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Report on the ESO workshop

New Heights In Planet Formation

held at ESO Headquarters, Garching, Germany, 15–19 July 2024

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Planet formation is a widespread by-product of the process of star formation itself and occurs within protostellar discs made of gas and dust that orbit the new-born star. In the past few years new observations of discs at various wavelengths — thanks to new-generation facilities — have revolutionised the field of planet formation and challenged some of the traditional theories. This workshop brought together around 200 scientists from all over the World to review the state of the art, pinpoint the main open questions, and explore new avenues. As well as invited reviews and talks, and contributed talks, the scientific programme offered ample space for informal poster viewing sessions.

Rationale

Planet-forming discs can nowadays be probed in unprecedented detail thanks to facilities such as the Atacama Large Millimeter/submillimeter Array (ALMA) at submillimetre wavelengths or high-contrast imaging instruments in the near-infrared, such as the Spectro-Polarimetric High-contrast REsearch (SPHERE) instrument at ESO's Very large Telescope. In the past decade these facilities have transformed the field of planet formation, enabling both moderate-resolution statistical disc surveys and high-resolution imaging studies of discs. Improvements in data quality and sample size have, however, raised many fundamental questions about the structure of discs and their evolution, all the way to the formation of planets. This observation-driven field seems to be continuing along this path with upcoming results from the James Webb Space Telescope (JWST) and the many recently accepted Large Programmes that are ongoing at different facilities. Theory and models are therefore faced with the task of explaining much more complex scenarios of disc evolution, planet formation, and planet–disc interaction.

This workshop aimed to bring together observers with expertise in different wavelength regimes, theorists, and modellers to evaluate our current progress, pinpoint critical unresolved challenges, and discuss ways forward.

Programme

Several topics were addressed during the ESO workshop. We started with a beautiful and extensive review of recent JWST results in the context of planet-forming discs, with a special focus on the level of improvement compared to its predecessors. This set the stage for a

Figure 1. Conference photo.

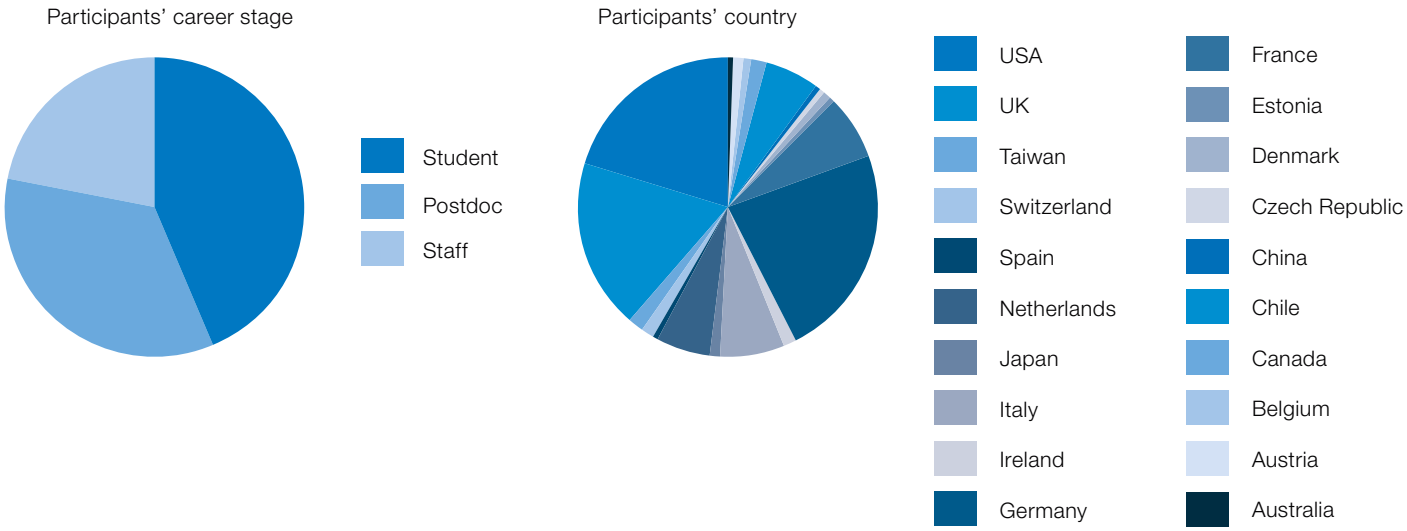

Figure 2. Demographics.

series of novel JWST results highlighted in both contributed talks and posters. The second day was devoted to the enormous contribution of ALMA to our understanding of discs. Some results from two of the recently accepted ALMA Large Programmes (AGE-PRO and Exo-ALMA) were presented, addressing the fundamental yet unsolved problem of disc evolution and the prospects of detecting embedded protoplanets using disc kinematics. The third day was mostly devoted to theory and simulations with a special focus on planet–disc interaction. On the fourth day we addressed the effects of the environment on discs. That topic was possibly the one that generated most interest and stimulated most of the discussion. Recent results, in fact, have shown that external processes may be very relevant in discs even at later stages while planets are forming. Finally, on the last day, the topic of astrochemistry was addressed and new advances in this area thanks to the recently accepted ALMA Large Programme DECO were presented.

The programme included 67 talks over five days, including seven invited review talks and five invited talks, the remainder being contributed talks selected by the Scientific Organising Committee (SOC). For the five invited talks the SOC selected junior members of the main five Large Programmes ongoing in the field of planet formation. We also held one open discussion session. As well as the oral contributions, 75 posters were presented, divided into two poster sessions in the first and second halves of the week. The SOC decided to give more visibility to some of the outstanding results presented on posters by rewarding the three best posters with a five-minute talk on the last day of the conference. Two of the best posters were selected by a committee and the third one was voted by the conference participants through a web poll.

Demographics

The workshop was co-funded by the DUSTBUSTERS[1] collaboration on protoplanetary discs, funded by an EU Marie Skłodowska Curie RISE grant. It was timed to serve as the closing event of DUSTBUSTERS. The SOC consisted of DUSTBUSTERS node leaders and external scientists, four female and five male members, with nine SOC members from seven countries (Australia, Italy, Chile, USA, France, UK, Germany). Our final numbers included 267 registered participants, of whom 186 were in person, from more than 20 different countries.

The SOC made every effort to ensure a balanced scientific programme, with 27 of 67 speakers (~40%) being female. Likewise, the priority was to support and give visibility to early-stage researchers (ESRs) in selecting both invited speakers and contributed talks. In fact, 55 of 67 speakers (~82%) were either PhD students or postdocs.

Outlook

The workshop was the major scientific event in the field of protoplanetary discs in 2024. Feedback from the participants was very positive. The efforts to give visibility to ESRs was much appreciated, as was the friendly atmosphere, which allowed interesting and respectful interactions and discussions. Despite the large number of participants, reaching the limits of the ESO capacity, the organisation was very smooth, mostly thanks by the numerous and engaged Local Organising Committee (LOC), composed of 12 ESO students, fellows and staff members.

Slides from most talks, the detailed programme, the list of posters, and the LOC/SOC composition are available at the workshop website[2].

Acknowledgements

We would like to thank all participants, both in person and remote, for their active participation in the conference, which was crucial to making it such a success. We would further like to thank our SOC and LOC members for their fundamental and invaluable effort. A special thanks goes to Denisa Tako for her support with the organisational aspects of the conference.

Links

[1] Link to the DUSTBUSTERS Webage: https://dustbusters.fisica.unimi.it/
[2] Link to workshop programme: https://www.eso.org/sci/meetings/2024/dustbusters.html