



### IAU Division G: Annual Report 2022

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- DS Division Secretary 2021-24
- G1-5 Commission President 2021-24
- DA Division Advisor 2021-24

This is the second annual report of the Division G Organizing Committee for the 2021-24 triennium. It reports on the time period from Jan 1, 2022 through Dec 31, 2022. Please note that the first annual report covered the time period between Sep 2021 and Aug 2022, so there is some overlap in the reported activities.

#### Membership

As of end 2022, there are 3788 full and 359 junior members of Division G; 312 members of Commission G1 (Binary and Multiple Star Systems); 236 members of Commission G2 (Massive Stars); 342 members of Commission G3 (Stellar Evolution); 230 members of Commission G4 (Pulsating Stars); and 260 members of Commission G5 (Stellar and Planetary Atmospheres).

In addition, there are 4 inter-division commissions: (1) Impact of magnetic activity on solar and stellar environments (122 members); (2) Planetary nebulae (84 members); (3) Stellar clusters throughout cosmic space and time (233 members); and (4) Galaxy spectral energy distributions (227 members).

Finally, there are 3 working groups associated with Division G: (1) Active B stars (119 members); (2) Ap

and related stars (73 members); and (3) Red giants and supergiants (17 members).

#### Division activities

##### Quarterly newsletter

In an effort to reach our membership and to continue with the legacy of the last triennium, the current OC will issue a quarterly newsletter with pertinent events, notices and deadlines. These newsletters will be posted online in pdf form and circulated by email through the regular IAU information channels and posted on the Division G website. The next issue is expected in June 2023.

##### Division G ombud

The IAU embraces equality, diversity and inclusion, and condemns all forms of non-ethical behavior such as bullying, harassment and malpractice. Unfortunately there can be situations when members feel treated unfairly or disrespected, or when they see someone else being treated that way. To provide a secure channel of communication for our members to express these concerns anonymously, be it on behalf of themselves or as an active bystander, we in

Division G have set up an on-line comment box:

<http://freesuggestionbox.com/pub/qxrqnsf>

We will not know who wrote the comment. A very limited number of people within the IAU will have access to the comments. The collected data will be reported in summarized and analyzed form at IAU Executive Committee level, and then be destroyed. It will not be passed on to anyone else. Should the members want us to contact them to further discuss their comments then they will need to leave contact details in the comment.

### Discontinuation of quarterly colloquia

The OC planned a quarterly colloquium that would highlight the work of early career scientists within the scientific realm of Division G. However, since the Covid pandemic, the online professional world has been inundated with colloquia and online-only events. For that reason we decided to discontinue Division G colloquium for the time being and focus our efforts on getting colleagues away from the screen.

### Division webpage revision

We received several small suggestions on making the Division G webpages more relevant. We will reach out to the webmasters and discuss the implementation feasibility for these suggestions. Of particular note are science highlights and science policy pages.

### PhD Awards

The IAU PhD Prize recognizes outstanding scientific achievement in astrophysics around the world. The Division G has the opportunity to award a stellar physics candidate who has carried out the most great work and has defended his/her PhD between the 16 December 2020, and 15 December 2021. For the year 2022 the OC received 23 proposals; after careful review, the PhD award was conferred to Kareem El-Badry from the United States, on his thesis titled “Binary Stars Across the Milky Way: Probes of Star Formation and Evolution.”

During the review, other Divisions elected to name Honorable Mentions. After discussing this option at

length, Division G OC did not find it appropriate to confer honorable mentions; instead, the OC decided to retain the custom of conferring an award to a single awardee.

### 2024 Symposium selection

We received proposals for 4 non-GA symposia, 12 GA symposia, and 29 GA focus meetings. Of those, 13 proposals listed Division G as the coordinating or supporting division. The OC ranked all proposals and was largely unanimous in their decision to support the proposals by Dr. De Marco: “Planetary Nebulae: a Universal Toolbox in the Era of Precision Astrophysics,” and by Dr. Miglio, “Linking near- and far-field galaxy formation with precise ages of stars and stellar populations.” The remaining proposals garnered support but the OC identified areas of improvement that were communicated to the proposers.

### IAU General Assembly in Busan

Division Days at the General Assembly took place on Friday (Aug 5) and Monday (Aug 8), where we welcomed everyone interested in the latest advancements in stellar astrophysics. We focused specifically on radiative transfer, radioactive decay and magnetic pressure in stellar atmosphere models; the roles of magnetic fields, convection, gravity waves, shear and turbulence in stellar interiors; symbiotic stars, cataclysmic variables and contact binaries; compact objects and tidal disruptions; evolved stars; and the search for transients across the sky. The scientific program comprised 5 invited talks, 16 contributed talks, and 18 e-talks and e-posters. Invited speakers include PhD prize winners Lisa Bugnet, Simon Blouin and Steven Goldman, Division vice-president Merieme Chadid, and the LSST/TVS pulsating stars chair Kelly Hambleton. The program also included a 30-min discourse on Division G’s role, scientific and collaborative impact, and worldwide support for stellar astrophysics. The program was varied and well attended. The list of talks is given in Table 1.

Presenter	Title
Soderblom/Prša	Division G status report (along with Commission updates)
Roel Lefever (C)	Towards a more realistic description of Wolf-Rayet atmospheres
Suman Bala (C)	A new Monte-Carlo radiative transfer simulation of cyclotron resonant scattering features
Oleksandr Yushchenko (C)	Radioactive elements with long and short decay times in stellar atmospheres
Innocenza Busa (C)	Magnetic pressure a necessary contribution to pressure in stellar atmosphere modeling
Lisa Bugnet (I)	Characterization of solar-type stars and study of their internal magnetic fields
Allan Sasha Brun (C)	On convection and gravity waves in F stars
Junho Park (C)	Shear instabilities and turbulence in radiation zones of rotating stars
Mateus Ribeiro (C)	Deep inside on the diversity of variability in symbiotic stars
Chris Tout (C)	A double magnetic dynamo in cataclysmic variables
Merieme Chadid (I)	First detection of gravity modes in RR Lyr stars
Vardan Elbakyan (C)	Accretion bursts in high-mass protostars
Einaz Bakhshi (C)	The first photometric study of AH Mic contact binary system
Div G Panel	What can Div G do for you?
Simon Blouin (I)	Decoding the white dwarf fossil record
Natalia Lewandowska (C)	Disentangling the mysteries of single pulses from the Crab pulsar
Taeho Ryu (C)	Fully relativistic global simulation of a tidal disruption event
Bonnie Zaire (C)	What does control the large-scale magnetic field configuration of cool stars?
Zeynep Bozkurt (C)	Detailed synthetic abundance analysis of secondary red clump stars
Steven Goldman (I)	A census of thermally pulsing AGB stars in the Andromeda galaxy
Jielai Zhang (C)	Kilonova and fast transients - an untriggered search
Melike Afsar (C)	Unveiling effective temperatures using line depth ratios in the infrared H and K bands
Kelly Hambleton (I)	The Transients and Variable Star science collaboration roadmap explained

**Table 1.** Division G Days program at the IAU General Assembly 2022 in Busan. Designations (I) and (C) stand for invited and contributed talks, respectively.

## In memoriam

We are saddened to report the passing of the number of IAU members affiliated with Division G. Their names and home countries are given in Table 2.

## Commission reports

### G1: Binary and Multiple Stellar Systems

Commission G1 covers a very broad range of topics including both observations and theoretical modelling of binary and multiple systems. Probably the most important contributions in the last year have again come from surveys and the production of catalogues. In particular the Gaia DR3 Catalogue, released in June 2022, contains information on du-

Deceased member	Home country
Dr. Norair D. Melikian	Armenia
Dr. Mohammad Heydari-Malayeri	France
Dr. Nikolai G. Bochkarev	Russia
Dr. Italo Mazzitelli	Italy
Dr. Jean-Pierre Swings	Belgium
Dr. Amelia F. Wehlau	Canada
Dr. Boris V. Somov	Russia
Dr. James B. Kaler	United States
Dr. Thomas R. Marsh	United Kingdom
Dr. J. Don Fernie	Canada
Dr. Tonu Kipper	Estonia

**Table 2.** Deceased Division G-affiliated IAU members.

plicity of the observed stars for the first time. Orbits have been determined for more than 433,000 multiple stellar systems. The Catalogue contains data on 2,184,477 eclipsing binary stars. Several dozen stars in Gaia DR3 have substellar and planetary companions. Other surveys include, in the framework of The Araucaria project, high-precision orbital parallaxes and masses of binary stars by VLTI/GRAVITY observations of ten double-lined spectroscopic binaries (Gallenne et al., arXiv:2302.12960) and ARMADA II for further detections of inner companions to intermediate-mass binary stars with microarcsecond astrometry at CHARA and VLTI (Gardner et al., 2022, AJ, 164, 184).

Various meetings related to the Commission's work have taken place and it is good to see a vibrant community emerging from the isolation of lockdowns. Among these "Stellar evolution along the HR diagram with Gaia", in Naples 20th to 23rd September 2022 included invited talks on "Multiple stellar systems in Gaia DR3" (Barstow) and "Understanding binary stars with Gaia" (Izzard) along with a number of other talks related to binary systems. Others included, "The fundamental role of stellar multiplicity in stellar dynamics and evolution", 31st October to 25th November 2022 and "The Impact of Binaries on Stellar Evolution", from 14th to 18th November 2022, both in Garching bei München, Germany.

### G3: Stellar Evolution

In 2022 we had arrived at a set of priority areas of development. We here briefly report on progress and further plans. We had wished to have made more progress, but it has in fact proven to be a very tough year on many fronts, and we had wished to have been in a better position to be an active and community-leading Commission.

#### *Improved communication and collaboration across disciplines*

Committee members reached out to other relevant Commissions Working Groups in the hope that some of these would result in more sustained cooperation or at least contact. This has not happened, but we

are keen to continue these attempts. If we can initiate one specific collaborative "project" then we can learn and build from there.

#### *Providing a service to our community*

We had started to explore the idea of a series of advanced workshops, preferably hands-on but with accessibility and inclusion in mind. Given some such workshops have taken place in other contexts we are now looking at how to position ourselves. We were in first instance going to approach our membership for ideas and volunteers to organise such workshops, but some coordination at IAU Executive Committee level might be desirable.

#### *Mobilizing our community*

Aside from an invitation to propose workshops we are keen to explore other ways of involving our membership in IAU related activities, and in offering this Commission as a vehicle for the community to develop their ideas for collaborative or strategic projects. While we are apprehensive of the risk of "on-line seminar overload" we do believe these could be a good way for our IAU Commission to stimulate broad discussion and enable people to participate who might find it challenging to attend conferences in situ.

The President has been actively involved within the Executive Working Group on Equity and Inclusion, notably the Standards subgroup, and collaborative work with the Working Group on Women in Astronomy, to revisit the way complaints are dealt with by the IAU and to resurrect some form of Ombud after this Commission's Ombud has become inactive. They have proposed that an Ethics committee is set up for this, independent of IAU Executives.

We continue to campaign for general astronomical community needs but will revitalize the role we play in the appreciation of Stellar Evolution as a cornerstone of the visible Universe.

## G4: Pulsating Stars

The President of the Commission is Róbert Szabó. Jadwiga Daszyńska-Daszkiewicz is the vice president, the Secretary of the Commission is Maria Pia Di Mauro. The previous president, Jaymie Matthews acts as an Advisor. The Organizing Committee has five additional members: Victoria Antoci, Daniel Huber, Steve D. Kawaler, Marcella Marconi, and Konstanze Zwintz.

### Conferences/workshops

In the post-covid era many in-person conferences and workshops are being organized, the following were particularly in line with the Commission's goals and topics:

- IV edition of the RRL meetings RR Lyrae/Cepheids 2022 - Large-scale surveys as bridges between spectroscopy and photometry that took place in the island of La Palma (Canary Islands, Spain) from 26 to 30 September, 2022;
- TASC6 / KASC13 Workshop Asteroseismology in the Era of Surveys from Space and the Ground: Stars, Planets, and the Milky Way that took place in Leuven (Belgium) from 11 to 15 July, 2022

### Awards/prizes

The 2022 Kavli Prize in Astrophysics has been awarded to Conny Aerts, Jørgen Christensen-Dalsgaard (both are Comm G4 members) and Roger Ulrich for the development of methods that allow precise study of the interiors of stars, i.e. for their pioneering work on helio- and asteroseismology.

The European Research Council (ERC) awarded a prestigious Synergy Grant to KU Leuven astrophysicist Conny Aerts. As coordinating principal investigator, she joins forces with Stéphane Mathis (CEA Paris-Saclay) and Michel Rieutord (University of Toulouse) from France and with Aaron Dotter (Dartmouth College) from the USA. The four principal investigators received almost 10 million euros for their project 4D-

STAR, which will develop and deliver innovative numerical models of rotating magnetic stars in three spatial dimensions throughout their evolution.

An ERC Starting Grant was awarded for Dominic Bowman to investigate massive stars using asteroseismology in the project called SYMPHONY.

### Other

In November 2022 the ESA Science Programme Committee (SPC) selected the space mission HAYDN for further study for the M7 mission opportunity. HAYDN (PI. A. Miglio, L. Girardi) is an asteroseismological mission focused on homogenous, controlled large samples of stars to provide calibrators for several aspects of fundamental astrophysics, fostering the understanding of stellar physics and the internal structure of stars, inaccessible with other techniques.

## G5: Stellar and Planetary Atmospheres

In-person activities in 2022 were partly constricted again by lingering concerns about the Covid-19 pandemic. Some members of Commission G5 were able to attend the Division Days at the XXXI General Assembly, August 5 & 8, in Busan, Korea. For details see [the GA program](#).

The commission is continuing to host a series of online seminars approximately once every two months. These seminars are recorded and kept available to enhance their impact. The work of deciding seminar topics and engaging speakers has been led by Katia Cunha, Daniela Korcakova, and Carlos Allende Prieto. The web host of the seminars is the Instituto de Astrofísica de Canarias, and recordings of the talks may be found at [this link](#).

Here are the G5 talks presented in 2022:

- "IAU G5 - The GALAH survey: science goals and highlights to date" by Dr. Sarah Martell; January 25, 2022
- "IAU G5: Inelastic hydrogen collisions in stellar atmospheres" by Dr. Paul S. Barklem; March 22, 2022

- “IAU G5 talk: Accelerating Computational Modeling via Neural Networks: Application to Exoplanet Atmospheric Retrieval/The first magnetic Helium-sdOs: which mergers are magnetic?” by Michael Himes & Dr. Matti Dorsch, May 24, 2022
- “IAU G5: A massive catalogue of ultracool dwarfs identified with LAMOST DR7”, by Dr. Youfen Wang; July 19, 2022
- “IAU G5: Winds of Magnetic Massive Stars” by Dr. Asif ud-Doula; September 20, 2022
- “IAU G5: Transiting Giant Planet Atmospheres: Physics, Chemistry, and First JWST Observations”, by Dr. Jonathan Fortney; November 22, 2022