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KEY=EMISSION - JAEDEN HIGGINS

THE EMISSION-LINE UNIVERSE

Cambridge University Press *This book presents lectures by prestigious researchers and experienced observers from the eighteenth Winter School of the Canary Islands Astrophysics Institute (IAC), devoted to emission lines and the astrophysical objects that produce them. It shows how emission lines in different wavelengths, from ultraviolet to near infrared, can provide essential information on understanding the formation and evolution of astrophysical objects, from the first stars to objects in our Galaxy. It includes practical tutorials for data reduction, making this a truly valuable reference for researchers and graduate students.*

THE EMISSION-LINE UNIVERSE

XVIII CANARY ISLANDS WINTER SCHOOL OF ASTROPHYSICS

A valuable 2008 reference on emission lines and the astrophysical objects that produce them, for researchers and graduate students.

OBSERVATIONAL MOLECULAR ASTRONOMY

EXPLORING THE UNIVERSE USING MOLECULAR LINE EMISSIONS

Cambridge University Press *Molecular line emissions offer researchers exciting opportunities to learn about the evolutionary state of the Milky Way and distant galaxies. This text provides a detailed introduction to molecular astrophysics and an array of useful techniques for observing astronomical phenomena at millimetre and submillimetre wavelengths. After discussing the theoretical underpinnings of molecular observation, the authors catalogue suitable molecular tracers for many types of astronomical regions in local and distant parts of the Universe, including cold gas reservoirs primed for the formation of new stars, regions of active star formation, giant photon-dominated regions and near active galactic nuclei. Further chapters demonstrate how to obtain useful astronomical information from raw telescope data while providing recommendations for appropriate observing strategies. Replete with maps, charts and references for further reading, this handbook will suit research astronomers and graduate students interested in broadening their skill to take advantage of the new facilities now coming online.*

THE EMISSION-LINE UNIVERSE

XVIII CANARY ISLANDS WINTER SCHOOL OF ASTROPHYSICS

Emission lines provide a powerful tool to study the physical properties and chemical compositions of astrophysical objects in the Universe, from the first stars to objects in our Galaxy. The analysis of emission lines allows us to estimate the star formation rate and initial mass function of ionizing stellar populations, and the properties of active galactic nuclei. This book presents lectures from the eighteenth Winter School of the Canary Islands Astrophysics Institute (IAC), devoted to emission lines and the astrophysical objects that produce them. Written by prestigious researchers and experienced observers, it covers the formation of emission lines and the different sources that produce them. It shows how emission lines in different wavelengths, from ultraviolet to near infrared, can provide essential information on understanding the formation and evolution of astrophysical objects. It also includes practical tutorials for data reduction, making this a valuable reference for researchers and graduate students.

THE WESTERBORK OBSERVATORY, CONTINUING ADVENTURE IN RADIO ASTRONOMY

Springer Science & Business Media *A small country builds a world-class telescope in its backyard and lives happily ever after (or at least for a quarter century). That in a nutshell is the story told in this collection of essays. The country of course is the Netherlands, and the telescope is the Westerbork Synthesis Radio Tele scope (WSRT), brainchild of Jan Oort. Living happily in this context is a continuing record of discovery and as such also a continuing basis for se curing observing time on facilities in other countries and operating at other frequencies. As our community celebrates the Silver Anniversary of the radio tele scope at Westerbork, it is fitting that we pause to take account of the scientific discoveries and insights it made possible. Initially the instrument represented the very significant step away from university-run, specialist facilities to a well-supported, common-user radio imager also having spec tral and polarization capabilities. It pioneered the mode of operation now common for satellite observatories, in which data is taken and calibrated by technicians and provided to researchers ready for analysis. It has been a major source of discovery in, among other areas, research on neutral hy drogen and studies of dark matter in galaxies.*

QSO ABSORPTION LINES

PROBING THE UNIVERSE

Cambridge University Press *This second title in the series published for the Space Telescope Science Institute researches the current models of quasar absorption and the systems of absorption lines in the spectra of quasars. Experts in this field discuss the nature of the absorbing process in the vicinity of quasars, the "Lyman-alpha forest", metal-line systems, and quasars as probes of high redshift galaxies. The Hubble Space Telescope will be a valuable tool for learning more about the physics and astronomy of quasars.*

USING EMISSION LINES TO CHARACTERIZE GALAXY PROPERTIES

FROM THE NEARBY TO THE DISTANT UNIVERSE

Ever since the hydrogen emission line of Lyman-alpha (Ly) has been postulated to hold one of the keys to studying high-redshift galaxies, the question of what emission lines can tell us about the properties and evolution of galaxies has driven much of our research. This work is a survey of emission lines across cosmic history. Just as galaxies evolve with redshift, so does how we can use emission line information from these galaxies. I begin with a study of resolved Ly emission in nearby galaxies, and how we can use pixel-by-pixel photometry to study emission on very small galactic scales and to characterize Ly scattering. Using the Lyman-Alpha Reference Sample, a set of 14 starbursting galaxies with redshifts of 0.02 z

ACTIVE GALACTIC NUCLEI

John Wiley & Sons *This AGN textbook includes phenomena based on new results in the X-Ray domain from new telescopes such as Chandra and XMM Newton not mentioned in any other book. Furthermore, it considers also the Fermi Gamma Ray Space Telescope with its revolutionary advances of unprecedented sensitivity, field of view and all-sky monitoring. Those and other new developments as well as simulations of AGN merging events and formations, enabled through latest super-computing capabilities. The book gives an overview on the current knowledge of the Active Galacitc Nuclei phenomenon. The spectral energy distribution will be discussed, pointing out what can be observed in different wavebands and with different physical models. Furthermore, the authors discuss the AGN with respect to its environment, host galaxy, feedback in galaxy clusters, etc. and finally the cosmological evolution of the AGN phenomenon.*

DEMOGRAPHICS OF THE COLD UNIVERSE WITH ALMA

FROM INTERSTELLAR AND CIRCUMGALACTIC MEDIA TO COSMIC STRUCTURES

Springer *This book presents the cold side of the Universe illustrated by the rest-frame, far-infrared emission with Atacama Large Millimeter/submillimeter Array (ALMA). The author constructed the largest-ever ALMA sample and dataset, which enables them to identify very faint, rest-frame, far-infrared dust continuums as well as the carbon fine-structure line emission from distant galaxies that have been missed in previous surveys. The observational findings described in this book reveal for the first time where and how much of the star formation, traced by the rest-frame far-infrared emission, is ongoing, from inter-stellar and circum-galactic media to cosmic structures. Moreover, since some of the findings are unexpected and as such challenge the current galaxy formation models, the book provides exciting questions that should be addressed in the next decades.*

FUTURE PROBES OF COSMOLOGY AND THE HIGH-REDSHIFT UNIVERSE

This thesis is a study in theoretical cosmology with an emphasis on the high-redshift universe and promising directions for future observations. In Chapters 2 and 3, we propose intensity mapping of spectral line emission from galaxies. This is a technique to observe the cumulative emission from many galaxies without resolving individual sources. We use analytic calculations and N-body simulations to predict the observational signal for different emission lines, including those from oxygen, carbon monoxide, and carbon.

THE MASS OF GALAXIES AT LOW AND HIGH REDSHIFT

PROCEEDINGS OF THE EUROPEAN SOUTHERN OBSERVATORY AND UNIVERSITÄTS-STERNWARTE MÜNCHEN WORKSHOP HELD IN VENICE, ITALY, 24-26 OCTOBER 2001

Springer Science & Business Media *Measuring the masses of galaxies as a function of redshift is perhaps one of the most challenging open issues in current astronomical research. The evolution of the*

baryonic and dark matter components of galaxies is not only a critical test of the hierarchical formation paradigm, but ultimately also provides new clues on the complex interplay between star formation, the cooling and heating of gas and galaxy merging processes. This book reviews current techniques to measure the baryonic (stellar) and dark masses of nearby galaxies, and focusses on ongoing attempts to measure theses same quantities in galaxies at higher and higher redshifts. It also gives room to future perspectives, with special emphasis on new survey projects and satellite missions.

THE NEW UNIVERSE

HANDBOOK ON RADIO ASTRONOMY 2013

United Nations *The Handbook on Radio Astronomy has been developed by experts of Working Party 7D of ITU-R Study Group 7 (Science Services) that is responsible for radio astronomy. This Handbook is not intended as a source book on radio astronomy, but rather deals with such aspects of radio astronomy that are relevant to frequency coordination as the management of radio spectrum usage in order to minimize interference between radio communication services.*

NUCLEI IN THE COSMOS V

Atlantica Séguier Frontières

HANDBOOK OF FREQUENCY ALLOCATIONS AND SPECTRUM PROTECTION FOR SCIENTIFIC USES

National Academies Press *The electromagnetic spectrum is a vital part of our environment. Information encoded in the spectrum of radiation arriving at earth from the universe is the means by which we learn about its workings and origin. Radiation collected from the Earth's land, oceans, biosphere, and atmosphere provide us with much of the data needed to better understand this environment. Wise use of the spectrum is necessary if we are to continue these advances in scientific understanding. To help guide this effort, the NSF and NASA asked the NRC to develop a set of principles for fostering effective allocation and protection of spectral bands for scientific research. This handbook contains practical information in this connection including a description of regulatory bodies and issues, a discussion of the relevant scientific background, a list of science spectrum allocations in the United States, and an analysis of spectrum protection issues.*

HIGH ENERGY ASTROPHYSICS

AN INTRODUCTION

Springer Science & Business Media *High-energy astrophysics has unveiled a Universe very different from that only known from optical observations. It has revealed many types of objects in which typical variability timescales are as short as years, months, days, and hours (in quasars, X-ray binaries, etc), and even down to milli-seconds in gamma ray bursts. The sources of energy that are encountered are only very seldom nuclear fusion, and most of the time gravitation, a paradox when one thinks that gravitation is, by many orders of magnitude, the weakest of the fundamental interactions. The understanding of these objects' physical conditions and the processes revealed by high-energy astrophysics in the last decades is nowadays part of astrophysicists' culture, even of those active in other domains of astronomy. This book evolved from lectures given to master and PhD students at the University of Geneva since the early 1990s. It aims at providing astronomers and physicists intending to be active in high-energy astrophysics a broad basis on which they should be able to build the more specific knowledge they will need. While in the first part of the book the physical processes are described and derived in detail, the second part studies astrophysical objects in which high-energy astrophysics processes are crucial. This two-pronged approach will help students recognise physical processes by their observational signatures in contexts that may differ widely from those presented here.*

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

COMPACT RADIO SOURCES AND JET-DRIVEN AGN FEEDBACK IN THE EARLY UNIVERSE

CONSTRAINTS FROM INTEGRAL-FIELD SPECTROSCOPY

To investigate the impact of radio jets during the formation epoch of their massive host galaxies, we present an analysis of two massive, log M{sub stellar}/M{sub {circle_dot}} ≈ 10.6 and 11.3, compact radio galaxies at z = 3.5, TNJ0205+2242 and TNJ0121+1320. Their small radio sizes (R ≤ 10 kpc) are most likely a sign of youth. In particular, we compare their radio properties and gas dynamics with those in well extended radio galaxies at high redshift, which show strong evidence for powerful, jet-driven outflows of significant gas masses (M ≈ 109−1° M{sub {circle_dot}}). Our analysis combines rest-frame optical integral-field spectroscopy obtained with SINFONI on the VLT with existing radio imaging, CO(4-3) emission line spectra, and rest-frame UV longslit spectroscopy. [OIII][lambda]5007 line emission is compact in both galaxies and lies within the region defined by the radio lobes. For TNJ0205+2242, the Ly[alpha] profile narrows significantly outside the jet radius, indicating the presence of a quiescent halo. TNJ0121+1320 has two components at a projected relative distance of ≈10 kpc and a velocity offset of ≈300 km s−1, measured from the [OIII][lambda]5007 velocity map. This suggests that the fainter component is orbiting around the more massive, radio-loud galaxy. If motions are gravitational, this implies a dynamical mass of 2 x 1011 M{sub {circle_dot}} for the radio-loud component. The dynamical mass, molecular gas mass measured from the CO line emission, and radio luminosity of these two compact radio galaxies imply that compact radio sources may well develop large-scale, energetic outflows as observed in extended radio galaxies, with the potential of removing significant fractions of the ISM from the host galaxy. The absence of luminous emission line gas extending beyond the radio emission in these sources agrees with the observed timescales and outflow rates in extended radio galaxies, and adds further evidence that the energetic, large-scale outflows observed in extended radio sources (Nesvadba et al. 2006) are indeed the result of influence of the radio jet.

THE FARTHEST THINGS IN THE UNIVERSE

Cambridge University Press *This book, first published in 1994, examines the excitement and challenge of studying the most distant and powerful objects.*

THE IRON UNIVERSE

D Publishing *The purpose of The Iron Universe is to provide in simple language for ordinary people a ‘paradigm-shift’ in the thinking about the creation, evolution and future of the universe. While researching The Iron Universe, I coined a new word to describe how I see the current state of affairs in regard to the scientific community’s ideas on the universe. That word is “COSMYTHOLOGY”. The Iron Universe is a cosmythology buster. The concepts described in The Iron Universe are original and will not be found in any other story of the universe. The Iron Universe challenges every current model of the universe and will stand up to any critical review and comparison with other models. Cosmythology in the 21st century has not occurred due to some deliberate attempt to deceive by the world's cosmologists, astrophysicists and astronomers. Cosmythology is the acceptance without question by scientists of the invalid theories of the cosmologists, astrophysicists and astronomers of the last hundred years. The major players in the cosmythology of the new millennium are the United States' National Aeronautics and Space Administration (NASA) and the National Academies of Science (NAS), the world’s university physics faculties, high school physics curriculum developers and popular science writers. Every university physics website on the internet marches in step with the cosmythology of the 20th century. A “new paradigm” is needed for the 21st century. High school physics curriculum developers are just copiers of the cosmythology material that is perpetuated in the university physics faculties of the world. Popular cosmythology authors present no new ideas outside science fiction. The Iron Universe provides the “paradigm altering science” that is required for the new millennium.*

MID-IR PROPERTIES OF AN UNBIASED AGN SAMPLE OF THE LOCAL UNIVERSE

I; EMISSION-LINE DIAGNOSTICS

"We compare mid-IR emission-lines properties, from high-resolution Spitzer IRS spectra of a statistically-complete hard X-ray (14-195 keV) selected sample of nearby (z

BLACK HOLES, QUASARS, AND THE UNIVERSE

Houghton Mifflin School *Recounts the major astronomical discoveries of our age, detailing the many startling findings of the past twenty years concerning black holes, quasars, pulsars, and other intriguing phenomena*

QSO ABSORPTION LINES

PROBING THE UNIVERSE : A COLLECTION OF 37 POSTER PAPERS DISPLAYED DURING A WORKSHOP HELD AT THE SPACE TELESCOPE SCIENCE INSTITUTE ON MAY 19-21, 1987

NUOVO CIMENTO

A COMPANION TO ASTRONOMY AND ASTROPHYSICS

CHRONOLOGY AND GLOSSARY WITH DATA TABLES

Springer Science & Business Media *Astronomy and Astrophysics is a comprehensive, fundamental, and up-to-date reference book. It is filled with vital information and basic facts for amateur astronomers and professional astrophysicists, and for anyone interested in the Universe, from the Earth and other planets to the stars, galaxies and beyond. An exceptionally thorough Index cross-references concepts, discoveries and individuals in both the Timeline section and Dictionary section. The combined result is a unique stand-alone reference volume in which the reader can quickly locate information, while also discovering new and unexpected knowledge.*

EXPLORING THE UNIVERSE WITH THE IUE SATELLITE

Springer Science & Business Media *This book was conceived to commemorate the continuing success of the guest observer program for the International Ultraviolet Explorer (IUE) satellite observatory. It is also hoped that this volume will serve as a useful tutorial for those pursuing research in related fields with future space observatories. As the IUE has been the product of the three-way collaboration*

between the U.S. National Aeronautics and Space Administration (NASA), European Space Agency (ESA) and the British Engineering and Research Council (SERC), so is this book the fruit of the collaboration of the American and European participants in the IUE. As such, it is a testimony to timely international cooperation and sharing of resources that open up new possibilities. The IUE spacecraft was launched on the 26th of January in 1978 into a geosynchronous orbit over the Atlantic Ocean. The scientific operations of the IUE are performed for 16 hours a day from Goddard Space Flight Center in Greenbelt, Maryland, U.S.A, and for 8 hours a day from ESA Villafranca Satellite Tracking Station near Madrid, Spain.

THE RESTLESS UNIVERSE

UNDERSTANDING X-RAY ASTRONOMY IN THE AGE OF CHANDRA AND NEWTON

Oxford University Press on Demand *A research astrophysicist at the Smithsonian Astrophysical Observatory offers an engaging introduction to the exciting field of x-ray astronomy. 62 halftones, 31 line illustrations, & 7 color images.*

MILLIMETER AND SUBMILLIMETER DETECTORS FOR ASTRONOMY

BARYONIC ACOUSTIC OSCILLATIONS WITH EMISSION LINE GALAXIES AT INTERMEDIATE REDSHIFT

THE LARGE-SCALE STRUCTURE OF THE UNIVERSE

In this PhD, I demonstrate the feasibility of the target selection for bright emission line galaxies. Also I now understand the main physical mechanisms driving the efficiency of a selection, in particular the relation to the parent photometry. A puzzling issue remains, I could not yet estimate quantitatively the impact of the dust on the selection efficiency. I hope to address this question with the data set described in chapter 4.Apart from the emission line galaxy target selection, I investigated, at first order, the two main systematic errors on the determination of the BAO scale we expect due to using emission line galaxies as tracers of the matter. First I showed the incompleteness in the redshift distribution, due to the measurement of the redshift with [Oii], is related to the instrumental resolution. I find there are two interesting regimes. For an observation of the brightest [Oii]emitters, a moderate resolution is sufficient, whereas for a fainter survey, the highest the resolution the best. Secondly, I estimated the linear galaxy bias of the selections discussed before and I find they are highly biased. On one hand, this is great news for the observers, as the time required to observed at a given signal to noise in the power spectrum decreases with the square of the bias. On the other hand, it constitutes a new challenge for reconstruction algorithms and the making of mock catalogs. The work in progress described in the last chapter shows I am starting to try and handle these questions in a robust manner.

ASTROPHYSICS OF THE DIFFUSE UNIVERSE

Springer Science & Business Media *The reference work on astrophysics to provide a comprehensive introduction to the physics of Interstellar Matter. The objective of the book is to show how physics can be applied to the understanding and diagnosis of the phase structure, the physical conditions and the chemical make-up and evolution of the interstellar medium. Unlike other textbooks in the field, here a more systematic approach has been adopted based on the authors' lecture course experience. It is aimed primarily at those undertaking post-graduate courses, or those doing advanced projects as part of honours undergraduate courses in physics or astrophysics.*

INVESTIGATING THE UNIVERSE

PAPERS PRESENTED TO ZDEN?K KOPAL ON THE OCCASION OF HIS RETIREMENT, SEPTEMBER 1981

Springer Science & Business Media *Professor Zdenek Kopal is sixty-seven this year even though his scientific activity, enthusiasm and springy step hardly betray the ad vancement in years. He carne to Manchester as Professor of Astronomy thirty years ago after a very fruitful association of fourteen years with the Harvard Observatory. Much impressed with the young man, Harlow Shapley, who with characteristic insight had recognised in Kopal the qualities that have since made him an outstanding leader in ec1ipsing binary research, had invited him over as a Research Associate. In the subsequent decade Kopal set about the task of introducing analytical rigour in the solution of orbit al elements that hitherto had depended ex c1usively on the semigraphical procedures introduced by Russell and exploited fully by Shapley. These first efforts stimulated publication of the first of his many books on ec1ipsing variables; the Introductian ta the Study of Ec/ipsing Variables summarized these iterative methods and remains a c1assic in this field. Soon after the appearance of this volume in print, Kopal gave a course on this subject for the graduate students at Harvard. I was one of those who had the opportunity to attend it and learn much on the need of care and precision in the practice of photoelectric photometry and the importance of exploiting such data to the fullest extent with methods of increasing resolving power.*

RADIO RECOMBINATION LINES: 25 YEARS OF INVESTIGATION

PROCEEDING OF THE 125TH COLLOQUIUM OF THE INTERNATIONAL ASTRONOMICAL UNION, HELD IN PUSCHINO, U.S.S.R., SEPTEMBER 11–16, 1989

Springer Science & Business Media *Text no 1 Radio Recombination Lines (RRLs), discovered in the USSR in 1964, have become a powerful research tool for astronomers. Available throughout the radio spectrum, these lines carry information regarding the density, temperature, turbulence and velocity of thermal plasmas. Their very existance shows the presence of thermal gas. They also can carry information regarding magnetic fields if Zeeman splitting were to be detected. Containing the proceedings of an IAU Colloquium celebrating the 25th anniversary of their detection, this volume tells us what has happened since. It contains the story of the detection of RRLs and reviews of many areas of physics of the interstellargas from which stars form, HII regions excited by newly formed stars, planetary nebulae involving dying stars, and the structure of our Milky Way and other galaxies reflecting the large-scale morphology of the star formation process. In addition there is an article describing modern laboratory studies of Rydberg atoms to probe the basic physics of atomic structure, and articles describing the theory of collisions and radiation upon Rydberg atoms leading to observate effects to be used as diagnostic tools in astromony. This book focuses on the 25 years of astronomical research with radio recombination lines (RRLs) since their discovery in 1965. It covers a wide range of topics: papers dealing with research into Rydberg atoms both in the laboratory and in the interstellar medium of our galaxy and others; papers on the interaction of radiation and atomic systems, as well as with the effects of inadiabatic collisions between these atoms and both ions and electrons. It deals with astronomical observations of atoms with `diameters' ranging from 0.08 to 50 mum a size factor of 625. It deals with RRLs in absorption, in emission and as true masers. And it deals with plasmas with temperatures ranging from 10 to greater than 104 kelvins, and with an even greater range of volume densities. Much new work is reported, including low frequency RRLs discovered in 1980 and the maser RRLs from the star MWC349, discovered in 1989. The advent of aperture synthesis telescopes and large single-element telescopes have made possible RRL studies with high angular resolution. The sum total of the work reported here will make the volume a platform from which to search new horizons in RRL research.*

GROUND-BASED AND AIRBORNE INSTRUMENTATION FOR ASTRONOMY

25-29 MAY, 2006, ORLANDO, FLORIDA, USA

GALAXY FORMATION AND EVOLUTION

Cambridge University Press *A coherent introduction for researchers in astronomy, particle physics, and cosmology on the formation and evolution of galaxies.*

ANALYZING THE REST-FRAME OPTICAL EMISSION-LINE AND HOST GALAXY PROPERTIES OF?

The study of galaxies across multiple epochs is essential for understanding the evolution of the universe. One key time period to study is z ~ 2, when star formation activity in the universe is at its peak. Comparing local galaxies to those in this more active time period is a critical way to learn about galaxy evolution by examining the differences and/or similarities in galaxy properties. In this thesis, I study the rest-frame optical emission-line and host galaxy properties of star-forming galaxies at z ~ 2 in the MOSFIRE Deep Evolution Field (MOSDEF) survey to better understand the evolution of galaxies over the past 10 Gyr of our universe's history. First, I investigate correlations between the emission-line properties and the physical and chemical properties of z ~ 2 star-forming galaxies in the MOSDEF survey. It is necessary to understand the known offset of z > 1 galaxies on the [O III][lambda]5008/H[Beta] vs. [N II][lambda]6585/H[alpha] ([N II] "BPT") diagram compared to their local counterparts because strong rest-optical emission-lines are commonly used to infer a variety of galaxy properties (e.g. gas-phase oxygen abundance). To investigate the physical driver of this shift, I defined two populations of z ~ 2 MOSDEF galaxies on the [N II] BPT diagram, one on and one off (i.e., offset from) the local sequence. I find that these two groups remain separated on the [O III][lambda]5008/H[Beta] vs. [S II][lambda][lambda]6718,6733/H[alpha] ([S II] BPT) diagram and the [O III][lambda][lambda]4960,5008/[O II][lambda][lambda]3727,3730 vs. ([O III][lambda][lambda]4960,5008+[O II][lambda][lambda]3727,3730)/H[Beta] (O 32 vs. R 23) diagram, which suggests that star-forming regions in the more offset galaxies are characterized by harder ionizing spectra at fixed nebular oxygen abundance. Such a phenomenon may be tied to [alpha]-enhancement and massive stars that are chemically "young." Second, I compare the z ~ 2 MOSDEF survey with the z ~ 2 portion of the Keck Baryonic Structure Survey (KBSS) that has been observed with MOSFIRE. Like MOSDEF, KBSS studies a large sample of star-forming galaxies at z ~ 2 with the MOSFIRE instrument; however, there are notable differences in survey construction and key results (e.g., the magnitude of the offset from the local star-forming sequence on the [N II] BPT diagram). Using consistent spectral-energy-distribution (SED) modeling for both surveys reveals that the MOSDEF z ~ 2 targeted sample has a higher median stellar mass, lower star-formation rate (SFR) and specific SFR, and redder U−V color compared to KBSS. However, the subsets of the surveys that have been analyzed in previous work with high S/N spectra and multiple emission lines detected are strikingly similar. Aside from stellar population age, all sample properties investigated agree within the median uncertainties. Additionally, applying uniform stellar Balmer absorption correction and emission-line fitting techniques for both samples results in the same offset on the [N II] BPT diagram. I find that the previously believed differences in key results between the two surveys can be attributed toutilizing different SED and emission-line fitting techniques. Third, I analyze the completeness of the MOSDEF z ~ 2 survey. Specifically, I use SED modeling and composite spectra created from spectral stacking to test if the subset of the MOSDEF z ~ 2 star-forming galaxies with high S/N spectra is representative of the complete sample of star-forming galaxies. I find that the host galaxy and emission-line properties (most notably offset from the local SDSS sequence on the [N II] BPT diagram) are very similar, indicating that the smaller spectroscopic samples are representative of the full catalog of star-forming galaxies. Additionally, comparing galaxy properties obtained through SED modeling reveals that the z ~ 2 sample observed by MOSDEF is representative of all z ~ 2 galaxies that met the selection criteria for the MOSDEF survey. Taken together, these results reveal that the emission-line trends established using high S/N z ~ 2 detection samples of star-forming galaxies in MOSDEF studies to date are representative of the rest-optical-magnitude-limited star-forming galaxy population at z ~ 2. Fourth, I focus on two actively merging galaxies in the MOSDEF survey at z = 1.89. We model the SEDs of the merging galaxies to find that they are both massive with low SFRs and similar stellar population ages. Additionally, the star formation in both galaxies began and peaked within a few hundred Myr of each other, suggesting that their bursts of star formation may be connected. For one of these galaxies, GOODS-S 43114, Sérsic profile fitting and a relatively low velocity dispersion estimate indicates that it is a face-on disk; therefore, it will likely undergo a large

structural change as it evolves into a massive, slowly-rotating elliptical galaxy in the present day. Finally, as an earlier part of research I used far-IR Herschel/PACS spectra to investigate the profiles of six OH doublets for a large sample of 178 local galaxies. I assembled ancillary data to probe AGN luminosity, radiation field hardness, dust temperature, and dust obscuration, and find correlations between the EW(OH) and these galaxy observables. Additionally, I comment on how the origin of emission for these OH doublets, whether from radiative pumping by infrared photons or from collisional excitation, may influence these relationships.

GRAVITATIONAL LENSES

Springer Science & Business Media *Light observed from distant objects is found to be deflected by the gravitational field of massive objects near the line of sight - an effect predicted by Einstein in his first paper setting forth the general theory of relativity, and confirmed by Eddington soon afterwards. If the source of the light is sufficiently distant and bright, and if the intervening object is massive enough and near enough to the line of sight, the gravitational field acts like a lens, focusing the light and producing one or more bright images of the source. This book, by renowned researchers in the field, begins by discussing the basic physics behind gravitational lenses: the optics of curved space-time. It then derives the appropriate equations for predicting the properties of these lenses. In addition, it presents up-to-date observational evidence for gravitational lenses and describes the particular properties of the observed cases. The authors also discuss applications of the results to problems in cosmology.*

HUBBLE SPACE TELESCOPE AND THE HIGH REDSHIFT UNIVERSE, THE - PROCEEDINGS OF THE 37TH HERSTMONCEUX CONFERENCE

World Scientific *Since the successful refurbishment mission, the Hubble Space Telescope has made dramatic and exciting progress in unravelling the nature of sources at high redshift. The upcoming installation of the next generation of instruments will give further impetus to the field, particularly in the infrared spectral region.The proceedings of this landmark meeting review the results of the first three years of post-repair data, including the deepest astronomical images ever obtained: the Hubble Deep Field. This was the first presentation of these exciting results at a major international conference. The interface between HST and ground-based facilities and planned programmes with forthcoming HST instruments are also extensively discussed.*

MINING THE SKY

PROCEEDINGS OF THE MPA/ESO/MPE WORKSHOP HELD AT GARCHING, GERMANY, JULY 31 – AUGUST 4, 2000

Springer Science & Business Media *The book reviews methods for the analysis of astronomical datasets, particularly emphasizing very large databases arising from both existing and forthcoming projects, as well as current large-scale computer simulation studies. Leading experts give overviews of cutting-edge methods applicable in the area of astronomical data mining.*

DEVELOPMENT OF THE 2ND GENERATION Z(REDSHIFT) AND EARLY UNIVERSE SPECTROMETER & THE STUDY OF FAR-IR FINE STRUCTURE EMISSION IN HIGH-Z GALAXIES

The 2nd generation z (Redshift) and Early Universe Spectrometer (ZEUS-2), is a longslit echelle-grating spectrometer (R~1000) for observations at submillimeter wavelengths from 200 to 850 [mu]m. Its design is optimized for the detection of redshifted far-infrared spectral lines from galaxies in the early universe. Combining exquisite sensitivity, broad wavelength coverage, and large (~2.5%) instantaneous bandwidth, ZEUS-2 is uniquely suited for studying galaxies between z~0.2 and 5-spanning the peaks in both the star formation rate and number of AGN in the universe. ZEUS-2 saw first light at the Caltech Submillimeter Observatory (CSO) in the Spring of 2012 and was commissioned on the Atacama Pathfinder Experiment (APEX) in November 2012. Here we detail the design and performance of ZEUS-2, first however we discuss important science results that are examples of the science enabled by ZEUS-2 Using the first generation z (Redshift) and Early Universe Spectrometer (ZEUS-1) we made the first high-z detections of the [NII] 122 [mu]m and [OIII] 88 [mu]m lines. We detect these lines from starburst galaxies between z ~2.5 and 4 demonstrating the utility of these lines for characterizing the properties of early galaxies. Specifically we are able to determine the most massive star still on the main sequence, the number of those stars and a lower limit on the mass of ionized gas in the source. Next we present ZEUS-2's first science result. Using ZEUS-2 on APEX we have detected the [CII] 158 [MICRO SIGN]m line from the z = 1.78 galaxy H-ATLAS J091043.1-000322 with a line flux of (6.44 ± 0.42) x 10-18 W m-2. Combined with its far-infrared luminosity and a new Herschel-PACS detection of the [OI] 63 [MICRO SIGN]m line we are able to conclude that H-ATLAS J091043.1-000322 is a high redshift analogue of a local ultra-luminous infrared galaxy, i.e. it is likely the site of a compact starburst due to a major merger. This detection, combined with the ZEUS-1 observations of the [NII] and [OIII] lines represent examples of work we plan to continue with ZEUS-2. As such, they demonstrate the potential of ZEUS-2 for increasing our understanding of galaxies and galaxy evolution over cosmic time.

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