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Rediscovering Our Galaxy

Edited by

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REDISCOVERING OUR GALAXY

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“Rediscovering our Galaxy” This is an image combining the southern plane of the Milky Way from the ATLASGAL survey (Credits: ESO/APEX/ATLASGAL consortium/NASA/GLIMPSE consortium/ESA/Planck) and a picture of the 19th century refractor telescope at the historic hill of Telegrafenberg in Potsdam that once housed the main Prussian observatories, and which now is part of the Albert Einstein Park. Also shown is the logo (Credit: Callegaro Architekten Berlin) of the conference which refers to the famed and architecturally revered “Einstein Tower” designed by E. Mendelsohn, which is also found in the same site. The illustration was extracted from the original creation by the designer José Lima (from KIKKEI LABS in Berlin) for the symposium Poster.

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REDISCOVERING OUR GALAXY

PROCEEDINGS OF THE 334th SYMPOSIUM
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UNION HELD IN POTSDAM, GERMANY
JULY 10–14, 2017

Edited by

CRISTINA CHIAPPINI (SOC chair)

IVAN MINCHEV AND ELSE STARKENBURG (SOC co-chairs)

and

MARICA VALENTINI (LOC chair)



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Preface

The IAU Symposium 334: Rediscovering our Galaxy was held in the historical site of Telegrafenberg, at the Albert Einstein Science Park, in Potsdam, Germany. This historic hill, once home of the main Prussian observatories, today hosts the 19th century Great Refractor (renovated just in time for the Symposium) and the Einstein Tower designed by E. Mendelsohn. The IAUS 334 marked the return of the IAU Symposia to Germany after 17 years, with the last one also held in Potsdam in 2000.

Around 200 astronomers from 25 countries enjoyed a full week of new scientific results and debated the large challenges ahead in the field of Galactic Archaeology, in the journey towards unveiling how the Milky Way was assembled, how it evolved, and its connection to the Lambda Cold Dark Matter paradigm. The Symposium marked a crucial point in the study of our Galaxy (including all its components, halo, bulge/bar and disk), where experts made up the balance of what has been achieved in the last decade since we left the Hipparcos volume, before we plunge in yet a new era combining much larger spectroscopic surveys such as WEAVE and 4MOST (and the just approved SDSS-V Surveys) with the exquisite data from Gaia-end of mission, LSST and hopefully many more giant stars with asteroseismic information to be delivered by Plato. How to effectively make use of the flood of data over the coming decade will be the largest challenge in the field of Galactic Archaeology. The symposium assembled an impressive large number of experts in the field of Galactic Archaeology, including experts from stellar modelling, stellar atmospheres, spectroscopy, photometry, astrometry, asteroseismology, galaxy simulations in the cosmological context, chemical evolution, and chemodynamics. This Symposium was largely inspired by the IAU Symposium 254 that has happened in 2008 entitled “The Galaxy Disk in the Cosmological Context” which also brought together astronomers coming from a wide spectrum of expertise. It has thus been a honor to have the IAUS254 organisers Birgitta Nordström and Johannes Andersen at our Symposium.

Since then, we have stepped out of the volume surveyed by the Hipparcos mission, reaching more extended regions around the Sun with spectroscopic surveys such as RAVE, SEGUE, APOGEE, LAMOST, GALAH and Gaia-ESO (although still confined mostly around 3-4 kpc from the Sun). The latest results from each of these surveys were reviewed and debated. In particular, the key role of APOGEE and the infrared photometric surveys OGLE and ESO-VVV/VVVx in complementing our view of the Milky Way close to the mid-plane towards the Bulge was highlighted. The new data has already driven many chemodynamical models of the inner Galaxy, which are now taking advantage of the new observational constraints.

There has certainly been a transition in the field towards much larger and statistically more relevant samples (e.g large samples of very-metal poor stars, as well as other rare objects, e.g., debris of dispersed Globular Clusters, and accreted stars from smaller galaxies). In particular, data-driven approaches are bound to change the way we work with the data and will impact our strategies for future surveys. The importance of training samples and how to increase those, was also highlighted. This exceptional development on the data side has been accompanied by an enormous improvement (and development) of fully cosmological modelling of Milky Way like systems. Also discussed was how the Milky Way can be used to constraint Lambda Cold Dark Matter. Much debated was how to combine complex datasets with complex simulations, and extract information on physical processes.

Ages of stars were often debated in the meeting, as it is now clear that only with accurate ages will it be possible to disentangle the several processes leading to the Galaxy

assembly and evolution. Also here the improvement has been major. One highlight is the impact that asteroseismology of red giants can have in this respect. New observational constraints were brought by the combination of asteroseismology (from CoRoT, Kepler and K2) and spectroscopic surveys. Equally important was the discussion of the first results of spectroscopic samples, which overlap with the TGAS catalogue. These results already gave a clear idea of the impact that further Gaia releases will have in this field. As age determinations are mostly model-dependent, the improvement in this area is strongly linked with improvements in stellar models. Currently the age precision is around 20-30% but the goal is to obtain ages precise to the 10-15%. This will require more calibrators (e.g. detached binaries), as well as tests of stellar models. In the long term, seismology will be key in helping improving stellar models, and providing ages for distant stars.

A rich scientific program focused on eight main sections, each of them involving data and modelling, as well as two one-hour discussion panels (special thanks goes to our panelists and the two discussion leaders Anthony Brown and Simon White). The 66 talks and more than 100 posters, as well as the lively discussions taking place during the (also rich) coffee breaks and wine & cheese poster session kept the participants very busy. A virtual reality program, taking place during the poster session, was also greatly welcomed by the participants. More than 160 astronomers have enjoyed the conference dinner on a boat tour around the Havel, with a beautiful sunset. Thanks to an amazing SOC, the Symposium not only achieved a very good scientific balance among the sections, while still keeping it focus, but has also achieved a very good gender, geographical and seniority balance. The IAU travel grant support was distributed among more than 40 researchers (mostly PhD students, young postdocs and early career researchers), working in 14 different countries (Argentina, Brazil, Chile, China, France, Germany, India, Japan, Lithuania, Russia, Spain, Sweden, UK, USA). Among the invited speakers and the SOC we had over 40% female participation, whereas for contributed talks we respected the pool of registrations. We were also able to provide affordable childcare during the whole week of the Symposium.

Finally, as an outreach program, we received the visit of the public elementary School “Neues Tor”, a bilingual Portuguese-German school, which is part of the Berlin European schools. The Portuguese language was here used to bring awareness on the fact that, although very international, science still struggles to include participants from the whole globe. The kids in this school, with their ties to Europe, Latin-America and Africa, just illustrate the diversity that we should aim also to preserve in science. We received around 40 kids ranging from 7 to 8 years old for a full program. They visited the campus, the Einstein Tower, the Great Refractor and heard a presentation in Portuguese about the Milky Way. As part of the program they also enjoyed the virtual reality program prepared specifically for them, where they could travel inside cosmological galaxy formation simulations. Finally, each kid also received a badge, and took part of the picture with the 200 astronomers inside the beautiful cupola of the Great Refractor telescope. May these children represent the future generations that will step into this golden era of Galactic Archaeology in which we are about to rediscover our Galaxy and a new, diverse, and fully inclusive way of doing science.

Cristina Chiappini (SOC chair)

Ivan Minchev and Else Starkenburg (SOC co-chairs)

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Potsdam, Germany, November 30, 2017

THE ORGANIZING COMMITTEE

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WITH KIDS AT GREAT REFRACTOR





Cristina Chiappini and Matthias Steinmetz welcome participants of the IAUS 334 in front of the Einstein Tower

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