

Report of the IAU Symposium 359 – Galaxy Evolution and Feedback across Different Environments (GALFEED for short)

The IAU Symposium 359 took place from March 2 to 6, 2020, in the “Grande Hotel Dall’Onder”, in the town of Bento Gonçalves, Rio Grande do Sul, Brazil, hosted by our Astronomy Department of the Physics Institute of Universidade Federal do Rio Grande do Sul (UFRGS). It gathered 185 participants presenting their works, from more than 20 countries, with a large (>50%) participation of post-docs, graduate and last year undergraduate students. We had close to 300 registrations, but many participants – in particular from China and Europe, who were not authorized by their institutions to come due to the outbreak of the Covid-19 pandemic. We used the IAU grant to support the participation of 40 young researchers. Outreach activities were a success, gathering about 2000 participants during 4 days and nights of the Symposium.



Welcome address by the Chair.



The audience of the Symposium.

Our goal was to bring together the Active Galactic Nuclei (AGN) and galaxy evolution science communities, that usually propose separate Symposia, to discuss galaxy evolution and feedback. As we now know that AGN is a phase occurring in most galaxies that critically influences their evolution, it is important to study the two processes together and to enable researchers, in both topics, to learn from each other. Key questions we have discussed during the Symposium include: How do galaxies acquire their gas and how efficiently is it transformed into stars? How is the Supermassive Black Hole in the galaxy center fuelled to trigger an AGN? What is the main physical mechanism that quenches star formation? How powerful are the stellar and AGN feedback processes in regulating galaxy evolution? What is the role of the environment on galaxy evolution and AGN triggering?

During our Symposium, the above questions have been discussed in 185 scientific contributions, grouped in six sessions:

(1) The first session addresses the formation and early evolution of galaxies and supermassive black holes via models, simulations and observations, targeting massive galaxies, starburst galaxies and QSOs;

- (2) The second session focuses on the epoch of Cosmic Noon, addressing black hole masses, galaxy mergers, star-forming galaxies, distant quasar host galaxies, including the claim that there is no quenching of star formation in quasars;
- (3) In the third session we discuss high density environments, from protoclusters, through the effect of black hole outbursts on galaxy clusters, to the effect of the environment on starburst and AGN activity;
- (4) The fourth session addresses feedback associated with secular evolution, including the effect of AGN jets and outflows on galaxies, via models and observations, and a discussion of the important role of the adopted gas density on the calculation of outflow power from ionised gas kinematics;
- (5) The fifth session concentrates on the fueling of star formation and nuclear activity, including the observation of gas flows with ALMA down to the inner few parsecs around the supermassive black hole and models of the flows in the innermost parsec;
- (6) In the sixth session, the primary topic is the state of the present day Universe, via the study of resolved stellar populations of galaxies to derive their star formation history and the investigation of resolved excitation and kinematics of the gas in individual nearby active and non-active galaxies.
- (7) A seventh and last session comprised a compilation of 25 specific questions proposed by the participants and discussed in the last day of the Symposium.

The Proceedings have already been edited and comprise 118 contributions from the participants plus the questions and answers discussed in the last day of the Symposium and for which the participants sent answers even after the Symposium, that were included in the last Section of the Proceedings.

Outreach activities

The partnership with the administration of the town of Bento Gonçalves allowed us to use the space “Casa das Artes”, adjacent to the hotel, to develop many educational and outreach activities, under the leadership of the director of the UFRGS Planetarium Daniela Pavani. Her and her team promoted activities for young school students during the days, and for the general public and high school students during the nights. About 2000 people attended these activities, that included shows in an inflatable Planetarium, nighttime observations and talks by renowned international participants of the Symposium.



Audience of nighttime outreach talks



Kids waiting for the Planetarium session.

We thank the support from the IAU, complemented by the support from the Brazilian institutions SAB (Sociedade Astronômica Brasileira), Instituto Serrapilheira and FAPERGS (RS foundation for research support). We thank also the SOC for the guidance; the LOC for the logistic support, the creation of the “Universe at your feet” sandals, bags and notebooks; the astronomy students from our Physics Institute of Universidade Federal do Rio Grande do Sul (IF-UFRGS) and from other institutes for the support during the sessions and outreach activities; our University UFRGS for its support and the provost of research Rafael Roisler, for his speech in the opening ceremony; our partner Universities Universidade Federal da Fronteira Sul and Universidade Federal de Santa Maria for their support and the town of Bento Gonçalves, represented in the opening ceremony by the Secretary of Tourism, Rodrigo Parisotto, who welcomed the participants.

Thaisa Storchi Bergmann, Chair of the SOC



SOC and LOC: In the back, the SOC, from left to right: William Forman, Françoise Combes, Thaisa Storchi-Bergmann, Richard Davies, Roderik Oversier and Keiichi Wada. Missing from the picture: Raffaella Morganti and Sebastian Sanchez. In front, the LOC, from left to right: Tiago Ricci, Hekatelyne Carpes, Cristina Furlanetto, Juliana Motter, Ana Chies Santos, Eduardo Brock, Marina Trevisan and Jaderson Shimoia. Missing from the Picture: Rogemar André Riffel and Rogério Riffel.

Photo of the Participants (List attached)



Participants of the IAU Symposium 359: Galaxy Evolution and Feedback across Different Environments (GALFEED)