Understanding the Extreme Classes of Dwarf Galaxies

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Propositions

accompanying the dissertation

Understanding the Extreme Classes of Dwarf Galaxies

1. Ultra-compact dwarf galaxies (UCDs) are also found in low-density environments, contradicting the traditional assumption that they are mostly found in high-density environments of galaxy clusters. Follow-up spectroscopy and radial velocity measurements are needed to determine the origin of these UCDs in low-density environments.
2. Near-infrared is the future of observational astronomy, with many recent developments and observatories to come.
3. The ultra-diffuse galaxy (UDG) Dragonfly 44 (DF44) and similar cluster UDGs host $\sim$20 globular clusters (GCs) on average. Considering the correlation between GC number and total mass of galaxies, these UDGs are massive dwarf galaxies. There is, however, no evidence of UDGs with over-massive (Milky Way-like) halo masses.
4. The merger history and star formation activity in the earliest stages of galaxy formation determine the fate of galaxies as UDGs or non-UDGs.
5. The degeneracy when discriminating the effects of physics of dark matter (i.e. mass and interaction cross-section of dark matter particles) and baryonic matter in shaping the dark matter halo of dwarf galaxies can potentially be resolved by their star cluster systems. However, without a better understanding of the physics of star cluster formation, especially the initial conditions at formation, it is hard to reach any conclusion on the nature of dark matter.
6. Exceptional insight can often be gained by studying the most extreme objects in a sample. In this respect, anomaly detection to search for rare and extreme galaxies would be a promising approach for astronomical research.
7. Until now, the majority of astronomical research that has employed machine learning has focussed on alternative (and sometimes smarter) solutions for existing problems. More attention must be paid to machine learning and data science for knowledge discovery, which is possible using unsupervised machine learning techniques.
8. PhD projects must be exciting, clear and well defined with carefully managed risks. The PhD experience depends on these criteria, which also determine the future scientific life of the PhD graduates. It would be irresponsible to offer projects which do not meet these criteria.
9. While "being correct" must be the main motivation behind any scientific work, "being the first" is important to make a career in academia in the first place.
10. Inequalities exist in every dimension of life. A better approach to account for the impact of inequalities in societies is to consider each case individually, rather than groups of people, marked by their gender, race, sexual orientation, etc.
11. Educating children with astronomy and the sort of questions that astronomy raises helps them to grow up as better thinkers and more critical observers of their surroundings. Maybe, a society with such members may, when the time comes, make smarter decisions.

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