

## COMMISSION G2

## MASSIVE STARS

*ETOILES MASSIVES*

**PRESIDENT**  
**VICE-PRESIDENT**  
**PAST PRESIDENT**  
**ORGANIZING COMMITTEE**

**Nicole St-Louis**  
**Lidia Oskinova**  
**Jorick Vink**  
**Sylvia Ekström (Secretary),**  
**Nidia Morrell, Miriam García García,**  
**Sergio Simón-Díaz, Fabrice Martins**

## TRIENNIAL REPORT 2021-2024

### 1. Background

The IAU Commission on Massive Stars (Commission G2) was created under Division G during the XXIX General Assembly that was held in Hawaii in 2015. Previously, the IAU Working Group on Massive Stars, its predecessor, had been in continuous operation for some 20 years, during which the community showed an intense level of activity. Therefore, the G2 Commission was launched on already solid bases, with a strong background and a large list of interested IAU members. This allowed a smooth transformation from Working Group to Commission during the structural changes proposed by the IAU and approved in Hawaii.

The objective of the new Commission was to promote research on massive stars and the interaction with other fields of Astrophysics for which massive stars play a crucial role (such as supernovae, black holes and neutron stars, binaries, interstellar medium, feedback, low-Z galaxies, starbursts and first stars in the Universe, binaries, gamma-ray bursts or gravitational waves). At the same time, the G2 Commission aimed to build on the basis of the successful activities of the preceding Working Group, for example the Massive Stars Newsletter (with its 24-hour announcement system) and the Massive Star Meetings that we try to hold every 4-5 years (most of the time with the support of the IAU).

In 2016, our commission was instrumental in organizing the IAU Symposium 329, *The lives and Death-Throes of Massive Stars*, that was held in New Zealand in November 2016. This very successful conference was attended by 178 participants and was aimed at strengthening the bonds between the massive stars and the supernova communities. For the next meeting, we had selected Puerto Rico as a venue but Hurricanes Irma and Maria in 2017 had other plans for us. In view of the terrible devastation that the island suffered, the organizers were forced to withdraw their proposal and a new call for the organization of the next massive star meeting was issued in January 2018. The town of Ballyconnell in the County of Cavan in Ireland was selected and the proposed conference on *Massive Stars Near and Far* was eventually selected by the IAU for an official symposium. IAU Symposium 361 was originally planned to be held in May 2020. It was not to be! The organizers were faced with a devastating last-minute cancellation because of the worldwide COVID-19 pandemic. After a period of uncertainty, our community showed great resilience and bounced back spectacularly. The organizers of IAUS 361 put together

an online Virtual Preview Meeting that took place in May 2021. This allowed early career researchers with invited and contributed talks to finally present their research to the community. Some 200 participants logged-on for the talks and the organizers created an archive of talks on a private youtube channel for those in our community located in timezones that prevented live participation. Finally, the live meeting was held 8-13 May 2022 (see below) and we are grateful to the IAU for allowing us to carry-over the allocated funds.

In 2020, observations began for a very important project for our community, the HST-ULLYSES project, the ultraviolet Legacy Library of Young Stars as Essential Standards. This Director's Discretionary program was designed to take advantage of HST's unique UV capabilities to observe both high- and low-mass stars over 1000 HST orbits. In order to take advantage of this wealth of UV observations, the IAU G2 Organizing committee under the leadership of its president at the time, Jorick Vink, successfully submitted an ESO proposal to gain complementary spectra in the optical and near infrared part of the electromagnetic spectrum. These observations were taken with the XSHOOTER spectrograph on the ESO VLT. In order to maximize the use of this wonderful dataset, our community organized itself in an international collaboration called XShootU (short for XShooting ULLYSES). XShootU is an open collaboration of astrophysicists dealing with the various scientific aspects resulting from the ULLYSES program and corresponding XSHOOTER data on massive stars (see Vink et al., 2023, A&A, 675, A154). Fourteen groups focussing on various topics are actively working to produce exciting scientific results. Already six virtual and two in-person meetings have taken place and several publications are either already published or in press.

## 2. Developments within the past triennium

This triennium, the organizing committee of the G2 commission welcomed three new members: Miriam García García, Sylvia Ekström and Sergio Simón-Díaz. Four members continued for another term: Fabrice Martins, Nidia Morrell, Lida Oskinova and Nicole St-Louis. Dr Oskinova was elected as Vice-president of the commission and Dr Ekström was named secretary. Dr St-Louis, past vice-president, took on the position of president.

During the fall and winter semesters, we aim to hold one meeting per month. We held six meetings in 2021-2022, nine meetings in 2022-2023 (of which one was held in person during the IAU361 symposium in Ireland - with seven members present) and up to now, six took place in 23-24 (with three more planned in April, May and June 2024). The minutes of these meetings are prepared by the secretary and stored on a password-protected *Switch Drive*, that we set up at the beginning of this triennium. All past minutes since October 2015 (when minutes started to be taken) are also held on this *SwitchDrive*. This constitutes a more secure arrangement compared to the past situation where the minutes were simply kept on the commission secretary's computer. Another improvement we have made to the communication channels is to put in place a *Slack* page with different channels to cover various issues. We later converted this to a *Zulip* account when *Slack* became less convenient to use. Together with the traditional emails, this provides us with uncreased flexibility for communication within the Organizing Committee. Finally, the commission website remains external to the formal IAU webpages (but linked to it) to allow a greater flexibility. It is maintained by the astronomy group in KU Leuven, Belgium under the supervision of Dr. Clio Gielen who provides very efficient and much appreciated support. All these changes have allowed us to strengthen and streamline our communication channels with the commission members and the massive star community as a whole.

Starting from February 2022, we began to make seminars on Massive-stars related topics accessible to all members of our community via Zoom. In an initial phase, we simply promoted talks on massive stars organized in various universities by members of the community that provided a Zoom link. We encouraged members to participate in this initiative so that a broader audience can benefit from talks already being planned. Later, our committee decided to launch an official *IAU G2 commission online seminar series*. We aimed for a balance of speakers in career levels, geography, gender, and topics. Since March 2023, we present talks monthly on the last Thursday of each month. With the agreement of the speaker, these talks are recorded and made available on our Website. All together, we are now approaching 50 recorded talks. At first, the presenters were chosen by the members of our committee but we now gladly welcome input from the community. In view of the great success of this endeavour, we are already planning the next set of talks for the upcoming year.

The latest IAU-supported conference related to massive stars, IAUS 361: *Massive Stars Near & Far*, took place in Ballyconnell, Ireland on 18-22 May 2022 after being postponed from its originally planned dates in May 2020 because of the Covid pandemic. As mentioned above, the organizers had also previously hosted a successful online meeting on 8-13 May 2021. Eager to meet again after five years without a large gathering, 211 participants from 32 countries travelled to Ireland for this great meeting that brought together observational and theoretical researchers from the massive stars in the local Universe and extragalactic communities. IAUS 361 was the XII massive star meeting in a series that began in 1971.

In preparation for the General Assembly in South Africa the Organizing Committee of the Commission encouraged members to submit proposals for IAU Symposia and Focus Meetings. One Focus Meeting was selected, FM4 *Bridging the Final Stages of Massive Star Evolution to SNe and Transients* and will be held on 13-14 August 2024. We look forward to this interesting meeting.

Planning for the next big gathering of massive star aficionados is already well underway. As our previous meeting had originally been set for 2020, we elected that the next conference should be held in 2025. During the in-person Ireland meeting, we sought ideas from our community for locations and scientific topics. A more formal call for interest to organize the next meeting was sent out by email and on Facebook in the fall of 2022. We received four strong proposals and after examining them carefully, we finally selected the proposal by Dr Aida Wofford to hold the meeting on *Massive stars across redshifts in the era of JWST and large surveys* in Ensenada, Baja California, Mexico. Drs Wofford (Institute of Astronomy of Universidad Nacional Autónoma de México, Mexico), St-Louis (Université de Montréal, Canada) and García García (Instituto Nacional de Técnica Aeroespacial, Madrid, Spain) will serve as co-chairs. The official Letter of Intent was submitted in September 2023 and the full proposal in December 2023. We are eager to hear if our proposal will be selected for an official IAU symposium.

Our committee became aware that the role and responsibilities of members of the ethics committee that are set-up at our scientific meetings could be clarified. Although the Code of Conduct of the IAU is quite clear on how participants should behave and what harassment consist of, for example, not enough effort is made to ensure that our community is aware of and understands it. Furthermore, members of the ethics committee do not receive adequate training on how they should react if something should happen. For the next meeting we aim for this issue to be resolved. At the very least, we would like that a small number of slides on this topic be prepared that could be shown at the beginning of the next IAU-endorsed massive stars conference.

For the future, our committee intends to promote the organization of a 3-day workshop

(<100 people) to help our community to get ready for the upcoming advent of giant telescopes (in particular the ELT). For the moment, we are planning for the meeting to be held in Spain. We are currently seeking funding to help with the organization.

One final action we undertook regarding conference organization on massive stars in general concerns a new service available on our Website. With many meetings being planned by members of our community, we wished to help to prevent potential problems of conflicts of dates or topics. Therefore, we set up a dynamic list, accessible via our Website, of meetings on topics related to massive stars that are either in the planning stages or confirmed, with dates and venues. We hope that this list will be widely used by our members and that it will eventually help to avoid that two conferences be planned on similar subjects or at the same time. Our goal is that this results in a broader offer of possible conferences to attend for our community.

Finally, the latest project on which the Organizing committee of the commission has been working on concerns the creation of an online school on massive stars. This idea was put forward by a member of our commission and former president of the massive star working group, professor Joachim Puls from Munich. This was in reaction to the fact that with the decrease in the expected length of PhD studies and the pressure on doctorate students and young researchers to publish an increasingly large number of papers, time to spend on learning the basic concepts on massive stars seems to be more and more lacking. We envisage that a topic would be studied by PhD students participating in the school with mentoring provided by more senior researchers. The student would eventually present the results of his or her work online to other participants and this would be recorded and kept on our Website or a dedicated YouTube channel. Eventually, we could have a collection of presentations on basic massive star topics available for our community to consult. To determine if this would be an activity that our community would like us to organize, we prepared a poll that we sent out to members of our community in December 2023. The idea was extremely well received and we decided to move forward with this project. As a first step, we asked for volunteers to put in place the modus operandi of this school. Eight people generously offered to participate and Dr Puls was asked to lead the efforts. Already, a kick-off planning meeting has taken place and we are hopeful that this activity could start next fall.

### **3. Closing remarks and future plans**

Our commission is therefore reaching the end of its 9<sup>th</sup> year of existence and its members are still as dynamic and active as ever. We plan to continue our efforts to provide opportunities to put forward massive star research and to help our community to interact and develop collaborations more efficiently. We hope in the forthcoming years to broaden our scope and reach out to more people from regions of the world such as Asia or South America that are not sufficiently represented within our membership.

Nicole St-Louis  
*Commission President*