization and spatial progression of star-forming activities within dwarfs, and the synthesis, dispersal and possible ejection of heavy elements during such violent episodes of dwarf galaxy evolution. The number of extremely metal-poor nearby star-forming dwarf galaxies has grown from about a dozen by the end of the past millennium to more than 70 in 2011. This

fact now allows us to study systematically and in great spatial detail collective star formation and feedback processes under chemical conditions approaching those in faint protogalactic building blocks in the faraway universe.

Dwarf galaxy research is certainly not threatened by the lack of momentum and new challenges. To the contrary, it constitutes an extremely vibrant field of astrophysical research, with many long-standing questions remaining unsettled and new ones continuously arising. However, for a significant step forward, not only better data and analysis techniques are required but also theoretical guidance is essential.

From a theoretical point of view, progress in the understanding of the formation and evolution of dwarf galaxies has been unquestionable, yet the number of open problems is overwhelmingly larger than the number of aspects for which a satisfactory explanation and unanimous consensus has been reached. We know that dwarf galaxies are quite vulnerable to energetic events associated with star formation (explosion of Supernovae and stellar winds), although this feedback is probably unable to expel all the gas from an initially gas-rich dwarf galaxy. We know that the environment surrounding a dwarf galaxy (other galaxies or inter-galactic medium) plays a key role in the evolution of these objects, but many fine details of these interactions are still obscure and the interplay between internal processes and environmental interactions has been explored only partially. We know that many physical processes (low star formation efficiencies, galactic winds, infall and so on) can keep the metallicity of a dwarf galaxy as low as observed, but the enormous diversity of chemical compositions and chemical evolution histories among dwarf galaxies still requires a satisfactory explanation. We know, by means of numerical models, how to reproduce many characteristics of the Local Group dwarf galaxies (the best-known class of dwarf galaxies), but the majority of details about their structure and evolution remains still elusive. A discussion apart would deserve the “cosmological approach” to the study of dwarf galaxies, starting from the question “are the dwarf galaxies we observe nowadays similar to the building blocks of more massive galaxies in the early universe?”.

In organizing this symposium, our aim was to bring together observers and theoreticians to exchange ideas and new results on the many evolutionary aspects and open issues of dwarf galaxies. The main topics that have been addressed include:

- The birth of dwarf galaxies: theoretical concepts and observable relics across wavelength and time
- The morphological, structural and chemical evolution of dwarf galaxies
- Possible evolutionary connections between early-type and late-type dwarfs
- The star formation history of dwarf galaxies and its dependence on intrinsic and environmental properties
- The origin and implications of starburst activity in dwarf galaxies
- The fate of dwarfish systems born out of tidally ejected matter in galaxy collisions

The JENAM symposium *Dwarf Galaxies: Keys to Galaxy Formation and Evolution* took place on 9 and 10 September 2010 in Lisbon. Its six sessions of 90 min each were all extremely well attended, with a vivid participation of more

than 100 astronomers from 20 different countries and a large number of high-quality contributions, including five reviews and several invited and contributed talks. Additionally, poster presentations were given before each evening session. These proceedings contain the large majority of the papers that were presented at the symposium.

Porto and Vienna

Polychronis Papaderos

Simone Recchi

Gerhard Hensler

Dwarf Galaxies: Keys to Galaxy Formation and Evolution

Proceedings of Symposium 3 of JENAM 2010

Papaderos, P.; Recchi, S.; Hensler, G. (Eds.)

2012, XXII, 346 p., Hardcover

ISBN: 978-3-642-22017-3