

The coming years bear the promise of being particularly exciting. Several groups will use new and improved data to challenge the above claims, and a ‘quest for redundancy’ will also be undertaken, looking for new astrophysical techniques that may allow independent measurements of these couplings, leading to a systematic mapping of their behavior throughout space-time.

In addition to the JENAM 2010 LOC and the EAS, the symposium was supported financially by CAUP and FCT. For those who wish to obtain more information, the slides of most talks are available at <http://www.astro.up.pt/vfc2010>

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SYMPOSIUM 2: GALAXY FORMATION AND ENVIRONMENT: 30 YEARS LATER

The effect of environment on the properties of galaxies constitutes a key observable to understand the baryon physics that transforms the primaeval distribution of gas into the galaxies we see today. The year 2010 marks the 30th anniversary of a seminal paper – by Prof. Dressler – on the connection between galaxy formation and environment. The symposium consisted of four main sections, addressing observations of environmental imprints on galaxies at low redshift, high redshift, cluster regions, and theories to model those effects.

The opening talk by Prof. Dressler (Carnegie) gave an overview of the morphology-density relation, including a description of the field in the years up to the discovery of this correlation. The main conclusion was that environmental effects could indeed be a reflection of the more «local» properties of galaxies, in the sense that more massive galaxies end up most likely in high-density environments. Dr. Weinmann (Leiden) reported on the Yang et al. SDSS groups catalogue and its role in discriminating between local and environmental properties. Prof. Aragon-Salamanca (Nottingham) presented the work of the EDisCS and STAGES teams on the effect of cluster environments on the transformation from gas rich spirals into lenticulars.

The modeling session was opened by a review by Dr. De Lucia (Trieste) on the way of incorporating environmental effects in semi-analytical models of galaxy formation. The recipes related to the suppression of gas condensation and gas stripping are still rather simple and need more physical insight. Prof. Kenney (Yale) gave an overview of observational evidence of ram-pressure stripping in galaxy disks. Dr. Khochfar (MPE) presented his work on gravitational heating as an efficient method to suppress gas cooling in clusters today and at early times in the most massive halos, introducing a mass-dependent environmental effect, difficult to separate from more intrinsic mechanisms.

The final discussion session was led by Prof. van den Bosch (Yale) with an interesting number of open questions, the most

important being the need for a proper indicator of environment (with central/satellite classification being a tentative candidate). The impact of environment on morphology is not a solved problem. We still need to pinpoint the essential mechanism to model environment, with a tentative option being strangulation. The discussion had very active participation by the audience, reflecting the state of the field.

The programme of the symposium, including PDF files of the talks, can be found at <http://www.mssl.ucl.ac.uk/~ipf/J10/Programme.html>

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SYMPOSIUM 3: DWARF GALAXIES: KEYS TO GALAXY FORMATION AND EVOLUTION

The JENAM symposium “Dwarf Galaxies: Keys to Galaxy Formation and Evolution” took place on the 9th and 10th September 2010. Its six sessions of 90 minutes each were all extremely well attended, with a vivid participation and a large number of high-quality contributions, including four reviews and several invited and contributed talks. Additionally, poster presentations were given before each evening session.

Evan Skillman who gave a review on outstanding questions and future perspectives of dwarf galaxy research opened the first session. Carme Gallart reported on new results from the “Local Cosmology from Isolated Dwarfs” (LCID) project, that suggests that reionization alone was not able to stop star formation in dwarf galaxies, as had been expected. Janice Lee closed the session with a discussion on the consistency between star formation rates (SFRs) inferred for late-type dwarf galaxies from their H α and far ultraviolet non-ionizing continuum emission. She pointed out that UV yields a higher SFR than H α by factors of two to more than ten, and that possible explanations for this discrepancy include a non-universal stellar initial mass function.

The second session was devoted to star-forming dwarf galaxies (SFDGs) beyond the Local Group both in galaxy clusters and in the field. It was opened by Nils Bergvall who provided us with an overview of the structural, chemical and environmental properties of SFDGs, laying special emphasis on the question of evolutionary links between dwarf irregulars (dIs) and Blue Compact Dwarf (BCD) galaxies, and the role of starburst activity on dwarf galaxy evolution. Jorge Iglesias-Paramo addressed the impact of the cluster environment on the star-forming activity of SFDGs as traced by their H α morphology. An impressive example of the interaction of a SFDG with the intracluster medium (ICM) was presented by Jeffrey Kenney: GALEX UV and WIYN optical images reveal in the Virgo dI IC3418 a spectacular “head-tail” morphology

with a one-sided tail of UV-bright knots connecting with the galaxy. These “fireballs” in the stripped tail are likely formed from dense gas clumps which continue to accelerate outwards through ram pressure, leaving behind streams of newly formed stars. Gerhard Hensler elaborated from the theoretician’s point of view the impact of ram pressure by the IGM on the morphological evolution of SFDGs in galaxy clusters: numerical models show that late-type dwarf galaxies plunging into the ICM can undergo strong morphological evolution, developing a “cometary” (head-tail) appearance.

The third session, concentrating on early-type dwarf galaxies, started with a review by Helmut Jerjen. The speaker highlighted the importance of these numerous, easily overlooked, systems for advancing our understanding of dwarf galaxy evolution and covered their different known species, from Local Group dwarf spheroidals (dSph) and dwarf ellipticals (dEs) all the way to Dark Matter (DM) dominated ultra-faint dwarfs (UFDs). The nature and evolutionary history of UFDs and classical dSphs, including the origin of extremely metal-poor ($[\text{Fe}/\text{H}] < -3$) stars in these systems were two of the key questions addressed by Stefania Salvadori. The speaker concluded that, for reproducing the observed Fe-luminosity relation and the mean Metallicity Distribution Function of dSphs, UFDs must be left-overs of minihaloes formed at $z > 8.5$ and thus the progenitors of classical dSphs. Tobias Goerdt, using numerical simulations, explored two possible scenarios for the formation of ultra-compact dwarf galaxies (UCDs): merging of globular clusters in the centre of a DM halo, or massive stripping of a nucleated dE. Both mechanisms produce density profiles and half-light radii in accord with the observations. However, UCDs formed by the first mechanism turn out to be underluminous and DM devoid. Agnieszka Rys gave an illustration of how stellar kinematical studies with SAURON in conjunction with spectral synthesis models can add new valuable insights into the formation history of nucleated dEs.

The second day of the symposium, devoted to SFDGs, opened with a review by Uli Klein on the properties of the interstellar medium (ISM). The topics addressed by the speaker included the determination of the baryonic and non-baryonic matter from gas kinematics, the observational evidence for starburst-driven gas outflows and the contribution of SFDGs to the magnetization of the ICM and intergalactic medium in the early universe. Erik Wilcots elucidated the impact of massive stars on their environment as the most important internal driver of the evolution of SFDGs using multi-wavelength data. Several impressive examples of the ionization and acceleration of the ISM of BCDs on spatial scales of several kpc away from their starburst region were presented by Gidon Vasiliev. The speaker elaborated on various key aspects of starburst activity in BCDs, such as the formation efficiency of Super-Star Clusters (SSCs) and the escape fraction of Ly-alpha photons. Guillermo Tenorio Tagle discussed the interaction of massive SSCs with a dense ambient medium, resulting in efficient gas cooling and positive star formation feedback. Ricardo Amorin addressed the properties of Green

Pea (GP) galaxies, low-mass starburst galaxies at redshifts 0.1-0.3 that were recently discovered through the Galaxy Zoo project. He reported that, while these systems have subsolar gas-phase metallicities, they are offset from nearby SFDGs by more than a factor of two with respect to their mass-metallicity relation. Peter Weilbacher emphasized the significant advantages of integral field unit spectroscopy for the study of chemical abundance patterns, ionized gas kinematics and stellar age gradients in SFDGs. The fate of Tidal Dwarf Galaxies (TDGs), self-gravitating low-mass entities condensing out of material ejected from interacting/merging galaxy pairs constitutes a vivid field of dwarf galaxy research. Pierre-Alain Duc presented observations and numerical simulations of TDGs and stressed the importance of these systems as testbeds for the study of dwarf galaxy formation and the associated feedback processes. Kate Pilkington presented cosmological hydrodynamical simulations, resulting in the reproduction of bulgeless dwarf spiral galaxies. Various quantities extracted from the models (e.g. gas kinematics, density profiles and velocity dispersion) permit a detailed comparison with observations and promise to yield important new clues to the evolution of gas and stars in dwarf galaxies. In this respect, the availability of a large, high-quality set of interferometric HI data for nearby late-type dwarf galaxies is particularly important. Elias Brinks reported on the science drivers and the current status of LITTLE THINGS, a deep HI survey of about 40 nearby dIs with the VLA. Gary Mamon, using a simple model of galaxy formation computed the distribution of mass-weighted stellar age as a function of galaxy mass and redshift, and predicted the frequency of low-mass galaxies with mostly young stellar populations, similar to I Zw 18, at the present cosmic epoch. These models predict about 8 young galaxy candidates in the nearby universe.

The symposium concluded with a thoughtful summary by Evan Skillman and a stimulating discussion, which illustrated once again the crucial and highly interlinked questions in dwarf galaxy research, and its present challenges and future prospects.

A particularly pleasing event was the presentation of several high-quality poster contributions, which unfortunately could not fit within the allocated time for oral contributions.

The organizers would like to thank everyone who has contributed in the symposium, including the speakers, poster presenters and the audience for making this meeting a valuable and enjoyable experience. The Local Organizing Committee of JENAM, in particular Andre Moitinho, deserve our special thanks for their tireless efforts and excellent organization of the conference.

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