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Edited by

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COVER ILLUSTRATION:

Dwarf galaxies, whether lurking near more massive neighbors as shown here or more isolated, serve as laboratories for studying star formation, feedback processes, gas kinematics, and chemical enrichment, and act as probes of structure formation and cosmology at earlier epochs.

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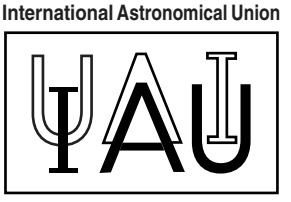

DWARF GALAXIES: FROM THE DEEP UNIVERSE TO THE PRESENT

PROCEEDINGS OF THE 344th SYMPOSIUM OF THE INTERNATIONAL ASTRONOMICAL UNION HELD IN VIENNA, AUSTRIA 20–24 August, 2018

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Preface

Dwarf galaxies have long served as excellent, individual laboratories for studying star formation, feedback processes, gas kinematics, and chemical enrichment in the local universe. As community interest in dwarfs has gained momentum, the study of dwarf galaxies has broadened to encompass larger questions themed around structure formation, stellar mass assembly, and the role environment plays in galaxy evolution. Now that cosmological simulations of structure formation are finally capable of resolving dwarf galaxies in increasingly larger cosmological volumes, the worlds of dwarf galaxy theory and observations are at a crossroads.

Our growing body of knowledge on dwarfs is diverse and stretches back to early cosmic times. For example, satellites at increasingly lower masses in the Local Group have placed limits on the effects of reionization. These dwarf galaxies are now not only seen as analogs to galaxies in the early universe, but they have become direct probes of the earliest epochs of star formation. Detailed studies of the cold interstellar medium in nearby galaxies made possible by Herschel and ALMA can now place constraints on the dust and molecular gas content of low mass galaxies. Low redshift studies have also begun to statistically populate the faint-end of the luminosity function, bridging the gap in the baryonic Tully-Fisher relation between dwarf spheroidals and irregulars but also revealing environmental variations. The expanding physical volume probed by current telescopes means the properties and histories of isolated dwarfs can be compared across environments ranging from dwarf galaxy associations, to dwarfs in groups, stellar streams, and directly interacting systems. The numbers of observed dwarfs can further be compared to cosmological simulations as direct tests of the Lambda Cold Dark Matter paradigm.

Burgeoning samples of extremely metal-poor star-forming dwarfs have opened new avenues of research on star formation in nearly pristine environments, creating tension with our current understanding of stellar feedback and the retention of baryons at low masses. We are on the threshold of observing and understanding the formation and lifecycle of massive stars in metal-poor environments that will connect star formation conditions locally with intermediate and high-redshift conditions that probe the physics of early generation stars. The upcoming progress in this area inspired by second generation high-multiplexing optical spectrographs, and the ideal laboratories provided by dwarf galaxies, made this a crucial time for bringing together the low metallicity, massive star and dwarf galaxy communities.

At the same time, advances in observational techniques have also moved us into the era of direct observations of dwarfs at high redshift, including studies of dwarf galaxies directly contributing to the reionization of the universe. For example, dwarf galaxies in the mass range of $10^7 - 10^8$ Msun are now being studied out to redshift 6; this is an area poised for significant growth. Such observational advances have been paralleled by large chemo- and hydro-dynamical simulations that are now resolving structures on dwarf galaxy mass-scales over critical cosmic timescales for galaxy evolution.

In this symposium, our goal was to integrate the current knowledge of dwarf galaxies across multiple distance scales and multiple communities, to build not only a consistent picture of low-mass systems across cosmic time but to also relate these observations to cosmological constraints from dwarf galaxy populations. The meeting incorporated (i) detailed studies of Local Group satellites, (ii) star formation, ISM content, feedback, gas kinematics, and chemical enrichment (or lack thereof) in nearby dwarfs, (iii) the interplay of the interstellar medium and massive stars hosted by low metallicity dwarf galaxies, (iv) the properties of dwarfs at high-redshift, (v) hydrodynamical simulations and cosmological models of low-mass structures.

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