

Focus Meeting 9, IAU General Assembly 2022

Tuesday 2 August

Morning e-poster session	0945–1030
FM9-1	1030–1200 (<i>Chair: Anish Amarsi</i>)
Nathan Sandford	Self-consistent stellar chemical abundance measurements: From near to far, high to low (resolution)
Yuan-Sen Ting	How many elements matter
Sven Buder	Galactic Archaeology with spectra from the GALAH survey
Maria Luiza Linhares Dantas	Old super-metal rich stars in the solar vicinity: from where did they come?
Lunch	1200–1330
FM9-2	1330–1500 (<i>Chair: Maria Luiza Linhares Dantas</i>)
Deokkeun An	Empirical calibration of synthetic stellar spectra based on large photometric surveys
Rachael Beaton	Stellar spectroscopy for cosmology: Prospects & challenges with late-type stars as standard candles
Dongwook Lim	IGRINS high-resolution near-infrared spectroscopy of globular cluster candidates toward the Galactic bulge
Vinicius Branco	A grid of synthetic spectra for the study of multiple populations in globular clusters
Break	1500–1515
FM9-3	1515–1645 (<i>Chair: Maria Luiza Linhares Dantas & Anish Amarsi</i>)
Mashhoor Al-Wardat	Al-Wardat's Method for analyzing binary and multiple stellar systems
Awni Kasawneh	Stellar parameters of the close binary system: HIP 27758
Thayse Pacheco	A grid of subdwarf's synthetic spectra to study hot stellar components in old stellar populations
Matheus Bernini Peron	X-rays in stellar atmospheres: The case of cool B supergiants
Break	1645–1700
Opening ceremony	1700–2000

Wednesday 3 August

Morning e-poster session	0945–1030
FM9-4	1030–1200 (<i>Chair: Deokkeun An</i>)
Roel Lefever	The challenges of modelling Wolf-Rayet atmospheres: Prescribed and dynamically-consistent winds
Luisa Fernanda Rodríguez Díaz	Current status and future prospects of the STAGGER grid
Jonas Klevas	3D hydrodynamical model atmospheres of M-dwarfs
Yixiao Zhou	3D model atmospheres and line formation calculations with non-standard chemical compositions
Lunch	1200–1330
FM9-5	1330–1500 (<i>Chair: Tiago Pereira</i>)
Cis Lagae	Modelling the Milky Way's most metal-poor star
Gloria Canocchi	Improving planetary atmosphere characterization by 3D NLTE modeling of the stellar centre-to-limb effect
Ella Xi Wang	Grids of 3D NLTE spectra in practice
Jack Mallinson (Remote)	Non-LTE impact of Ti I and Ti II on metal poor type star abundances
Break	1500–1515
FM9-6	1515–1645 (<i>Chair: Rachael Beaton</i>)
Hans-Günter Ludwig (Remote)	A library of high-resolution spectra of 3D model atmospheres
Anish Amarsi	Accurate iron abundances of dwarf stars
Tiago Pereira	Speeding up 3D non-LTE spectral synthesis with neural networks
Piercarlo Bonifacio (Remote)	Fiorella Castelli and her legacy
Afternoon e-poster session	1645–1730
Invited discourse 1	1730–1830

6 female contributed talks; 18 male contributed talks



Summary of scientific highlights

We found that our decision to not have any invited talks, but rather only contributed talks (all submissions of which were accepted), was well received. This helped to shed light on the exciting science driven by the early career researchers already at the forefront of their respective fields.

Yuan-Sen Ting gave a provocative talk, asking the question: Can we infer the chemical history of a galaxy, or part of a galaxy, if we are only given information on just two elemental abundances — for example that of iron and an element formed by α capture? While many of the most important features of galaxy evolution can be captured by just two elements, further cross-element correlations carry important information and structure that cannot be seen with the two-element approach. This motivates the measurement of as many elemental abundances as possible.

Sven Buder explained how the GALAH survey arrived at its third public data release. An inspiring account of how, with a combination of trial-and-error, theoretical insight, and a deep understanding of the data, this data release has far surpassed in reliability, precision and accuracy the previous data releases. The perspective is that this trend shall continue with future data releases.

A very interesting talk by Luisa Fernanda Rodríguez Díaz dealt with the status and future of the grid of three dimensional hydrodynamical model atmospheres (3D models, for short) computed with the STAGGER code. Jonas Klevas reported on the advances made on the computation of 3D models for M dwarfs using the CO⁵BOLD code. Both efforts will be important in the interpretation of the data from on-going and future photometric and spectroscopic surveys.

Several interesting talks were delivered on the topic of spectrum synthesis from 3D models. Anish Amarsi reviewed the advances made in 3D non-LTE spectrum synthesis. These physically motivated computations allow to go beyond the limitations of 1D models and LTE line transfer, and can improve the accuracy of effective temperature, surface gravity, and abundance inferences from stellar spectra. Hans Günther Ludwig presented a library of synthetic spectra computed under the assumption of LTE using the CO⁵BOLD grid of 3D models. These spectra can be used to measure radial velocities more accurately for example, because they take into account convective blueshifts, which cannot be predicted by 1D models. Thomas Nordlander presented a large grid of line formation computations for molecular lines in extremely metal-poor 3D models. Iron-poor stars, down to 10^{-6} the iron concentration of the Sun, are the most primitive stars in our galaxy and most of them are extremely rich in carbon, hence the interest of such a study.

Roel Lefever provided a very clear account of the difficulties in modelling the spectra of Wolf-Rayet stars. These hot evolved stars display spectra dominated by strong wind. Modelling their spectra requires NLTE line transfer, in an optically thick wind. The velocity field has a major impact on the resulting spectrum.

At the end of the meeting Piercarlo Bonifacio traced a picture of the career and often pioneering research of late Fiorella Castelli, to whom the meeting was dedicated. He highlighted also the legacy value of data and codes that Fiorella left to the community, always a proponent of open science *ante litteram*.



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Executive summary

The Focus Meeting # 9, “Stellar Synthetic Spectra to Study Stellar Populations in the Era of Gaia” took place on August 2 and 3 2022 at Busan, Republic of Korea, during the XXXI General Assembly of the International Astronomical Union. The goal was to assemble the community that has made significant advances in the last ten years in the field of model atmospheres, in the modelling of stellar spectra and the use of synthetic spectra to interpret the observations of stars in the Galaxy and in the Local Group galaxies. In order to ensure a strong participation of young scientists the Scientific Organizing Committee adopted a radical approach: there were no invited talks but only contributed talks. This proved to be successful as out of the 25 talks delivered 15 were by PhD candidates. It is difficult to find a meeting or conference, using the traditional approach of invited talks, where 60% of the talks are delivered by PhD candidates. Furthermore many of the other talks were delivered by early stage researchers, confirming that the invited speaker approach tends to privilege more senior researchers. Feedback from participants on this approach was positive.

The 25 talks, either in-room or remote, were complemented by 3 pre-recorded e-talks, that were available on the IAU GA platform, and by 7 e-posters that were also available on the platform. The posters could be discussed during three 45 minutes sessions on the morning of August 2nd and 3rd and on the afternoon of August 3rd.

The quality of the contributions was very high, showing that the field is vibrant and that the younger scientists provide a major push towards progress. The majority of the participants were in presence, but the remote participants were also able to profit of the meeting thanks to the streaming capabilities provided by the IAU GA LOC. The chair-persons were very efficient in managing questions from participants in-person and from remote participants, mainly provided through a chat channel. The Slack channel proved to be very useful, also for discussions after the talks. This and similar tools are very valuable even for fully in-person meetings. Often when one wants to put an extra question to a speaker, but lacks the opportunity, the communication channel makes sure this is always possible. Besides question and answer are available to all the participants, while “traditional” in-person conversations are lost for most. Unfortunately the contents of the Slack channel are no longer available after the end of the IAU GA and it would be useful to consider the possibility of preserving and publishing these contributions that are part of the meeting.

The meeting was closed by Piercarlo Bonifacio, former student of the late Fiorella Castelli, to whom the meeting was dedicated. Few of the participants were old enough to have known personally Fiorella, however many were familiar with the codes and data that she left as legacy. Fiorella would have certainly enjoyed this Focus Meeting and it has been a good opportunity to remember her contribution to the field.



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Figure 1: Fiorella Castelli (©Lorenzo Castelli)

