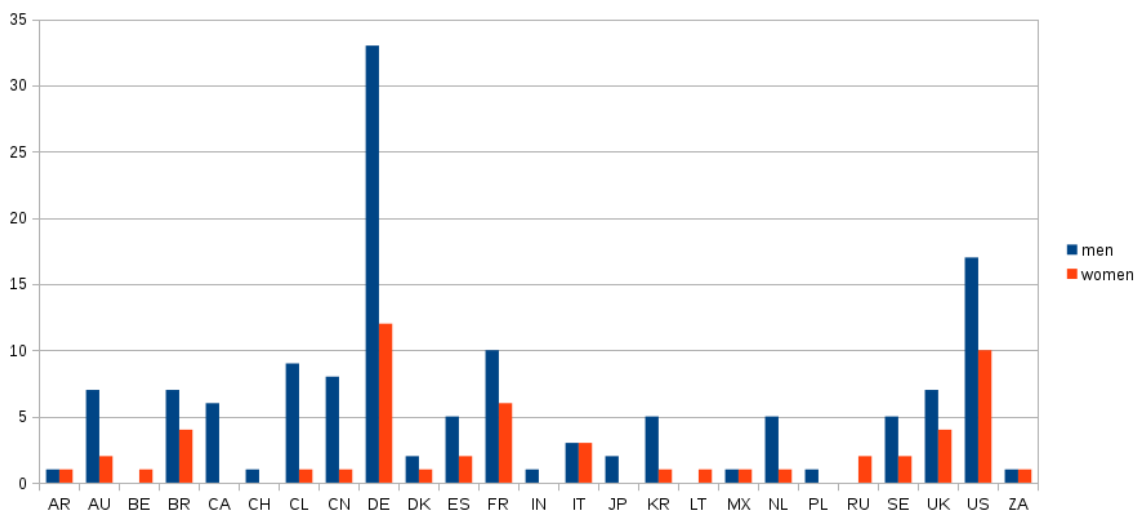




# Post Meeting Report

1. **Meeting Number:** IAU Symposium 334
2. **Meeting Title:** Rediscovering our Galaxy
3. **Coordinating Division:** Division H (+ support from Division G)
4. **Dedication of the Meeting:** No official dedication, but it was dedicated to Bernard Pagel
5. **Location:** Potsdam, Germany
6. **Dates of the Meeting:** 10<sup>th</sup> – 14<sup>th</sup> of July 2017
7. **Number of participants:** 196
8. **List of represented countries:** Argentina, Australia, Belgium, Brazil, Canada, Chile, China, Switzerland, Germany, Denmark, Spain, France, India, Italy, Japan, South-Korea, Lithuania, Mexico, Holand, Poland, Russland, Sweden, United Kingdom, United States, South Africa.



9. **Report submitted by:** Dr. Cristina Chiappini

10. **Signature of Chairperson:**

## IAUS 334: Rediscovering our Galaxy – Scientific Highlights

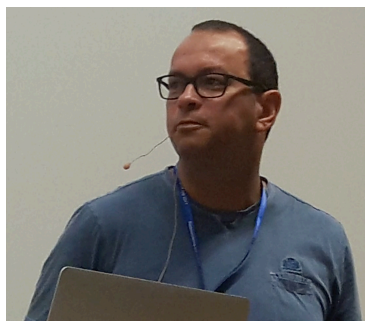
The symposium assembled an impressive large number of experts in the field of Galactic Archaeology (including experts from stellar modeling, stellar atmospheres, spectroscopy, photometry, astrometry, asteroseismology, galaxy simulations in the cosmological context, chemical evolution, and chemodynamics). Since the last largest IAU Symposium on the Milky Way (the IAUS254), we have stepped out of the volume surveyed by the Hipparcos mission, reaching far-out regions of the Milky Way 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. The key role of the near-infrared APOGEE and the photometric OGLE and ESO-VVV/VVVx surveys, able to penetrate the dust that obscures significant fractions of the disk and bulge of our Galaxy, were certainly a highly, now seriously complementing our view of the Milky Way, close to the mid-plane and towards the Bulge. 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 the most-metal poor stars, as well as other rarer objects, such as 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 modeling of Milky Way like system. Also discussed was how the MW can be used to constraint  $\Lambda$ -CDM. 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 (in particular RAVE, which had the larger number of targets for which TGAS proper motions were available). 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 long term, seismology will be key in helping improving stellar models, and providing ages for distant stars.

The Symposium marked a crucial point in the study of our Galaxy, where experts made 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 with the exquisite data from Gaia-end of mission, LSST and hopefully many more giant stars with asteroseismic information 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.

## IAUS 334 Discussion Panels



**Discussion Panel 1 – Chair: Anthony Brown – Panel Members: Whitelock, Nordstrom, Miglio, Beers, Smith, Barbuy, Bland-Hawthorn**

**Discussion Panel 2 – Chair: Simon White – Panel Members: Matteucci, Pfrommer, Wyse, Combes, Navarro, Freeman**

## IAUS 334: Rediscovering our Galaxy – Executive Summary

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 is a historic hill in Potsdam that once housed the main Prussian observatories. On it stands the 19th century *Gross Refraktor* (renewed just on time for the Symposium) as well as the famed and architecturally revered "Einstein Tower" designed by E. Mendelsohn. 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 was the Milky Way assembled, how it evolves, and its connection to the Lambda Cold Dark Matter paradigm.

A rich scientific program focused on eight main sections, each of them involving data and modeling, as well two one-hour discussion panels. The 66 talks and more than 100 posters, as well as the lively discussions taking place during the (also rich) coffee breaks kept the participants very busy. Section I focused on the tracers of the oldest MW stars as well their implications for the MW halo assembly. Section II focused on the mixed stellar populations towards the inner Galaxy (the inner thin/thick disks, inner halo, bulge and bar), and their implication for scenarios of the MW formation. Section III was more focused on the Galactic disk and the many new results brought by large spectroscopic surveys, summarized in dedicated reviews of the recent results of RAVE, Gaia-ESO, APOGEE, LAMOST reviews. Open clusters were also covered, with many objects coming OCCASO, Gaia-ESO and APOGEE surveys. In each of these three sections both the new observational constraints as well as the implications on the models of the MW formation were highlighted. A poster *wine and cheese* section, on the end of the second day, was very successful, as the posters were of excellent quality. Section IV was dedicated to the challenge of obtaining precise ages and chemistry for smaller samples. The new results obtaining with asteroseismology and TGAS were presented. This naturally led to Section V, focused on stellar models, and the challenges ahead. Expectations are that also in this field both, seismology and Gaia, will lead to much more precise stellar models, required to reach the age precision necessary to bring the MW assembly and evolution into focus.

Section VI was dedicated to the MW Potential and Dynamics. Many are still the challenges here, especially on how do we improve estimates of the MW halo mass, how to learn on the history of the bar activity in the MW, what should be considered a “good enough” equilibrium model, and what is allowable evolution, and how can MW studies help constraining the nature of Dark Matter. This debate led to Section VII dedicated to cosmological simulations of MW-like galaxies. The state-of-the-art simulation were presented, and the challenges still linked with sub-grid physics and star formation were debated. In addition, another difficulty became clear, namely, how to compare the predictions of MW-like simulations with the rich MW data, also involving detailed chemical modeling. Section VIII was then dedicated to a debate of all the open questions, and it was organized in two one-hour discussion panels (composed mainly of SOC participants, together with some invited). Finally, Section IX closed the conference with reviews on future missions, such as 4MOST, WEAVE and LSST (the Plato mission was covered in Section IV).

The Symposium achieved a very good gender, geographical and seniority balance. The IAU travel grant support was distributed among 41 researchers (among which 20 PhD students, 10 young postdocs, 1 master student, and several early carrier 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 child care 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, we often lack participants from important parts of the world. Therefore, we had brings kids with ties with Europe (Germany/Portugal), but also Latin-America (Brazil), and Africa (Angola/Mozambique). We received around 40 kids from the 2<sup>nd</sup> and 3<sup>rd</sup> class. They visited the campus, the Einstein Turn, the Gross Refraktor and heard a presentation in Portuguese about the Milky Way. As part of the program they also enjoyed the virtual reality program prepared for the Symposium (see [vr.aip.de](http://vr.aip.de)), where they could travel along cosmological galaxy formation simulation. Finally, each kid also received a badge , and took part of the picture with the 200 astronomers (see attached program). On the next day, more than 160 astronomers did take place in the conference dinner, which happened on a boat tour around the Havel, with a beautiful sunset.



**Meeting of astronomers with kids for especial 3D picture in the historical Gross Refraktor at Telegrafenberg**