University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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"Solo Dwarf Galaxy Survey: The Sagittarius Dwarf Irregular Galaxy"

Department of Physics and Astronomy

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Human and Social Development
A250

Supervisory Committee:
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Abstract

Galaxy evolution depends on a diverse suite of factors, from the environment in which the galaxy exists to the number of supernova that explode throughout its history. The structure and stellar populations present will also be altered by a galaxy's merger history, stellar mass, star formation rate, among other influences. Some factors, like mergers, are dependent on the environment of the galaxy, while others, like feedback from star formation, are intrinsic to the galaxy themselves. Dwarf galaxies are sensitive to many of these factors due to their smaller masses, hence shallower potential wells. Dwarfs are also interesting in themselves as the least massive structures that can form stars, forming the faint limit of galaxy types. There is some indication that the evolutionary pathway of dwarfs might be different than their more massive counterparts. Indeed, some dwarfs may be the stripped remnants of larger galaxy after a major interaction. Regardless, dwarfs are thought to be the building blocks of larger galaxies via hierarchical galaxy formation and understanding these small dwarfs helps us build a more complete picture of galaxy formation and evolution at all masses.

As dwarfs generally have low stellar mass, they are very faint. Our most complete sample of dwarfs is therefore restricted to those that are nearby. These nearby systems are dominated by dwarfs satellite to the Milky Way and M31. However, the evolution of these satellites will be greatly influenced by their massive host. By studying nearby isolated dwarfs, we can try to separate the secular evolutionary processes of dwarfs from the influence of their larger host. Additionally, stellar populations can be resolved in these nearby galaxies, and so their structures can be probed to much fainter regimes than integrated light studies allow.

The Sagittarius Dwarf Irregular Galaxy (Sag DIG) is one of the most isolated, low mass galaxies, located at the edge of the Local Group. Its isolation from other galaxies coupled with its relative proximity provide an excellent opportunity to study the intrinsic properties of this low mass system. We preform an in-depth analysis of its resolved stellar populations and its structural properties as the first galaxy in the larger dataset, Solitary Local Dwarfs Survey (Solo). *Solo* is a wide field photometric study targeting every isolated dwarf galaxy within 3 Mpc of the Milky Way. *Solo* is based on (*u*) *gi* multi-band imaging from CFHT/MegaCam for northern targets, and Magellan/Megacam for southern targets. All galaxies fainter than $M_V \simeq$ -18 situated beyond the nominal virial radius of the Milky Way and M31 ($\gtrsim$ 300 kpc) are included in this volume-limited sample, for a total of 42 targets.

For Sag DIG, we provide updated estimates of its central surface brightness and integrated luminosity, and trace its surface brightness profile to a level fainter than 30 mag./sq.arcsec. Sag DIG is well described by a highly elliptical (disk-like) system following a single component Sersic model. However, a low-level distortion is present at the outer edges of the galaxy that, were Sag DIG not so isolated, would likely be attributed to some kind of previous tidal interaction. Further, we find evidence of an extremely low level, extended distribution of stars beyond ~ 5 arcmins (> 1:5 kpc) that suggests Sag DIG may be embedded in a very low density stellar halo. We compare the stellar and HI structures of Sag DIG, and discuss results for this galaxy in relation to other isolated, dwarf irregular galaxies in the Local Group. Sag DIG, and the similarly isolated dwarf Aquarius, both have HI distributions that are more circular than their stellar components. In contrast, Wolf { Lundmark { Mellote (WLM), another isolated but slightly more massive dwarf, has stellar and HI components that trace each other well. Sag DIG and Aquarius also differ in that there is no signature of rotation in the HI of Sag DIG, while there is clear rotation in both the HI and stellar component for Aquarius. These preliminary comparisons demonstrate some of the potential analysis which will be possible on a much larger scale with the full Solo Survey.