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COVER ILLUSTRATION:

“View of Toledo”. A painting by *El Greco* (Domenikos Theotokopoulos), ca. 1598–1599. Metropolitan Museum of Art of New York (www.metmuseum.org). Probably the first cityscape ever painted and one of the most dramatic views of a stormy sky. Fortunately, the weather in Toledo during IAU symposium 321 was far more hospitable. Similar to the light breaking through the clouds in the painting, we hope the meeting has helped to shed light on the relatively unexplored realm of the outskirts of galaxies.

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FORMATION AND EVOLUTION OF GALAXY OUTSKIRTS

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OF THE INTERNATIONAL ASTRONOMICAL
UNION HELD IN TOLEDO, SPAIN
MARCH 14–18, 2016

Edited by

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Preface

Symposium 321 of the International Astronomical Union (IAU) entitled “Formation and Evolution of Galaxy Outskirts” was held March 14th to 18th, 2016 in Toledo, Spain. The symposium included a total of 210 researchers from 32 countries from all over the world, and featured 102 oral presentations and 97 posters. Besides the strong interest of the community in this topic as revealed by this broad participation, we are also proud that equitable participation of male and female researchers was achieved throughout the symposium: in attendance, presentations, IAU grant awards, and LOC & SOC membership.

The goal of the symposium was to build a holistic picture of galaxy outskirts, and advance our understanding of how these rarefied regions have formed and how their properties have evolved with time. This required bringing together researchers from a broad range of fields which usually have small cross-sections with each other. The evolution of galaxies within their so-called optical radius appears to have been dominated, at least in the last few gigayears, by well-studied internal secular processes and star formation. In their outer parts, however, other processes such as accretion of stars from satellite galaxies, accretion of halo gas, and stellar migration compete and may drive their photometric, chemical, and dynamical evolution. Thus, understanding the formation and evolution of galaxy outskirts also requires answering questions as varied as: what parameters control the accretion of gas from the intergalactic medium onto galaxies?, how does feedback evolve with redshift and how might it relate to the abundances measured in damped Lyman- α systems?, how might the nature of star formation (triggering mechanisms, initial mass function) be different at low densities or low metallicities?, what is the impact of stellar migration and satellite accretion on the evolution of galaxies? what observational strategies should be used to map the elusive low surface brightness Universe?

As a result, the symposium hosted a good number of reviews and invited talks (16 in total) from experts in topics ranging from the study of the stellar and gas properties in the outer parts of the Milky Way and Local Group galaxies to the growth of galaxies at very high redshift. The journey of the study of galaxy outskirts is one that has been advanced through recent instrumental developments (ALMA, WFC3@HST, HSC@Subaru, KMOS & MUSE@VLT, to name a few), ambitious surveys (RAVE, SLUGGS, EDGES, MAD, GASP, KMOS3D, etc.), and recent advances in numerical modelling of the evolution of individual galaxies and of the Universe as a whole (e.g., EAGLE, CARMA).

The scientific program of the symposium reflected the nature of this journey, with the first day devoted to resolved stellar populations, mainly in the Milky Way and the Local Group, the second to the modelling of galaxy outskirts, the third and part of the fourth to detailed studies of the properties of nearby galaxies, and the rest of the fourth and the last day fully devoted to high-redshift galaxies and damped Lyman- α systems. We also organized round tables at the end of each day where participants could synthesize results and discuss future challenges to be tackled in on each of these areas. A closing round table looked to possible advances with forthcoming observation capabilities such as MEGARA@GTC, LSST and JWST.

This symposium also served as the closing meeting for the DAGAL (Detailed Anatomy of Galaxies) project, an Initial Training Network funded by the European Union’s 7th Framework Program. During the symposium, junior members of DAGAL had the opportunity to present their results on nearby galaxies, ranging from studies of the structural properties of bars and disks, via star formation and stellar populations, to numerical

modelling of bars in spiral galaxies, and of the origin of elliptical galaxies. These presentations highlighted new results as well as the complementarity of the efforts of the different groups within the network, which spanned the study of morphological components, stellar population modelling, and dynamical modelling.

We hope that all IAUS321 participants learned as much as we did from this symposium. It is fitting for a symposium on a subject which is at the intersection of many fields of astrophysics to be hosted in Toledo – a city where The Three Cultures lived together for centuries and preserved writings and knowledge throughout the Middle Ages until the Renaissance.

Armando Gil de Paz, Johan H. Knapen, Janice C. Lee (Editors)

Madrid, October 10th, 2016

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Tourist Office, for their support for the symposium and Prof. Eduardo Battaner for giving the public lecture at the Alcázar. We are also grateful to the volunteers of the “*Asociación de Astrónomos Aficionados*” at UCM (ASA AF-UCM) for their help in the organization of the Star Party. Finally, we would like to thank the people of Toledo for their hospitality and for making of the IAU321 a very special meeting.

Photographs are courtesy of Alejandro Sánchez, Janice Lee, Patricia Sánchez-Blázquez, Ainhoa Sánchez Penim, Jesús Gallego, and Jaime Zamorano Calvo.

CONFERENCE PHOTOGRAPH



Photograph courtesy of Alejandro Sánchez

OPENING CEREMONY



Left: Opening ceremony with local, regional and national authorities. From left to right: Mr. José M^a González Cabezas, Dr. José I. Doncel Morales, Prof. Carlos Andradas-Heranz, Dr. Mar Álvarez Álvarez, Dr. Armando Gil de Paz. *Right:* The Rector of the Universidad Complutense de Madrid, Prof. Carlos Andradas-Heranz, giving his welcome speech at the ceremony, accompanied by the vice-major of Toledo, Mr. José M^a González Cabezas (left) and the vice-director for scientific infrastructures of the Spanish ministry for economy and competitiveness, MINECO, Dr. José Ignacio Doncel Morales (center).

LOCAL ORGANIZING COMMITTEE



Left: LOC members getting ready for the arrival of the first participants (from left to right: Nicolás Cardiel, Pablo Pérez-González, Raúl Cacho, Maider Miranda, Antonio Verdet, Ainhoa Sánchez, Pablo Picazo, Cristina Catalán Torrecilla, África Castillo Morales). *Right:* África, Ainhoa and Armando Gil de Paz taking care of the registration process.

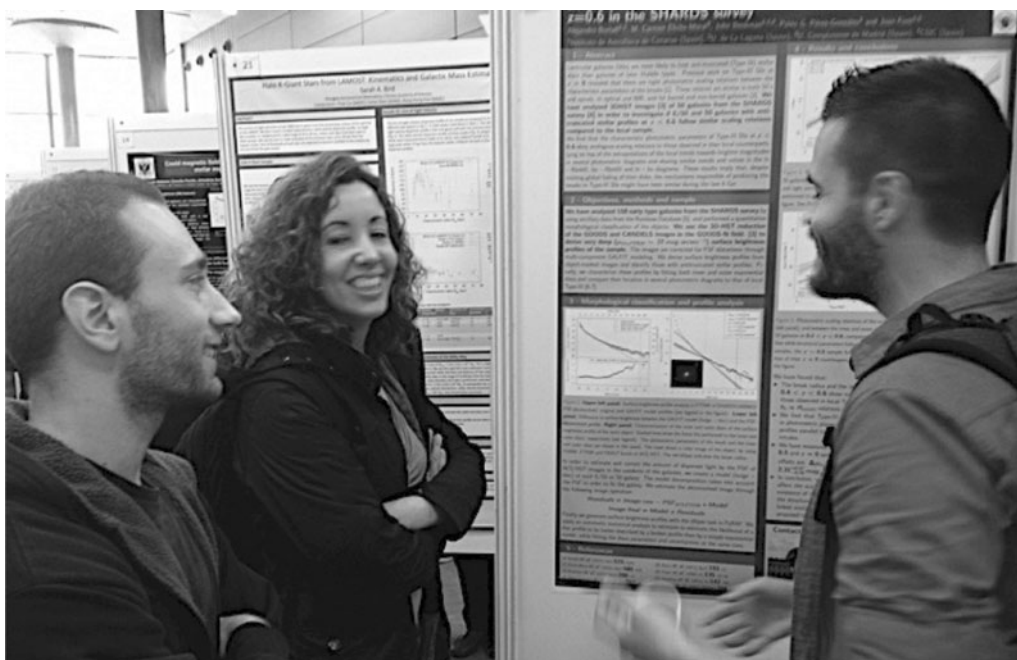


LOC members at the conference dinner (from left to right: Miguel Querejeta, Armando, Patricia Sánchez-Blázquez, Pablo, Ainhoa, Maider, Cristina, Antonio, África, Nicolás).

CONFERENCE, POSTER SESSIONS AND BREAKS



Left: Lecture hall at the Toledo Congress Center “El Greco”. *Right:* Press conference with local and national media with the participation of (from left to right) Jesús Gallego and SOC co-chairs Cláudia Mendes de Oliveira, Janice Lee and Armando Gil de Paz.



Luis Cicuendez (left), Mireia Montes (center) and Alejandro Borlaff (right) discussing their results in the poster viewing area.



Poster viewing area at the “Zocodover space” during one of the conference coffee breaks.

CONFERENCE DINNER



Left: SOC co-chairs Janice Lee (right) and Armando Gil de Paz (left) ready for the conference dinner. *Right:* “Cortador de Jamón” (ham cutter).



Dinner between DAGALers Johan Knapen (above at right; also SOC member), Marc Verheijen (next to Johan), Reynier Peletier (above at left), Heikki Salo (below at right), John Beckman (next to Heikki), Benne Holwerda (below in the center) and good friends (from left to right, top) Joop Schaye, Marcella Carollo, Bianca Poggianti, and (bottom) Sudhanshu Barway, Noah Brosch, Koshy George and Panos Patsis.



Participants enjoying the conference dinner at the “Cigarral del Ángel Custodio”.



Participants enjoying the conference dinner at the “Cigarral del Ángel Custodio”.

STAR PARTY



Left: ASAAF-UCM volunteers and future astronomers preparing the telescopes for the Star Party at the “Cuesta de los Capuchinos”. *Right:* Photograph of the “Alcázar de Toledo” taken while the public waits for the city illumination to dim.

GOOD BYE, TOLEDO!



View of the outskirts (*extramuros*) of Toledo from the main entrance of the conference venue.

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