

GALAXIES IN 3D ACROSS THE UNIVERSE

IAU SYMPOSIUM No. 309

COVER ILLUSTRATION:

The cover illustration was designed to bring together an aesthetic view of the main science and technology topics of the conference “Galaxies in 3D across the Universe” held in the city of Vienna. In this day and age we are able to investigate our 3D Universe and its constituents from different perspectives, through observations and simulations, to portray its content and evolution through different eyes, and to follow leads from selected information given in narrow wavelength ranges or excitation states.

We are visualizing the analysis of light - once split up in ESO’s 3D spectrograph VIMOS, here depicted as a flat field observation of the HR blue grism in black and white in the background and overlaid by HI VLA contours of NGC 6046 from the THINGS survey. Vienna’s skyline represents the space where communication, discussion and continuing education take place, which are the foundation of any IAU symposium.

There is no *one* way to answer today’s science questions, as there is no *one* way to communicate them. An artistic approach to science leads to finding the largest common denominator of art and science: creativity. In the words of Werner Heisenberg, the mathematically simplest answer is usually the most beautiful one (Carl Friedrich von Weizsäcker: *The Unity of Nature*, 1971). The beauty of creating something new - in fundamental research as well as in art - is an inherent drive to all of us. While for artists “intellectual property is the oil of the 21st century” (Michalis Pichler: *Statements on Appropriation*, 2009), it is also the intense incentive that leads us scientists to continue research - and to continue sharing steps and results along the way.

“I want people to treasure light the way we treasure gold” said visual artist James Turrell. For us astronomers, light is the passage to knowledge while getting together to communicate our findings is a way of building the future.

Cover art and text: Ulrike Kuchner

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Edited by Bodo L. Ziegler , Françoise Combes , Helmut Dannerbauer , Miguel Verdugo

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Preface

The IAU symposium 309 took place in Vienna from 7th to 11th July 2014. According to the title “Galaxies in 3D across the Universe” the common theme of the 109 oral presentations and 103 posters was the aspect of spatially and energetically resolved galaxy properties. This topic was very timely for a world-wide international audience of 218 participants from 28 countries because astrophysics has just entered a new epoch with unbiased investigations of intrinsic properties of galaxies and their evolution. High performance technology in 3D-spectroscopy in the optical/NIR regime and in radio interferometry allows for the first time the efficient mapping of stars, gas, and dust, in galaxies near and far. Detailed measurements of individual objects are complemented by surveys aiming at a full census of galaxies across the local Universe. Reaching out to the limits of the Universe, the evolution of spatially resolved properties is traced along the whole cosmic history. Likewise to these observational campaigns, new computer technology and highly advanced algorithms are exploited for detailed simulations to probe the underlying physical and cosmological connection.

That “3D” is not only a hot topic for cinema enthusiasts but also for scientists is already evident from the fact that the year 2014 has seen three major conferences emphasizing this aspect, with the other two held in Garching bei München and Oxford. To distinct the IAUS309 in Vienna SOC had decided to lay the focus on star formation spanning the whole range from its gaseous source and fuel, via its manifestations, to its global dependence and influence on galactic scales as well as its overall cosmic evolution. Following this observers from both the optical and radio communities as well as theoreticians and simulators lively discussed the interplay between the gas and dust content and star formation in galaxies taking into account spatially resolved properties of gas, dust and stellar populations of galaxies, including their kinematics, distribution and evolution. Another topic covered was analysis and visualization of data cubes as well as new development in instrumentation like KMOS and MUZE as second-generation instruments on ESO’s VLT and the submm-/radio-array ALMA.

To meet the overwhelming interest of about 300 astronomers a diversity of contributions was set up from review, invited, contributed, and high-light talks to posters displayed next to the 350-persons lecture hall in the Juridicum building of the University of Vienna in the centre of the city. The program and additional information can still be found on the conference webpage galaxy3d.univie.ac.at. To increase the awareness of posters participants could vote for their favourite poster resulting in three additional talks by the winners of this poster competition.

This symposium was also timely for the hosting Department of Astrophysics since among its recent buzzing activities research fields have come into existence based on 3D-spectroscopy as well as radio interferometry. Such new projects encompass local galaxies (mainly within the CALIFA survey), clusters of galaxies at half the age of the Universe, and very distant galaxies first detected by their submm emission. It was also a milestone on the way to the IAU General Assembly 2018 in Vienna.

The whole week of intense scientific presentations and discussions surrounded by social events focusing on special features of Vienna was engraved by a strong spirit of collegiality and enthusiasm, which the editors wish to be revived whenever this proceedings book is taken off the shelf.

We acknowledge the support of International Astronomical Union, University of Vienna (in particular from Event Management Gerald Schneider, Florian Krug, Margarethe Jurentisch, Benedikt Burkhardt, Mina Jaramaz), Juridicum, Vienna Convention Bureau, Department of Astrophysics, Faculty of Earth Sciences, Geography and Astronomy, Raiffeisenlandesbank Niederösterreich–Wien, Restaurant Kahlenberg, and Caterer Reithofer.

Special thanks go to our SOC and LOC members, without whom this symposium could not have happened!

B.L. Ziegler, F. Combes, H. Dannerbauer, M. Verdugo (eds)
Vienna, October 10th, 2014

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Ulrike Kuchner

Oliver Czoske

Christian Maier

Joao Alves

CONFERENCE PHOTOGRAPH



LOCAL ORGANIZING COMMITTEE



Oliver Czoske, Miguel Verdugo, Helmut Dannerbauer, Christian Maier, Ulrike Kuchner and Bodo Ziegler.

CONFERENCE, POSTER SESSIONS AND BREAKS



lecture hall.

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Edited by Bodo L. Ziegler, Françoise Combes, Helmut Dannerbauer, Miguel Verdugo

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Conference photograph

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CONFERENCE, POSTER SESSIONS AND BREAKS



Left: Adam Schaefer, Nicholas Scott and Scott Croom. *Right:* Ana Monreal Ibero and Angel Lopez-Sanchez.



Miguel Verdugo and Veronica Menacho explain Dave Murphy and Jeff Kenney their poster.

CONFERENCE, POSTER SESSIONS AND BREAKS

Left: Polychronis Papaderos and Thierry Contini. *Right:* Tom Richtler and Bärbel Koribalski.



Left: Poster session. *Right:* Christian Maier and Nadja Lampichler counting the votes for the poster competition.

WELCOME RECEPTION



Thaisa Storchi-Bergmann and Rosa Gonzalez Delgado toasting.



Left: Rhea-Silvia Remus, Marja Seidel and Barry Madore. *Right:* Bodo Ziegler and Raffaella Anna Marino.

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Conference photograph

RECEPTION



Left: Tucker Jones, Robert Singh and Carlos Eduardo Barbosa *Right:* Laurie Rousseau-Nepton, Alfredo Zenteno, Rebecca Davies and Caroline Foster.



Tobias Goerdt, Michael Hilker, Sylvia Ploekinger and Helmut Dannerbauer.

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RECEPTION



Left: Roberto Cid-Fernandes, Carlos Lopez Sanjuan and Michael Opitsch *Right:* Alfredo Zenteno, Rene Fassbender and Miguel Verdugo.



Marja Seidel, Ulrike Kuchner, Katherine Alatalo and Rhea-Silvia Remus.

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Conference photograph

EXCURSION TO THE UNIVERSITY OBSERVATORY



Cristina Catalán-Torrecilla , Raffaella Anna Marino and Alexander Fritz.

CONFERENCE DINNER



Etsuko Mieda, Minju Lee, Tomoko Suzuki, and Toshiki Saito.

Conference photograph

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CONFERENCE DINNER



Left: Wendy Williams, Moses Mogotsi, David Carton, Lucas Ellmeier, Miguel Verdugo and Carmen Toribio *Right:* Ulrike Kuchner and Bodo Ziegler.



Mischa Schirmer, Noelia Jimenez, Kevin Xu and Philip Hopkins.