SESSION 1. EXTREME STARBURST: OBSERVATIONAL PROPERTIES

T. Heckman (Review)

Extreme Starburst in the Local Universe: The Cosmological Context

R. Overzier (Oral)

Extreme Starburst Galaxies at low and high redshift

Starburst galaxies are important for our understanding of galaxy evolution at all redshifts. I will present and discuss the latest results from our ongoing survey of "Local Analogs of Lyman Break Galaxies". Because these starbursts are similar to typical UV-selected starbursts at high redshift in most of their observed and physical properties, we have an excellent training set for understanding the relation between massive star formation, ISM, host galaxy structures, and nuclei of starbursts. In this talk, I will highlight three of our most recent results:

(1) The nearby sample shows a deviation from the so-called IRX-beta relation that is widely used to infer the ratio of total IR-to-UV luminosities at high redshift. This offset is similar to that found for a few lensed LBGs that have direct detections in the IR. I will show how an improved understanding of the IRX-beta relation directly affects estimates of the cosmic star formation rate history.

(2) The LBG analogs at low redshift and LBGs at high redshift display a range in structures from compact to clumpy that is different from typical local star-forming galaxies. Recent studies have suggested that, at least at high redshift, intense star formation is triggered by massive gas accretion in the form of cold flows. Based on a detailed comparison with the morphologies of LBGs in the Hubble Ultra Deep Field, we conclude, however, that starbursts triggered by mergers remain a viable mechanism for driving the evolution of these starbursts.

(3) Some of the local starbursts display peculiar nuclei that are more massive and more dense than any central star cluster observed to date. We speculate that they are progenitors of the central cusps in low-mass ellipticals being formed in dissipative mergers. The massive, dense nuclei provide an ideal environment for the formation of black holes. New radio and X-ray data suggest the presence of 10^5-10^6 Msun black holes.

T. Gonzálves (Oral)

Integral-Field Observations of Lyman Break Analogs: Lessons for the High-Redshift Universe

Lyman Break Analogs (LBAs), characterized by high far-UV luminosities and surface brightnesses as detected by GALEX, are intensely star-forming galaxies in the low-redshift universe (z~0.2), with star formation rates reaching up to 50

times that of the Milky Way. These objects present metallicities, morphologies and other physical properties similar to higher redshift Lyman-break galaxies (LBGs), motivating the detailed study of LBAs as potential local analogs to this high-redshift galaxy population. Strong hydrogen emission lines and compact sizes make LBAs ideal candidates for integral-field spectrography. We present results for 20 LBAs observed with Keck/OSIRIS with an AO-assisted spatial resolution down to ~200pc. We detect satellite companions, diffuse emission and velocity shear, all with high signal-to-noise ratios. We artificially redshift our data to z=2.2 to allow for a direct comparison with observations of high-z LBGs and find striking similarities between both samples. This suggests that the same physical processes may be responsible for the observed properties of star forming galaxies in the early universe. We also find a strong correlation of observable properties with stellar mass, in which more massive galaxies show greater resemblance to a disk-like structure, not unlike what is observed at high redshifts. Finally, we argue that kinematic studies of the ionized gas in star-forming galaxies is not an appropriate diagnostic to rule out major merger events as the trigger for the observed starburst.

A. Alberdi (Invited)

Radio Supernovae: A Window into the Heart of Starburst Galaxies

High-resolution radio observations of the nuclear regions of Luminous and Ultraluminous Infrared Galaxies (ULIRGs) have shown that their radio structure consists of a compact high surface-brightness central radio source inmersed in a diffuse low brightness circumnuclear halo. While the central components could be associated with AGNs or compact star-forming regions, where radio supernovae are exploding, it is well known that the circumnuclear regions host bursts of star-formation. Studies of radio supernovae can provide essential information about stellar evolution and CSM/ISM properties in regions hidden by dust at optical and IR wavelengths. High-resolution radio observations of LIRGs can allow us to determine the core-collapse supernova rate in them as well as their star-formation rate.

M. A. Perez Torres (Oral)

An extremely prolific SN factory in the buried nucleus of Arp 299A

The central kiloparsec of many local luminous infrared galaxies are known to host intense bursts of massive star formation, leading to numerous explosions of core-collapse supernovae. However, the dust-enshrouded regions where those supernovae explode hamper their detection at optical and near-infrared wavelengths.

We investigated the nuclear region of the starburst galaxy IC 694 (=Arp 299-A) at radio wavelengths, aimed at discovering recently exploded core-collapse supernovae, as well as determining their rate of explosion, which carries crucial

information about star formation rates, the initial mass function, and the starburst processes in action.

We used the electronic European VLBI Network (eEVN) to image with milliarcsecond resolution the 5.0 GHz compact radio emission of the innermost nuclear region of IC 694. Our observations detected a rich cluster of 26 compact radio emitting sources in the central 150 pc of the nuclear starburst in IC 694. The high brightness temperatures observed for the compact sources are indicative of a non-thermal origin for the observed radio emission, implying that most, if not all, of those sources are young radio supernovae and supernova remnants. We found evidence of at least three relatively young, slowly evolving, long-lasting radio supernovae that appear to have unusual CCSN properties, suggesting that the conditions in the local circumstellar medium (CSM) play a significant role in determining the radio behaviour of expanding SNe. Their radio luminosities are typical of normal RSNe, which result from the explosion of type IIP/b and type IIL SNe. All of these results provide support for a recent (less than 10-15 Myr) instantaneous starburst in the innermost regions of IC 694, and confirm that the inner regions of Arp 299-A are an extremely prolific supernova factory.

A. Pasquali (Oral)

Exploring local Starbursts with LBT/LUCIFER: the case of NGC 1569

We observed NGC 1569 during the commissioning run of LUCIFER, the NIR imager and spectrograph now available at the Large Binocular Telescope. The imaging was performed under very good seeing conditions and with the highest angular resolution offered by LUCIFER. We obtained high-quality spatial maps of HeI, [FeII] and Br-gamma emission across the galaxy, and used these together with HST/ACS data (1) to derive the spatial map of the galaxy dereddened star-formation rate, (2) to study the ongoing star-formation activity of NGC 1569.

A. Monreal-Ibero (Oral)

Ionization mechanisms in the extra-nuclear regions of LIRGs

Luminous Infrared Galaxies (LIRGs) are an important class of objects in the low z universe bridging the gap between normal spirals and the Ultraluminous Infrared Galaxies. LIRGs are also relevant in a high-z context as a large fraction of the stars in the Universe have been formed in these objects. Here, I will present a study aiming to understand the nature and origin of the ionization mechanisms operating in the extra-nuclear regions of LIRGs as a function of the interaction phase and infrared luminosity. The study is based on Integral Field Spectroscopy data obtained with the VIMOS instrument of 32 LIRGs covering all types of morphologies (isolated galaxies, interacting pairs, and advanced mergers), and the entire 10^{11}, 10^{12} Lsun infrared luminosity range.

A. Alonso-Herrero (Review)

The Spitzer view of starburst galaxies

In this talk I will review some of the new findings for nearby starburst galaxies obtained with the imaging (IRAC and MIPS) and spectroscopy (IRS) instruments on board of the Spitzer SpaceTelescope. In particular I will summarize new results about the most prominent features in the mid-infrared spectra detected in nearby starbursts, such as PAH features, fine structure lines, the 9.7micron silicate feature, and molecular hydrogen lines. Finally I will discuss our progress on using mid-infrared features (e.g., monochromatic luminosities, PAH features, neon lines) as tracers of the star formation rate of galaxies in the local Universe and at high redshift.

T. Diaz-Santos (Oral)

The Spatial Extent of (U)LIRGs in the mid-Infrared

We present our analysis of the extended mid-Infrared (IR) emission of the local Luminous and Ultraluminous Infrared Galaxies (U)LIRGs comprised in the Great Observatory All-sky LIRG Survey (GOALS) sample. We use Spitzer IRS spectra to determine the fraction of extra-nuclear emission in these (U)LIRGs as a function of wavelength which allow us to compare among different spectral features. We find that in more than 30% of LIRGs, at least ∼50% of their mid-IR emission stems from the extended component, which may contribute even up to ∼80%. As a whole, the mid-IR emission of local LIRGs is 2.5-3 times more extended than that of ULIRGs, suggesting that mid-IR emission of LIRGs is rather distributed across their disks on a scale of several kpcs. We find that the compactness of the mid-IR continuum emission at 13.2-micron of the LIRGs/ULIRGs in our sample does not depend on their merging stage, but in turn it is related to the AGN contribution to the mid-IR emission. The more AGN-dominated a system is the less extended appears in the mid-IR. The compactness of the LIRGs/ULIRGs is related with the IRAS 60/100-micron color. Colder galaxies are more extended. This places a lower limit, depending on the far-IR color, to the physical size of the region responsible for the fir-IR continuum emission of these systems, which will soon to be probed by Herschel.

S. Aalto (Oral)

Molecules in highly obscured galaxies

S. Garcia-Burillo (Oral)

Star formation laws in LIRGs/ULIRGs

We have used the IRAM 30m telescope to observe a sample of 15 LIRGs simultaneously in the 1--0 lines of HCN and HCO^+. With the proposed observations we have significantly improved the statistics of LIRGs where high-quality data are available for these key molecular probes of the dense gas content. These observations complement the survey of LIRGs and ULIRGs made by Gracía-Carpio et al.(2006, 2008) and make possible to build up a final sample of 24 LIRGs with HCN and HCO^+ data. Both the star formation rates (SFR) and the typical sizes of the star forming (SF) regions of the galaxies in our sample are well characterized through available high-resolution imaging at different wavelengths (Alonso-Herrero et al 2006). We analyze the star formation efficiency and the SF law derived for the dense molecular gas as traced by HCN(1--0) and HCO^+(1-0) in 24 LIRGs. Results issued from these observations will be discussed in the context of the currently debated SF laws in galaxies.

D. Miralles Caballero (Oral)

Characterization of star forming regions in (U)LIRGs

A significant fraction (U)LIRGs are known to constitute interacting and merging systems, where star formation is triggered within the galaxies and along the tidal features that usually form. A systematic analysis of almost 3000 star forming regions in a representative sample of 32 (U)LIRGs has been performed by means of high angular resolution ACS/HST B and I images. This talk presents the results of the photometric characterization of these star forming regions as a function of the luminosity of the systems, the interaction phase and the distance to the closest nucleus. Characteristics such as sizes, colours and luminosities will also be compared with those of clusters observed in less luminous interacting galaxies such as the Antennae. Complementary IFU data for a third of the systems is also considered in order to select TDG candidates in (U)LIRGs.

SESSION 2. TRIGGERING MECHANISMS AND ENVIRONMENTS

P. Di Matteo (Review)

Star formation and environment

L. Kewley (Oral)

Extreme Starbursts in Merging Galaxies

I present new results from our large multiwavelength survey of nearby infrared merging galaxies. We show that metallicity gradients in galaxy pairs provide a "smoking gun" for large-scale gas inflows in merging galaxies and are intricately connected to extreme central bursts of star formation. At first close pass, gas inflows dramatically flatten metallicity gradients which do not recover until very late merger stages. We use optical, infrared and X-ray diagnostics to investigate the evolution of starburst and AGN activity as a function of merger progress. We show that the galaxies form a clear merger sequence where fuel boths starburst and AGN are fueled, and where the AGN becomes increasingly dominant during the final merger stages of the most luminous IR objects. Our results indicate that identification of the "diffuse merger" stage is critical for understanding the connection (if any) between starburst and AGN activity. In this stage, extreme starburst and AGN activity co-exist, yet the presence of compact radio cores indicative of AGN disappears. We discuss these results in terms of thermal free free absorption caused by large amounts of merger driven gas inflows.

C. Ramos Almeida (Oral)

The triggering mechanisms of powerful radio galaxies: mergers and interactions

Despite speculation that both starburst and nuclear activity in galaxies may be intimately linked via the common triggering mechanism of mergers and interactions, very little is known about the true nature of the link. Thus, the role of AGN in the formation and evolution of galaxies is still not well established.

I will present deep Gemini/GMOS imaging observations which are used to investigate the triggering mechanism(s) in a complete sample of radio-loud AGN for which, uniquely, we have quantified the level of both the AGN and star formation activity. I will show results on the proportion of powerful radio galaxies triggered in galaxy mergers and also on the link between the degree of star formation/AGN activity and the interaction status of the host galaxies.

B. Weiner (Oral)

Spatial clustering of infrared-luminous galaxies, a clue to their fates

The most massive starbursts in both the local and high redshift universe manifest themselves as ultraluminous infrared galaxies. However, it remains controversial what IR-luminous galaxies at z=1 are, and what they will evolve into. Are IR-luminous galaxies at high redshift mostly galaxy mergers, as they are at low redshift? Are ultraluminous IR galaxies strongly clustered, and can we infer whether they must evolve into cluster galaxies today? We measure the spatial clustering of LIRGs and ULIRGs at z=1 using Spitzer/MIPS sources cross-correlated with galaxies from the DEEP2 redshift survey. Because the evolution of clustering strength is well understood, the correlation lengths constrain the galaxy populations that LIRGs and ULIRGs will evolve into, and the classes of AGN to which they may be linked.

B. Rothberg (Oral)

The Impact of Star-Formation and Gas Dissipation on Galaxy Kinematics

Mergers in the local universe present a unique opportunity for studying the metamorphoses of galaxies in detail. Yet, many studies and simulations show gas-rich mergers do not contribute significantly to the overall star-formation rate and total mass function of galaxies. The ultimate implication is that Lambda-CDM and our current understanding of galaxy formation and evolution may be completely wrong. I will discuss recent results, based on high-resolution imaging and multi-wavelength spectroscopy, which demonstrate how star-formation and the presence of multiple stellar populations has lead to a serious underestimation of the dynamical masses of star-forming galaxies, in particular, Luminous & Ultraluminous Infrared Galaxies. The presence of Red Supergiants and Asymptotic Giant Branch stars can severely affect the global properties measured in a galaxy, including: mass, age, extinction, and star-formation rate. I will also discuss the impact of these stellar populations on studies of high redshift galaxies.

J. Tan (Oral)

Star Formation: From Local Regions to Extreme Starbursts

I review the star formation process as we understand it from studies of nearby Galactic regions, including infrared dark clouds, embedded clusters, and the local volume of the Milky Way. I then discuss how the various physical processes are expected to change as we go to more extreme proto star clusters and more extreme circumnuclear disks.

S. Jogee (Oral)

Assembly Modes and Star Formation of Galaxies out to z~3

Mergers, smooth accretion, and secular processes are relevant for the assembly and central activity of galaxies in hierarchical models of galaxy evolution, but their relative importance at different epochs remains hotly debated. I will discuss the role of galaxy mergers on star formation and structural assembly based on three of our studies, which target galaxies from the local Universe out to redshifts of 3: (1) In Jogee et al.& the GEMS collaboration (2009), we explore the frequency of galaxy mergers and their impact on star formation over the last 7 Gyr using HST ACS, COMBO-17, and Spitzer data from the GEMS survey. We also compare the empirical merger history for high mass galaxies to theoretical predictions from five different suites LambdaCDM-based models. Among high and intermediate mass systems, we find that the mean SFR of visibly merging systems is only modestly enhanced compared to non-interacting galaxies, and that visibly merging systems only account for less than 30% of the cosmic SFR density over this interval. (2) In Weinzirl, Jogee, Khochfar, Burkert & Kormendy (2009), we set constraints on the merger history of high mass systems out to z~2 based on the structural property of local bulges. (3) In Weinzirl, Jogee, and the GINS collaboration (2010, in prep.), we discuss the structure, very high star formation rate, and AGN activity of the most massive galaxies (M*=5e10 to few 1e12 Msun) at redshifts of z~2-3, amd discuss the implications for galaxy evolution models.

SESSION 3 : STAR FORMATION HISTORIES

R. González Delgado (Invited)

Stellar Populations models: testing stellar libraries for Starbursts

This contribution will be divided in two parts. First, we will revise the relevance of the stellar libraries for fitting the optical stellar continuum of a young and intermediate age stellar population. The most up date stellar libraries (Granada library, MILES, STELIB) are using in the evolutionary synthetic models for the spectral synthesis of stellar clusters in the LMC/SMC. The comparison of the results derived from this method and previous estimations available in the literature allow us to evaluate the pros and cons of each set of libraries to determine the age, metallicity and extinction for a stellar population. In the second part, we will apply this spectral synthesis method to a sample of Starbursts in Luminous Infrared Galaxies (mostly mergers) to retrieve their star formation history. We relate their SFH with the dynamical state of the interaction. Strategies to overcome the difficulties involved with this method associated to these type of obscured starbursts are presented in more detail in Cid Fernandes contribution.

J. Rodríguez Zaurín (Invited)

Star formation histories and evolution in local LIRGs and ULIRGs

Luminous and Ultraluminous infrared galaxies (LIRGs and ULIRGs) are much more numerous at higher redshifts than locally, dominating the star formation rate density at redshifts ∼2. Therefore, they are important objects in order to understand how galaxies form and evolve through cosmic time. Local samples provide a unique opportunity to study these objects in detail. With that in mind, we have undertaken a programme of spectroscopic observations of over 40 objects involving both, long-slit and integral field spectroscopic datasets. Our aim is to investigate the distributions of the parameters associated with the stellar populations (i.e. age, reddening and percentage contribution), and also, whether the properties of the stellar populations correlate with other properties of (U)LIRGs (such as the spectral classification, infrared luminosity, etc...). For example, in the case of ULIRGs, our modelling results clearly reveal that the star formation histories of ULIRGs are complex, with at least two epochs of star formation activity. These and other results will be presented in this talk and discuss in the context of merger simulations.

R. Cid Fernandes (Oral)

Fossil methods applied to U/LIRGS: Challenges, Strategies and Results

Spectral synthesis (the "art" of retrieving the star formation history of galaxies by means of spectral analysis using the most up to date spectral models for stellar populations) progressed enormously in the past half decade or so, fostering equally large advances in our understanding of galaxy evolution. Systems with

intense star formation and large amounts of dust, however, are still challengingly complex to model. This contribution illustrates these difficulties by applying modern spectral synthesis techniques to Luminous and Ultra Luminous Infra-Red galaxies. A new version of the code STARLIGHT was developed to handle these systems, which incorporates optical spectra plus Far-IR data in order to constrain the star formation history of these (mostly interacting) galaxies. Strategies to overcome the difficulties and degeneracies involved are presented.

M. Rodrigues (Oral)

How to retrieve stellar population in starburst

In starburst galaxies, the light emitted by massive stars dominates the photon budget along most of the spectral energy distribution: hidden by the luminous stars, the fraction of old stellar population is systematically underestimated by current methods [Wuyt et al. 2009]. This systematic has a large impact on the study of stellar populations and stellar masses in distant galaxies, when galaxies were actively forming stars. We have recently implemented a new algorithm to retrieve stellar populations from spectroscopy and photometrical data using constrains from the observed SFR. The method relies on a meta-heuristic minimization method (the swarm intelligence algorithm). It allows us to alleviate the well-know degeneracy between age and extinction, and better extract the hidden older stellar populations.

R. Delgado-Serrano (Oral)

Starburst galaxies in the present and past Hubble sequence

The way galaxies assemble their mass to form the well-defined Hubble sequence is amongst the most debated topic in modern cosmology. One difficulty is to link distant galaxies to those at present epoch. One observational way is at establishing how were the galaxies of the past Hubble sequence (e.g., 6 Gyrs ago). We have intended to derive a past Hubble sequence that can be causally linked to the present-day one. We selected samples of nearby galaxies from the SDSS and of distant galaxies from the GOODS survey. We verified that each sample is representative of galaxies. We further showed that the observational conditions necessary to retrieve their morphological classification are similar in an unbiased way. Galaxies are also divided in starburst and quiescent by their [OII]3727 EW, larger or smaller than 15 A, respectively. After morphological classification we have been able to quantify their number fractions. We found an absence of number evolution for elliptical and lenticular galaxies, which strikingly contrasts with the strong evolution of spiral and peculiar galaxies. Spiral galaxies were 2.3 times less abundant in the past, that is exactly compensated by the strong decrease by a factor 5 of peculiar galaxies. It strongly suggests that more than half of the present-day spirals had peculiar morphologies, 6 Gyrs ago, and this has to be accounted by any scenario of galactic disk evolution and formation. The past Hubble sequence can be used to test these scenarios as well as to test evolution of fundamental planes for spirals and bulges.

SESSION 4. FEEDBACK EFFECTS

C. Tadhunter (Review)

The importance of outflows in AGN

H. Spoon (Invited)

Mid-infrared kinematic evidence for outflows in ULIRGs

Abundant evidence exists for the presence of outflows in active and starburst galaxies. Ultraluminous infrared galaxies host both extreme starbursts and supermassive black holes accreting at high Eddington rates. Outflows are hence expected to be ubiquitous in ULIRGs. The mid-infrared wavelength range is home to a suite of strong fine-structure lines from various ionization stages of neon, spanning a range in ionization potentials of 21 to 127eV, relatively unaffected by extinction. These lines can be exploited to probe the ionization structure and origin of the outflowing gas. We report on the results of a first systematic study of the line profiles of the mid-infrared fine-structure lines of Ne+, Ne2+, Ne4+ and Ne5+ gas in a sample of 320 ULIRGs, HyLIRGs, Seyferts, LINERs, QSOs and starburst galaxies observed in by Spitzer-IRS. The sources span a range of 5 decades in [NeV] AGN luminosity and 6 decades in 21cm radio luminosity. Blue shifted [Ne III] and/or [Ne V] emission (shifted by 200 km/s or more) is found for 30% of the ULIRG sample. The incidence of blue shifted [Ne V] emission is even higher (60%) among the sources with a [Ne V] detection. A comparison of the line profiles of the neon lines reveals the ionization of the blue shifted gas to increase with blue shift, implying decelerating outflows in a stratified medium, photo-ionized by the AGN.

P. Hopkins (Invited)

Gas, Galaxy Mergers, Starbursts, and AGN: Powering an Evolving Hubble Sequence

In the last few years, the combination of models that include realistic large gas supplies in galaxies, and prescriptions for feedback from both stellar evolution and super-massive BHs to maintain those gas reservoirs, have led to huge shifts in our understanding of galaxy formation. In particular, gas-richness, and the magnitude of starbursts driven by tidal action, may represent the most important driving factor in the net effects of galaxy-galaxy mergers on bulge structural properties, stellar populations, mass profiles, and kinematics; models with the appropriate gas content have finally begun to produce realistic bulges that resolve a number of discrepancies with observations. In the regime of very gas-rich mergers, expected at high redshift and/or low masses, gas can qualitatively change the character of mergers and starburst galaxies, making disks robust to destruction in mergers and providing a natural explanation for the observed morphology-mass relation. These processes provide a link between the 'relic' population seen today, low-redshift

starburst populations, and rapidly star-forming galaxies at high redshifts. Feedback is critical in a number of ways: it regulates and maintains gas supplies, can 'shut down' the tail-end of starburst activity leaving 'quenched' galaxies, and may set a characteristic upper limit to the densities reached by any rapidly star-forming systems from the scales of star clusters to the most massive high-redshift starbursts.

D. Rupke (Invited)

Gas flows in Starburst Mergers

Starbursts in merging galaxies are bookended by gas flows. They are preceded by strong radial inflows that fuel the star formation, and followed by outflows of enriched and entrained gas that act as regulatory feedback. Using both observations and simulations, I will present new results on (1) how we constrain gas inflows by tracking metals in starburst mergers and (2) how we are finally revealing the complex structures of the ubiquitous gas outflows in merging galaxies.

POSTERS SESSION

A. Alonso Herrero (Poster)

PMAS Optical Integral Field Spectroscopy of Luminous Infrared Galaxies

The general properties (activity class, star formation rates, metallicities, extinctions, average ages) of local luminous infrared galaxies (LIRGs) are well known since large samples have been the subject of numerous spectroscopic works. There are, however, relatively few studies of large samples of LIRGs using integral field spectroscopy (IFS). We present optical (3800-7200A) IFS data taken with the Potsdam Multi-Aperture Spectrophotometer (PMAS) of the central few kiloparsecs of eleven LIRGs. We complemented the PMAS observations with existing HST/NICMOS Pa-alpha imaging. The optical continua of selected regions are well fitted with combinations of evolved (0.7-10Gyr) and ionizing (1-20Myr) stellar populations. The latter is more obscured than the evolved population, and has visual extinctions in good agreement with those obtained from the Balmer decrement. Except for NGC 7771, we found no evidence for an important contribution to the optical light from an intermediate-aged stellar population (100-500Myr). Even after correcting for stellar absorption, a large fraction of spaxels with low equivalent widths of Halpha in emission still show enhanced [NII]6584/Ha and [SII]6717,6731/Ha ratios. These ratios are likely to be produced by photoionization in HII regions and diffuse emission. These regions of enhanced line ratios are coincident with low surface brightness HII regions. The fraction of diffuse emission in LIRGs varies from galaxy to galaxy, and it is less than 60% as found in other starburst galaxies. The Halpha velocity fields over the central few kpc are generally consistent, at least to first order, with rotational motions. The velocity fields of most LIRGs are similar to those of disk galaxies, in contrast to the highly perturbed fields of most local, strongly interacting ULIRGs. The peak of the Halpha velocity dispersion coincides with the position of the nucleus and is likely to be tracing mass.

E. Bellocchi (Poster)

Kinemetry of local (Ultra)luminous Infrared Galaxies

The kinematics of a sample of 42 (Ultra)Luminous Infrared Galaxies [(U)LIRGs] at low redshift (<z>=0.022) will be analysed thanks to Integral Field Spectroscopy (IFS) carried out with the VIMOS instrument on the VLT. Studying the characteristics of (U)LIRGs at low redshift allow us a better understanding the interrelated physical processes involved, and the implications for high-z since these galaxy populations more numerous at cosmological distances than locally. As preliminary steps, the data reduction and post-reduction have been performed using the EsoRex pipeline (by ESO) and IDL and IRAF scripts (creating the final data cube). Then, the line profiles of these spectra (e.g., H_alpha) will be studied in order to extract the relevant emission line information (central wavelength, FWHM and flux intensity). We are going to apply the kinematic criteria used by

Shapiro et al. (2008) to the whole sample in order to distinguish galaxies dominated by ordered rotational motions (i.e.,disk) and those involved in major merger events (i.e., merger) considering the asymmetries in both the velocity field and velocity dispersion maps of the warm gas (as traced by Halpha). To this aim the "kinemetry" method, developed by Krajnovi*ć* á et al. (2006), will be considered. Here, the results of a sub-sample will be discussed.

C. Cortijo Ferrero (Poster)

The LIRG galaxy IC1623: the most nearby Lyman Break Analog

We present the analysis of imaging data from Hubble Space Telescope (STIS, ACS and NICMOS) and Spitzer Space Telescope (IRAC bands), and the long-slit spectra from ALFOSC-NOT for the z=0.02 merging system IC1623. IC1623 is a very Luminous Infrared system, log(L_IR/Lsum)=11.65, being too the west component very bright at ultraviolet wavelength too.

The images show that the merging system is composed of two galaxies. The western component is very bright in the UV and optical, while the eastern one is very bright in the infrared. The west galaxy shows properties very similar to the cosmological Lyman Break galaxies, and it can be considered as the nearest Lyman Break Analog. We have identified the stellar clusters in the HST images, and the colours indicate that there are two different types of clusters: those located in the UV bright galaxy which have ages between 1-10 Myr and are little affected by extinction 0-1mag, and those located in the IR bright galaxy much older and extinguished. The masses of the clusters span a range between 10^6 and 10^8 Msum.

The long-slit optical spectra through IC1623 are also analyzed with Starlight code to estimate the properties (age, extinction and metallicity) of the nucleus, some of the brightest clusters and the underlying galaxy.

J. Maíz Apellániz (Poster)

HST and ground-based surveys of 30 Doradus

I will present preliminary results from two major studies that are being conducted with 30 Doradus as target. One is a spectroscopic survey of 1000 stars with FLAMES at the VLT, The other one is a multi-filter NUV-to-NIR imaging campaign with HST/WFC3.

E. Pérez (Poster)

Variegated star formation in the LIRG merger system IIZw96

IIZw96 is a very luminous infrared merger, log (L_IR/Lsun)= 11.94, formed by three spiral galaxies. Recent results from Spitzer data indicate that 80% of the FIR luminosity is associated with a compact heavily obscured super star cluster located in the main intergalactic tidal stream of the system.

Here we present preliminary analysis of the Halpha and [NII] emission line maps of the whole system obtained with the OSIRIS Tunable filters at the Gran Telescopio de Canarias (GTC) and long-slit optical spectroscopy, that characterize the star formation history and detailed stellar population properties.

J. Piqueras López (Poster)

A near-infrared study of a sample of local LIRGs and ULIRGs

We are carrying out a large program involving integral field spectroscopy observations of local LIRGs and ULIRGs, with the aim of studying their kinematics, ionization mechanisms, etc. In particular, this study is based on VLT-SINFONI observations covering both H (1.45-1.85 micron) and K (1.90 - 2.50 micron) bands, with an intermediate spectral resolution (R~3000 - 4000), a FOV of ~8"x8", and spatial resolution of ~0.25 arcsec/pixel.

I will present SINFONI reconstructed maps of the Hydrogen recombination lines (Pa_alpha and the Brackett series), molecular Hydrogen excitation lines and metal lines (HeI, [FeII], [SiVI]) of a sample of 9 LIRGs and 7 ULIRGs. Since the reddening is less important at infrared wavelengths, we can investigate in detail the different ionizing mechanisms and how they relate with the star formation activity. A further study of the kinematics and the spatial distribution of the dust will prove the full potential of our dataset.

SESSION 5. THE AGN/SB CONNECTION

G. Canalizo (Review)

The Connection Between Starbursts and QSO Activity

Recent observations of low redshift quasar host galaxies indicate that mergers and significant episodes of star formation are ubiquitous in these galaxies. By constraining the timescales of such events we can gain a better understanding of the role of AGN feedback in galaxy evolution. I will discuss results from a long campaign of space- and ground-based imaging and spectroscopic observations of $z < 0.5$ hosts that imply that mergers are indeed essential for the triggering of quasars, and that these mergers invariably induce starbursts either during or shortly after the merger. There appears to be, however, a large range of values for the time delays between the merger and the onset of the nuclear activity, varying from a few Myr to more than a Gyr. We find some evidence for a bimodal distribution, although this could be a selection effect.

M. Imanishi (Oral)

The AGN-starburst connections in nearby luminous infrared galaxies

We present the results of our systematic search for optically elusive, but intrinsically luminous buried AGNs in >100 nearby ($z < 0.3$) luminous infrared galaxies with $L(IR) > 10^{11}$ Lsun, classified optically as non-Seyferts. To disentangle AGNs and stars, we have performed

(1) infrared 2.5-35 micron low-resolution ($R \sim 100$) spectroscopy using Subaru, AKARI, and Spitzer, to estimate the strengths of PAH (polycyclic aromatic hydrocarbon) emission and dust absorption features,

(2) high-spatial-resolution infrared 20 micron imaging observations using Subaru and Gemini, to constrain the emission surface brightnesses of energy sources, and

(3) millimeter interferometric measurements of molecular gas flux ratios, which reflect the physical and chemical effects from AGNs and stars. Overall, all methods provided consistent pictures. We found that the energetic importance of buried AGNs is relatively higher in galaxies with higher infrared luminosities (where more stars will be formed), suggesting that AGN-starburst connections are luminosity dependent. Our results might be related to the AGN feedback scenario as the possible origin of the galaxy down-sizing phenomenon.

M. Lazarova (Oral)

Infrared SEDs and Star Formation Rates of LoBAL QSOs

Low-ionization Broad Absorption Line QSOs (LoBALs) are a rare class of objects, accounting only for 1-3% of the general population of QSOs. Their defining

characteristic is the presence of high velocity (>2000 km/s) mass outflows of low- and high-ionization ions, which are evident in the very broad blue-shifted absorption troughs in their rest-UV spectra. There is some observational evidence that LoBALs at low redshifts might exclusively reside in Ultra Luminous Infrared Galaxies (ULIRGs) with disturbed morphologies and young stellar populations as a result of a recent galaxy merger. Those studies and the currently sparked interest in AGN feedback as a possible mechanism for regulating galaxy evolution have highlighted the importance of testing previous ideas proposing that BALs represent a short-lived outflow phase early in the life of QSOs. Herein we present the first results from a multiwavelength, systematic study of a complete sample of 22 LoBALs drawn from the SDSS DR3 within $0.5 < z < 0.6$. We model their infrared SEDs and measure the total IR luminosities from 24, 70, and 160 micron Spitzer/MIPS observations. Also, we estimate the star formation rates from their IR luminosities and the PAH features in their Spitzer/IRS spectra.

M. Villar Martin (Oral)

Extended emission line nebulae around type 2

I'll present recent results based on VLT and GTC spectroscopic and imaging data of a new programme whose main goal is to investigate the existence of extended emission line nebulae associated with type 2 quasars, characterize their properties and use them as cosmological tools.

M. Brotherton (Invited)

Post-Starburst Quasars

I will discuss our investigations to find and understand post-starburst quasars, hybrid objects with accreting black holes and recent massive starbursts, and their role in the evolution of galaxies. Data from SDSS, Keck, HST, Galex, and Spitzer will be featured.

S. Cales (Oral)

A Detailed View of Post-starburst Quasars

The hybrid nature of Post-starburst quasars (QSO) may reveal an evolutionary link between AGN and starburst activity. These broad-lined AGN possess the spectral signatures of massive (up to ten billion solar masses), moderate-aged stellar populations (hundreds of Myrs). We launch a program to characterize in detail a subsample of the Brotherton et al. 2010 Post-starburst quasars (PSQs). We examine morphologies, degree of disturbance and quasar-to-host light contributions via HST/ACS-F606W imaging. We also present the first results of composite spectral modeling of the PSQs (stellar poulations plus AGN) via analysis of Keck and KPNO-4m data.

V. Wild (Oral)

Timing the starburst AGN-connection

There are many theories successful in explaining the observed correlations between black holes and their host galaxies. In turn, these theories play a crucial role in explaining other observed aspects of the galaxy population, such as the red/blue bimodality. However, observational measurements of the interaction of black holes with their hosts remain scarce. I will present the time-averaged growth of black holes in the 400 strongest starbursts in local galactic bulges observed in the SDSS. These bulges have experienced a strong burst of star formation in the past 600Myr. I will focus on an observed delay of 250Myr between the onset of the starburst and accretion onto the black hole, and the decay in SFR during the 600Myr immediately proceeding the starburst. With both bulge and black hole increasing their mass by ~10% in 600Myr, the processes at work in this local starburst sample, may well be relevant to the co-evolution of black holes and bulges over cosmic time.

SESSION 6. THE DISTANT UNIVERSE

Matthew Lehnert (Invited)

Extreme Starbursts in the Distant Universe

I present near-infrared integral field observations of galaxies at redshifts ~1-3 with high star-formation rates and intensities. From these results and analogy with local regions of intense star-formation, I discuss the impact of these high intensities on the nature of the ISM - density, distribution of phases, the mechanisms through which energy is dissipated or advected, and its impact on the nature of star-formation.

M. Swinbank (Oral)

The Properties of star-forming regions in high-z star-forming galaxies

Measuring the properties of star-forming regions in high redshift galaxies (such as sizes, luminosities, and velocity dispersions) define some of the key science drivers for ELT and ALMA. Such observations can tell us how and why the star-formation in distant galaxies is much for efficient than that seen locally, and whether local, intense star-forming regions are good analogs for high-z galaxies. In this talk, I will show some recent observations which have been aided by strong gravitational to probe the properties of star-forming regions within galaxies at z~2--5 on scales of ~100pc. These results show that the mode of star-formation at z~2 is similar to that seen in local ULIRGs, although the energetics are unlike anything seen in the local Universe.

K. Menendez-Delmestre (Oral)

An IFU view to Extreme Starbursts at z~2: the Case of Submm Galaxies

A population of extreme starbursting galaxies at z~2 that have been the favorite candidates to be progenitors of the most massive galaxies at z~0 are the so-called submillimeter galaxies (SMGs). With colossal IR luminosities (>10^{12} Lsun) that translate into unusually high SFRs (~100-1000 Msun/yr), SMGs could build the stellar bulk of a massive galaxy in under a few hundred million years. The predominance of AGN signatures in SMGs shows that star formation and AGN activity coexist in these objects, implying that we are witnessing the coupled growth of the stellar spheroid and a central SMBH. Furthermore, the low SMBH masses (< 10^{8} Msun) in these galaxies suggest that the submm phase may play an important role in the rapid growth of SMBHs that lead to the establishment of the local Magorrian relation. We have undertaken the first integral-field spectroscopic observations of SMGs using Laser Guide Star Adaptive Optics (LGS-AO), taken with the OSIRIS spectrograph on Keck. I will discuss various aspects of SMGs in the light of these observations, including: the spatial distinction of AGN and star-forming

regions as revealed by differences in Halpha spectral properties; their merger-like kinematics suggested by velocity offsets between individual galactic-scale sub-components; their high SFR surface densities similar to local extremes like ULIRGs and circumnuclear starbursts; and their spatial extensions, which suggest that SMGs may be undergoing such intense star-forming activity on significantly larger spatial scales than extreme local environments.

F. Hammer (Invited)

Disk formation in massive spirals: merger or secularly induced star formation?

Using the deepest and most complete observations of distant galaxies, we investigate how large disks could have been formed. Observations include spatially-resolved kinematics, detailed morphologies and photometry from UV to mid-IR. Six billions years ago, half of the present-day spirals were experiencing major mergers, evidenced by their anomalous kinematics and morphologies as well as their relatively high gas fractions. They are consequently modelled using the state of the art hydrodynamics models. This provides a new channel of disk formation, e.g. disks reformed after gas-rich mergers. Then one may estimate which fraction of the stellar mass density has been formed during mergers. This will be compared to expectations from nearby galaxies, including the Milky Way and M31.

P. G. Pérez-González (Oral)

Understanding the mass assembly of galaxies at 0<z<4: Spitzer's contribution and open questions

We will present the main results of our research about the assembly of galaxies at z<4 based on the data obtained by the deepest Spitzer surveys carried out with IRAC and MIPS during the cryogenic mission. These data in the near-, mid- and far-IR have allowed us to obtain unprecedentedly robust estimations of the obscured SFRs and stellar masses of distant galaxies. Analyzing SFR and stellar mass functions in several redshift bins at 0<z<4, we have found and quantified that galaxies formed following a downsizing scenario, with the most massive systems assembling early in the lifetime of the Universe and very quick (i.e., with very high star formation efficiencies, and a significant amount of obscured starbursts), while less massive systems assembled later and/or more slowly. However, Spitzer has left several open questions that still hamper our current understanding about the formation and evolution of galaxies. I will discuss three of these results and how future facilities such as Herschel, ALMA, E-ELT or JWST can lead to a more robust and detailed (with higher spatial resolution and depth) characterization of how galaxies formed in the early Universe: (1) the mid-to-far IR colors of galaxies evolve with redshift, departing considerably from the typical values observed in the local Universe, specially at z>1.5-2.0; (2) the IMF might not be universal, evolving to a top-heavy IMF at z>1.5; (3) obscured AGN may be ubiquitous in high-z galaxies, playing a significant role in the downsizing scenario.

SESSION 7. SUMMARY AND FUTURE PROSPECTS

J. Turner (Review)

Molecular Gas and Star Formation in Starbursts: A Closer Look

Molecular clouds are the fuel for starbursts. What conditions cause molecular clouds to create starbursts? Are high gas surface densities sufficient? What effects do starbursts have on surrounding molecular gas? The current state of our knowledge of star formation and gas links will be reviewed, and extrapolated to what upcoming observations in the far-IR and millimeter/submillimeter may reveal about the causes and effects of starbursts.

J. Fischer: (Oral)

Herschel PACS Spectroscopy of ULIRGs

I describe our Herschel PACS survey of local Ultraluminous Infrared Galaxies (ULIRGs), which is part of the SHINING Guaranteed Time survey of local galaxies. In particular, I discuss far-infrared spectroscopy of Mrk 231, the most luminous of the local ULIRGs, and a type 1 broad absorption line AGN. For the first time in a ULIRG, all observed far-infrared fine-structure lines in the PACS range were detected and all were found to be deficient relative to the far infrared luminosity by 1 – 2 orders of magnitude compared with lower luminosity galaxies. The deficits are similar to those for the mid-infrared lines, with the most deficient lines showing high ionization potentials. Aged starbursts may account for part of the deficits, but partial covering of the highest excitation AGN powered regions may explain the remaining line deficiencies. A massive molecular outflow, discovered in OH and 18^OH, showing outflow velocities out to at least 1400 km s^{-1}, is a unique signature of the clearing out of the molecular disk that formed by dissipative collapse during the merger. The outflow is characterized by extremely high ratios of 18^O / 16^O suggestive of interstellar medium processing by advanced starbursts

S. F. Sanchez (Invited)

CALIFA: Calar Alto Legacy IFs Astronomical Survey

We present CALIFA, an IFS survey of ~600 galaxies in the local Universe (z<0.003), to be performed with PPAK@3.5m telescope at Calar Alto, aimed to study the spatial resolved properties of the stellar populations and ionized gas within the ~90% of the area covered by the galaxies, by sampling the optical wavelength range between 3700-7100 A with a resolution of R~1000/2000. The main goals of this survey would be to understand the details of the star formation history, galaxy growth and evolution within the Hubble sequence, fixing the anchor point of the cosmological evolution of galaxies.

L. Colina (Invited)

Mid-IR JWST view of dusty starbursts near and far

This talk will present MIRI, the Mid-IR imager and spectrograph for the JWST. MIRI will offer unique capabilities for the study of the dustiest and more extreme starbursts in the local Universe and at cosmological distances.

S. Veilleux (Review)

Summary & Future Prospects

I'll give a brief summary of the workshop, and discuss the relevance of Herschel, ALMA, and future ground-based and space facilities for the study of starbursts.