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ABSTRACTS OF CONTRIBUTED PAPERS

HUBBLE SPACE TELESCOPE ULTRAVIOLET SPECTROSCOPY OF CENTRAL STARS OF THE LMC PLANETARY NEBULAE

A. Arrieta[1], L. Stanghellini[1], R.A. Shaw[2] and D. Karakla[1]

In the quest to understand the origin of Planetary Nebula (PN) morphology, correlations have been sought between the nebular shapes and the evolutionary status of the central stars. In fact, several of the mechanisms proposed to explain asymmetric shapes have a direct link with the central star's evolutionary status. Among the possible mechanisms invoked to produce asymmetric PNs, stellar rotation is certainly an effective one, as several hydrodynamics models have shown. In this work we present *Space Telescope Imaging Spectrograph* (STIS) UV spectra of a representative sample of LMC PNs and their central stars. LMC PNs distances are known, thus the observed characteristics of the stars translate into absolute physical quantities readily, and provide the safest dataset for theory-observation comparisons. We fit stellar models to the observed spectra in order to determine the stellar temperature, radio and reddening. Stellar lines and P-Cygni lines are also studied to widen our understanding of these stars. Eventually, stellar characteristics will be related to the morphology of the nebulae observed by our group with *HST* STIS optical slitless spectroscopy.

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HOT PLASMA IN DWARF GALAXIES: X–RAY OBSERVATIONS OF IC 2574

Elias Brinks [1], Fabian Walter [2] and Jürgen Kerp [3]

The successful launches of Chandra and XMM–Newton have brought X–ray astronomy literally to new heights. Until recently, it was virtually impossible to detect X–ray emission from dwarf galaxies, except for some pathological objects. With these two new satellites, hot X–ray emitting gas originating in superbubbles and supergiant shells can now be mapped. In this contribution previous ROSAT observations of IC 2574 will be compared to much deeper data obtained with Chandra. Also, the data on IC2574 will be put in perspective by comparing them with a recent survey of some 8 nearby dwarf galaxies.

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MASSIVE STELLAR CLUSTERS IN WOLF-RAYET GALAXIES

B. Buckalew[1] and R. Dufour[1]

We report here the first results of an extensive optical/near-infrared imaging and spectroscopic study of massive stellar clusters in Wolf-Rayet (WR) galaxies using observations obtained from KPNO (USA), OAN (México), the HST and the 2MASS data archive. We have collected spectra, B imagery and 2MASS JHK imagery of approximately 60 prominent stellar clusters in 23 WR galaxies. One-third of the clusters have a WR stellar signature at λ4686. In this poster, we present the comparison of the derived ages and masses of clusters with WR stars (WRCs) against clusters not containing WR stars (nWRCs). The results show that the age distribution of WRCs is 5.2$\pm$1.8 Myr This compares with our age distribution of 6.4$\pm$2 Myr for the nWRCs. The mean ages of the two cluster groups are not statistically different. The mass range of WRCs appears to be larger than the nWRC masses and one typically finds that the WRC mass in a particular galaxy is larger than the nWRC mass.

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CHEMICAL EVOLUTION OF THE GALACTIC DISK FOR TWO SETS OBSERVATIONAL DATA

L. Carigi [1]

Two sets of observational carbon stellar yields for low-and-intermediate mass stars are computed based on planetary nebula abundances derived from C II λ4267 and C III $\lambda\lambda$1906 + 1909 lines, respectively. These observational yields are assumed in chemical evolution models for the solar vicinity and the Galactic disk. The models are compared with three sets of observational data: a) stars od the solar vicinity, b) O/H, C/H and C/O HII regions values derived from collisionally excited lines under the assumptions of no temperature varitions, c) O/H,C/H and C/O HII regions values derived from recombination lines.

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RAMBLINGS ABOUT THE COMPOSITION, MORPHOLOGY, AND PHYSICAL PROCESSES IN NGC 6888 AND OTHER WOLF-RAYET SHELL NEBULAE

R. J. Dufour [1]

I will review aspects of our current knowledge about the composition of Wolf-Rayet shell nebulae (WRSNe). A discussion of the results in the context of recent developments in the modeling of massive stars, their evolution, and their ejecta will be given. Finally, several of the results obtained from a HST imagery and spectroscopy study of the prototypical WRSN NGC 6888 will be presented. These include parameterizing the ionizing flux from the WN6 star, high spatial resolution morphology of the ejected knots and stellar-wind arcs, and model analyses of the physical properties and geometrical aspects of the ejected knots, which are not only He- and N-rich, but O-poor, compared to the ISM and Sun.

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NEW HST OBSERVATIONS OF THE WOLF-RAYET SHELL NEBULA NGC 6888

R. Dufour[1], B. Moore[1], J. Hester[2], P. Scowen[2], and B. Buckalew[1]

HST/WFPC2 imagery and STIS spectra of the circumstellar shell NGC 6888 are presented. We present color-coded pictures of our new WFPC2 imagery along the shell's norther perimeter. These include three fields in addition to additional filters in the field studied by Moore et al. (2000). Our new observations show that previous estimates of [N II]/Hα were low by 20-50%. The lower gas density in new photoionization models developed is in better agreement with the evolutionary scenario discussed in Moore et al. We derive a new ionizing flux for the WN6 star which is closer to that of the stellar model of Crowther & Smith (1996). We present an upper limit on the carbon abundance in the nebula based on UV STIS spectra. Support for the observations came from AURA/STScI to Rice & ASU as General Observer Program GO-08568.

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THE CHAOTIC ISM OF THE POST(?)-STARBURST GALAXY NGC 1569

R. Dufour[1], B. Buckalew[1], P. Shopbell[2], and D. Walter[3]

We present the results and analysis of HST-WFPC2 imagery of the starburst galaxy NGC 1569 (d=2.2Mpc), which permit unprecedented resolution (1pc) of the ionized gas and stellar population. The primary data in our analysis consist of images taken through narrow-band filters isolating Hβ, Hα, [O III]λ 5007, and [S II]λ6717+30 as part of the General Observer Program 8133. A variety of color-coded and grey-scaled maps of the morphology, ionization structure, and dust distribution are presented. Unsharp masks of the Hα images how a very chaotic structure for the ionized gas, with numerous filaments and arc-like bright rim features across the entire galaxy, but without significant large-scale ionization variations. Variations in the ionization and line-of-sight reddening occur on small scales (10-50pc). Numerous small emission blobs are seen in [S II], along with a large (21pc) "EGG" that appears to be a giant SNR.

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THE ENVIRONMENT OF AGN AND AN EVOLUTIONARY SCHEME

D. Dultzin-Hacyan[1], Y. Krongold[1] and P. Marziani[2]

We have investigated the environment of Seyfert 1 and 2 galaxies, Narrow line Seyferts, Bright IRAS galaxies and LINERs. Oue results do not support the Unified Scheeme but rather suggest an evolutionary scheme.

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THE HYDRODYNAMICS OF PHOTOIONIZED FLOWS

Gary Ferland[1] , Robin Williams[2] , Will Henney[3] and Jane Arthur[3]

I will describe recent advances in simulating HII regions as flows from the surface of molecular clouds. We have incorporated hydrodynamics into the large-scale plasma simulation code Cloudy. This allows the full HII Region - PDR problem to be solved on a self consistent basis, with the hydrodynamics joining the two regions. I will present results for the Orion HII Region, and outline future developments, which are aimed at calibrating luminosity indicators in Starburst Galaxies.

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[2] Cardiff University, Wales, UK
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BLACK HOLES: THEIR RELATION TO GALAXY EVOLUTION

K. Gebhardt [1]

In the past few years, supermassive black holes have gone from being considered possible oddities at the centers of galaxies to fundamental components of galaxies. This shift is due primarily to data taken with the Hubble Space Telescope which show that all bulge systems have supermassive black holes that correlate closely with properties of its host galaxy. This correlation appears to extend down to globular cluster size objects as well. These results strongly affect formational and evolutionary scenarios for both black hole and its host. I will present the current state of our observational understanding, as well as results from general dynamical modeling. It also appears that we will be able to measure the growth history of the black hole relative to the galaxy by using masses derived from the integrated light of quasars. By tying these results together with the current dynamical state and the quasar luminosity function, we will have a robust picture of the dominant source for black hole growth—whether luminous accretion or mergers play a more important role.

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WOLF RAYETS IN IC10: PROBING THE NEAREST STARBURST

S. Holmes [1] and P. Massey [2]

Based on Halpha surface brightness measurements and the large number of Wolf Rayet stars per unit area, IC10 is the nearest starburst galaxy. The ratio of WC- to WN- type Wolf-Rayets (2) is unexpectedly high given IC10's metallicity. Here we present the first results of a new, deeper survey for Wolf-Rayet stars in IC10. This survey detected all spectroscopically confirmed Wolf-Rayets, and based upon comparisons with a neighboring control field, we can estimate the total number of Wolf-Rayets is approximately 100. We also present spectroscopic confirmation of two new Wolf-Rayet candidates, both of which are WN-type. Our photometric survey offers a revised WC/WN ratio of 0.3: a value consistent with IC10's metallicity. Due to the increase of an already extensive Wolf-Rayet content, IC10 has a Wolf-Rayet surface density 20 times higher than in the LMC. This suggests, if the majority of the candidates are spectroscopically confirmed, that IC10 has an extensive population of high mass stars.

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A DYNAMICAL MODEL FOR PLANETARY NEBULAE WITH CENTRAL STARS OF THE WOLF-RAYET TYPE

S. Medina[1], M. Peña[1] and G. García-Segura[2]

We describe how the gaseous components of planetary nebulae with central stars of the [WC]-type are affected by the strong stellar winds. We are using the analytic solutions for the dynamics of bubbles expanding into media with power-law distributions, derived by Garcia-Segura & Mac Low (1995).

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THE KINEMATICS OF H_2 IN YOUNG STELLAR OUTFLOWS

L. Salas [1] and I. Cruz-Gonzalez [2]

We have observed a number of molecular outflows in the 2.12 μm line of H_2 with an IR Fabry-Pérot interferometer with a spectral resolution of 23 km/s. Although outflows vary greatly in morphology, energetics, degrees of collimation and age, a similar flux-velocity relation is generally observed. This relation consists of a flat spectrum for low velocities followed by a decreasing power law $dF/dv \,\alpha\, v^{\gamma}$, with γ between -1.8 and -2.6, for velocities higher than a clearly defined break velocity at 2 to 17 km/s. By comparing H and CO mass-velocity spectra, it is shown that there is a velocity regime where both molecules coexist and produce similar values. Evolution effects in outflows show as a correlation between outflow length and γ, as outflows age the spectra becomes steeper. Our results support a common physical origin for both CO and H_2 emission and a strong association between the molecular outflows traced in each molecule.

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REIONIZATION OF THE UNIVERSE AND THE END OF THE COSMIC DARK AGES

P. Shapiro [1]

The universe was reionized by redshift z 6 by a small fraction of the baryons in the universe, which released energy following their condensation out of a cold, dark, and neutral IGM into the earliest galaxies. The theory of this reionization is a critical missing link in the theory of galaxy formation. Its numerous observable consequences include effects on the spectrum, anisotropy and polarization of the cosmic microwave background and signatures of high-redshift star and quasar formation. This energy release also created feedback on galaxy formation which left its imprint on the mass spectrum and internal characteristics of galaxies and on the gas between galaxies long after reionization was complete. Recent work suggests that the photoevaporation of dwarf galaxy minihalos may have consumed most of the photons required to reionize the currently-favored Lambda-CDM universe. We will review recent developments in our understanding of this process.

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OPEN CLUSTERS AND STAR FORMATION IN THE NORTHERN CARINA NEBULA

M. Tapia[1], M. Roth[2], R.A. Vázquez[3] and A. Feinstein[3]

Results are presented of a large-scale imaging photometric study of the stellar population in the northern part of NGC 3372 in the $UBVRIJHK$ bands with a wavelength coverage from 0.33 to 2.5 μm. The observations were made at Las Campanas Observatory. The optical CCD mosaics cover an area approximately of 32×22 square arcminutes centred between the Tr 14 and Tr 16 clusters. The survey was extended to cover 12×12 square arcminutes at the location of Tr 15. Near-infrared NICMOS3 mosaics covering the areas occupied by these clusters were obtained in the JHK photometric bands. By means of star counts in V, the centres and sizes of each cluster were redetermined yielding: Tr 14 (r = 264 arcsec), Tr 15 (r = 320 arcsec) and Tr 16 (r = 320 arcsec). It was confirmed that Cr 232 is not a true cluster. Multicolour optical photometry was obtained for 4152 stars. Two colour and colour-magnitude diagrams are presented and analyzed for each individual cluster and compared to those of the field. The widespread variations in the dust density and also in the dust size distribution leading to widely different values of A_V and reddening laws towards Tr 14 and Tr 16 are confirmed. No spatial patterns were found for these variations. Spectroscopic

parallaxes were computed and the results are consistent with all three clusters being at similar distance from the Sun ($< d >= 2.7$ kpc) but the data showed very large scatter in both A_V and d. Analyses of the extinction-corrected colour-magnitude diagrams suggest ages between 3 and 60 million years for the stars in Tr 15 and between less than 1 and 6 million years for Tr 14 and Tr 16. A small number of infrared-excess stars were found in Tr 16 and Tr 14 but not in Tr 15. The distribution of stars in Tr 14 seen in the near-infrared suggests that this cluster is partially embedded in a molecular cloud. This molecular cloud extends towards the west reaching its highest density, marked by a CO peak emission, some three arcmin to the southwest of the nucleus of Tr14. The rich UV field created by the Tr14 stars ionizes most of the visible HII region in its vicinity and most of the radio HII region Car I. Evidence is found of ionization fronts leading into the molecular cloud, which appears to be "wrapping" the Tr 14 cluster. Deep JHK images of the Car I region reveal the presence of an embedded stellar population illuminating a large infrared reflection nebula. It includes at least one O9–B0 star associated with an ultracompact HII region. Nebulous 2.2 μm emission from three of the mid-infrared sources in the Tr 14 region is also found.

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[3] Facultad de Ciencias Astronómicas y Geofísicas, UNLP, Argentina

ON THE FROZEN INTERIORS OF SUPER-GALACTIC WINDS

G. Tenorio-Tagle [1]

We shall review the present evidence of supergalactic winds in galaxies in the local universe. In particular the structure believed to be channeling the recently processed matter from nuclear starbursts and the requirements for a super wind will be thoroughly stressed. We shall also present steady state and numerical simulations of super winds, taking into consideration strong radiative cooling. The two possible outcomes: quasi-adiabatic and strongly radiative flows and their implications on the appearance of superwinds on X rays and in the visible line regime will be discussed.

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THE AGES OF HII GALAXIES

R. Terlevich [1]

Recently there has been a huge increase in the amount of data available for astronomical research. ++New large surveys like the 2 degree Field (2dF), the Sloan digital sky survey (SDSS), 2MASS, VIRMOS and DEEP2 are revolutionizing the way we do astronomy, by adding enormous quantities of high quality data to that already available for research. The main challenge will be the development of tools capable of analyzing these huge datasets and cross-correlate their information.

One cannot overemphasize the importance and complexity of this challenge. In the next five years the data available to research in databases will increase to the level of having hundreds of parameters on tens of millions of astronomical objects,. i.e. MEGADATASETS. This complexity, will be compounded by the presence of measurement errors, biases and tendencies in the data.

I will describe a line of supervised analysis that can potentially provide with strong statistical information about the ages of HII galaxies and the star formation history of these extreme emission line galaxies.

[1] INAOE, México

STELLAR ENERGY INJECTION IN A THERMALLY UNSTABLE ISM

E. Vázquez-Semadeni [1]

We discuss the mechanical response of a thermally unstable atomic ISM to the ionization heating from OB stars. To this end we first review the results of linear theory, remarking that entropy perturbations are unstable under typical cooling conditions for the atomic ISM, but adiabatic perturbations are stable. Velocity perturbations, such as those due to the expanding shells caused by stellar ionization heating, and in general those present in a turbulent medium, can be nearly adiabatic when the motions are transonic and have characteristic size scales such that $\tau_{\rm d} < \tau_{\rm c}$, where $\tau_{\rm d}$ is the dynamical crossing time scale and $\tau_{\rm c}$ is the cooling time. At the median conditions of the atomic ISM ($n \sim 1\ {\rm cm}^{-3}$, $T \sim 2400$K), this corresponds to velocity fluctuations of a few km

s^{-1} across size scales smaller than several parsecs. We then present numerical simulations showing that in fact a significant mass fraction of unstable gas may be expected in the atomic ISM, in agreement with several obervational studies. We briefly discuss numerical issues of concern and convergence studies. We conclude by suggesting that the gas with unstable temperatures can be observationally distinguished through simultaneous determination of two of its thermodynamic variables.

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A MODEL FOR THE X-RAY EMISSION FROM THE HD 5980 SYSTEM

Pablo F. Velázquez[1], Gloria Koenigsberger[2], 3 and Alejandro C. Raga[1]

Numerical simulations of the interaction between supernova ejecta and a stellar wind are presented. We follow the temporal evolution of the shock fronts that are formed through such an interaction and determine the velocities, temperatures and densities. We model the X-ray emission from the SNR-stellar wind collision region and we compare it with recent results from X-ray observations carried out with the Chandra satellite of the SMC supernova remnant SNR 0057-7226 which could be interacting with the wind of the Wolf-Rayet system HD 5980. The simulations predict the presence of shell-like regions of enhanced X-ray emission which are consistent with the presence of X-ray emitting arcs in the Chandra image. Also the observed X-ray luminosity is comparable to the X-ray luminosities we obtain from the simulations for a supernova with an initial energy in the 1-5 E50 erg range.

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LIST OF ABSTRACTS

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