

# Maintaining Scientific Discourse During a Global Pandemic: ESO's First e-Conference #H02020

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From 22 to 26 June 2020, ESO hosted its first live e-conference, #H02020, from within its Headquarters in Garching, Germany. Every day, between 200 and 320 participants around the globe tuned in to discuss the nature and implications of the discord between precise determinations of the Universe's expansion rate,  $H_0$ . Originally planned as an in-person meeting, we moved to the virtual domain to maintain strong scientific discourse despite the COVID-19 pandemic. Here we describe our conference setup, feedback gathered from participants before and after the meeting, and lessons learned from this unexpected exercise. As e-conferences will become increasingly common in the future, we provide our perspective on how they can make scientific exchanges more effective and inclusive, and also climate friendly.

## Before 18 March 2020: in-person conference at ESO Headquarters, Garching

Our preparations for an in-person conference involving approximately 100 participants began in summer 2019, shortly after the Kavli Institute for Theoretical Physics workshop on Tensions between the Early and the Late Universe (Verde, Treu & Riess, 2019). Together with the Scientific Organising Committee (SOC), composed of Chuck Bennett, Annalisa Calamida, Matthew Colless, Frédéric Courbin, Claudia de Rham, Wolfgang Gieren, Chow-Choong Ngeow, Hiranya Peiris, Mickael Rigault, Dan Scolnic and Licia Verde, we selected invited speakers who would cover a wide range of topics from basic

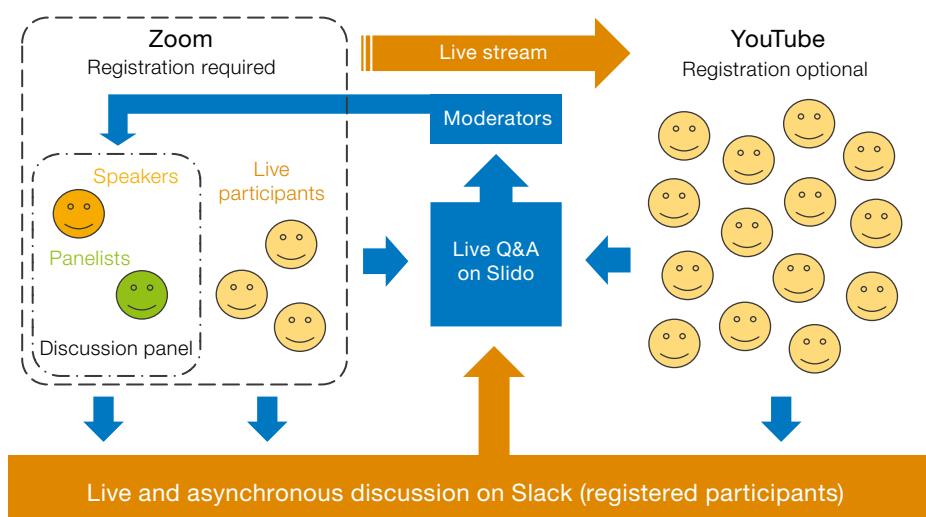


Figure 1. The #H02020 online meeting setup.

astrometry to theoretical cosmology. The conference was planned to run from Monday to Friday, featuring 20 invited talks, 2 introductory lectures, 34 contributed talks, 8 short 10-minute discussion sessions, four 10-minute poster flash talk sessions in addition to physical posters, and a 1.5-hour discussion panel at the end. A public lecture by Adam Riess at the Technical University of Munich's downtown campus was also planned.

Registration for the workshop opened in late January 2020 with abstracts due by 1 April. However, as cases of COVID-19 started skyrocketing in February and March, it became clear that an in-person meeting in June was unrealistic. Faced with the question of whether to postpone or cancel the meeting, on 26 March we decided on a third option: to convert the in-person meeting to a live global e-conference within the course of 12 weeks.

We had no blueprint to follow and no pre-arranged technical solutions for implementing ESO's first global live e-conference, leading to a somewhat tricky situation that was rendered even less straightforward by the fact that nearly all ESO staff were working remotely for the first time. Nonetheless, we felt strongly that maintaining strong international scientific discourse was worth the challenge — especially since many other meetings were being cancelled or postponed indefinitely — and we decided to go ahead with this meeting despite the short planning timescale.

## Participant surveys before & after the meeting

Recognising the experimental nature of our e-meeting, we conducted participant surveys before and after the meeting to assess how well it met participant needs and expectations, and to measure whether it fulfilled our own goals. Before the conference we collected responses from 89 individuals, and 79 afterwards. Since anonymous submissions were allowed, only 46 before & after responses could be uniquely matched. The following account is based on this survey information.

## Goals of the online meeting

In adapting the conference for the virtual domain, we pursued the following main goals:

1. To advance the specific research field by enabling continued international scientific exchange.
2. To create a schedule compatible with most regions of the world.
3. To foster informal discussions that go beyond the scope of the invited presentations.
4. To strike a balance between giving the wider community a strong voice and covering a broad range of topics via invited presentations.
5. To explore and leverage benefits inherent to online meetings, such

as reduced access barriers to foster diversity, equity, and inclusion.

6. To provide inspiration and guidance for those considering hosting an e-conference.

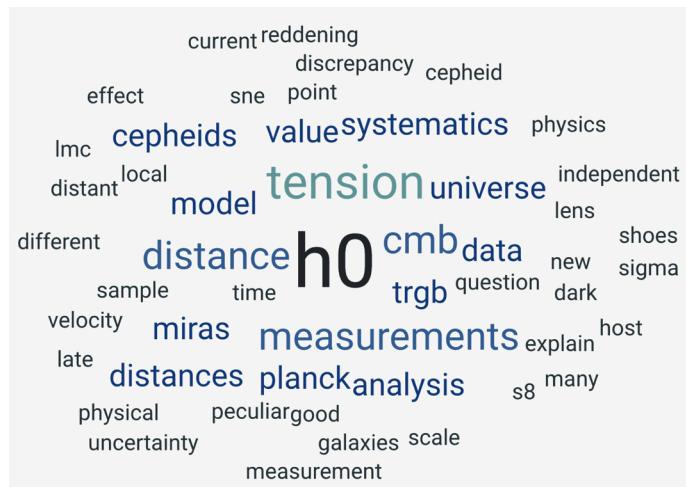
The meeting setup was chosen so as to maximise the above goals, to the possible detriment of other worthwhile goals, such as networking sessions or online poster sessions focusing on young researchers, which we unfortunately could not include given the compactified planning schedule.

## Meeting setup

Figure 1 illustrates the e-conference setup adopted, which was also explained in a YouTube video<sup>1</sup>. Targeting goal number 2 above, we selected the time slot of 12:50–15:10 UTC on each day, which is at least somewhat close to normal waking hours in most areas of the world. However, the start time (5:50 am in Vancouver) and end time (1:10 am in Canberra) were somewhat uncomfortable for regions bordering the Pacific Ocean. No breaks were included in the short window of 2 hours and 20 minutes. Feedback indicated overall approval of this time slot. Some participants regretted the absence of breaks, while others thought it appropriate to skip breaks since most were following the meeting from home.

Each day's session consisted of four invited talks (20 minutes talk + 5 minutes Q&A) and a 30-minute live discussion panel<sup>2</sup>. The latter served the dual purpose of providing a voice to the community (in lieu of contributed talks) and enabling critical discussion, thus targeting goals 3 and 4 above. The panels featured prepared statements and informal group discussion, and addressed questions left unanswered after the invited talks. Panels were composed of the day's invited speakers and 3–5 participants who had asked to be panel members during registration.

The conference call was held on Zoom and live streamed via YouTube<sup>3</sup> (incurring a delay of ~ 20 s), where all videos remain publicly accessible and have been viewed more than 5000 times. Only invited speakers, discussion panelists, and moderators were invited to unmute their microphones



**Figure 2.** Word cloud created from questions on Slido. 301 questions were asked, 48% of them anonymously, and they received a total of 1168 upvotes.

in the Zoom call in order to ensure an orderly and uncomplicated meeting. To add a human touch, each day's session began and ended with a brief greeting during which all Zoom participants were asked to turn on their video and greet each other. To provide a lively response to each talk, moderators thanked speakers by applauding. This worked well enough, but another possibility, suggested by Tom Shanks, would be to use pre-recorded applause; despite being a bit artificial, it would provide something of the atmosphere of a real conference and would be easier to manage than actual applause over many microphones on a conference call.

Planning and adhering to a tight schedule were crucial to ensuring a smooth meeting involving live participants across 18 time zones. We therefore did extensive onboarding work with invited speakers and provided a short (< 5 minutes) YouTube video explaining the meeting setup to all participants. Onboarding was done in one-on-one Zoom calls during which we explained the meeting setup, launched mock presentations, and answered any technical questions. We believe that this onboarding work was the reason so few technical issues were experienced during the conference. Although we briefly considered pre-recording talks to minimise technical issues, we decided in favour of live presentations to preserve the more direct feeling of a real conference and to avoid speakers' feeling they had to record "the perfect talk".

Live participation on Zoom and YouTube (up to 330 live participants on Day 1) exceeded our in-person expectations three-fold, while asynchronous streaming from YouTube has reached an audience 10 times greater than a conventional meeting would have done.

All questions were submitted via the online platform Slido, which allowed participants to upvote relevant questions and supported anonymous question submission. Figure 2 shows a word cloud created from the questions submitted. Questions deemed relevant by a majority were then relayed to speakers by the session moderator. Advantages of Slido included very concise formulations as a result of the 160-character limit, democratisation of the Q&A thanks to voting, the ability to ask questions anonymously, and a written account of all questions, which allowed speakers to reply in writing to any unanswered questions. A simultaneous benefit and drawback of using Slido for Q&A was that follow-up questions were not possible; the advantage being that precious Q&A time could not be exhausted by individual questions and the disadvantage being that some questions were not answered satisfactorily. Post-conference feedback shows that a large majority of participants were extremely pleased with this form of Q&A.

We created a Slack workspace<sup>4</sup> for this event to support asynchronous exchanges. In principle, Slack allows the exchange of information in chat channels consisting of various user groups as well as allowing

participants to get in touch with each other directly via one-to-one chat or video calls. Over the course of the conference week, participants exchanged more than 1500 messages, including organisational messages, scientific discussions, answers to questions, diagrams and other documents, such as presenter slides. However, becoming familiar with several new communication tools at once (Zoom, Slido, Slack) represented an initial hurdle for some participants. Once accustomed, though, participants reacted very positively to Slack as a coherent communication platform for the meeting.

### Participation and representation

We sought fair community representation among SOC members, who helped select a diverse set of invited speakers across the spectrum of career stages, locations, gender, and subject matter. Registration was open until the 300 person limit of the Zoom license was exhausted. The list of participant host countries used to create Figure 3 was determined from participants' IP addresses during registration. The only information collected concerning the identity of participants was name, position, and affiliation. Gender statistics shown in Figure 4 are derived from manually (and possibly incorrectly) assigned (binary) gender based on first names.

Representation of women amongst the invited speakers and the SOC was significantly higher than amongst all registered participants. Gender representation amongst panel members mirrored the registration demographics. Two participants who had requested panel slots were not assigned because they either misunderstood the panel setup or because they had not yet completed graduate studies. Six of the 20 invited speakers were early-career researchers. The all-male 'other' category in Figure 4 comprises six retirees, one teacher, one journalist, one freelance researcher, and three other types that did not fit any other category.

We note the sharp decrease in female representation between the categories of students and postdocs. It is a well-known fact that retaining qualified women is a major issue in STEM fields, and the

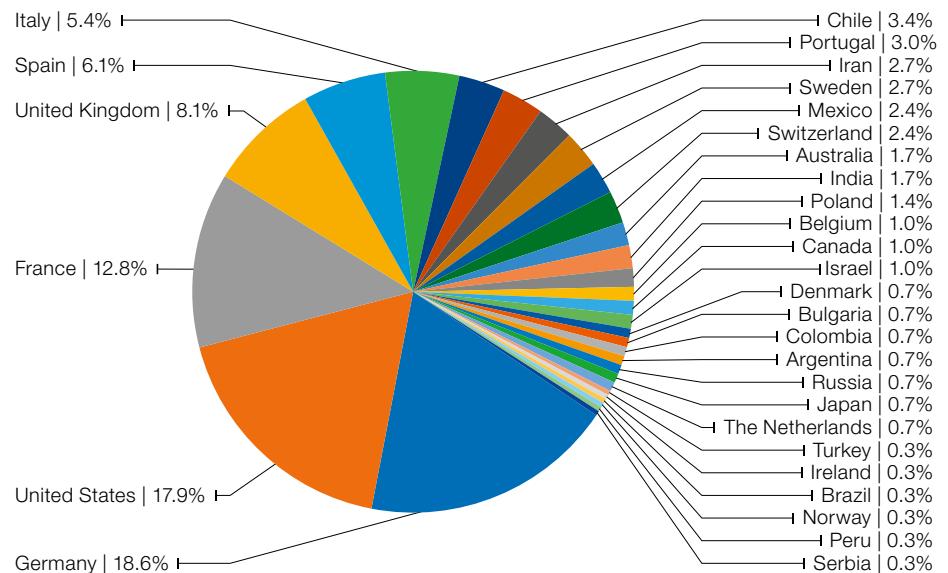


Figure 3. Registration locations by IP address.

observed trend suggests that women are less likely than men to continue beyond their doctorate degrees towards a career in astronomy. However, we do not have sufficient information to assess this drop-off in detail, or to cross-reference it with other potentially relevant factors, such as postdoc-seniority or childcare responsibilities, which has disproportionately impacted women during the COVID-19 pandemic.

Representation of people of colour amongst speakers and panelists was low, particularly in the case of non-Asian people of colour. This was especially evident given the timing of the meeting, which coincided with #BlackinSTEM week. There are many and complex reasons for the underrepresentation of people of colour in STEM, and they may differ significantly across different regions of the world. However, online conferences in particular should strive to do better since barriers to participation (funding, travel, etc.) are lower than for in-person conferences. We note that we could not identify any participants from the African continent based on either IP address, e-mail address, host institute name, or YouTube analytics data, although we did have participants from several underprivileged countries. We had listed our conference on the Canadian Astronomy Data Centre

website<sup>5</sup> and advertised it through ESO's mailing list, newsletter and website, and several astronomy-related mailing lists, also advertising it on Twitter. We are concerned that our announcement practices could have excluded people from certain regions, and we have identified that internet censorship would have prevented potential participants from China or Iran from seeing our Twitter posts or YouTube live streams. Professional organisations such as the International Astronomical Union could play an important role in providing guidance on the best ways to increase diversity in virtual conferences.

Up to 120 participants (registered or not) joined via the YouTube livestream every day. YouTube channel analytics provide information concerning audience age, location, and gender, as shown in Figure 5. The analytics available are far from complete since they are likely based on inhomogeneous samples including registered and unregistered YouTube users, depending on category. For example, the total number of views by location adds up to only 46%; location information is missing for the majority of viewers. Nonetheless, we see that YouTube was favoured by a younger audience, possibly down to different approaches to using the internet and/or different career stages.

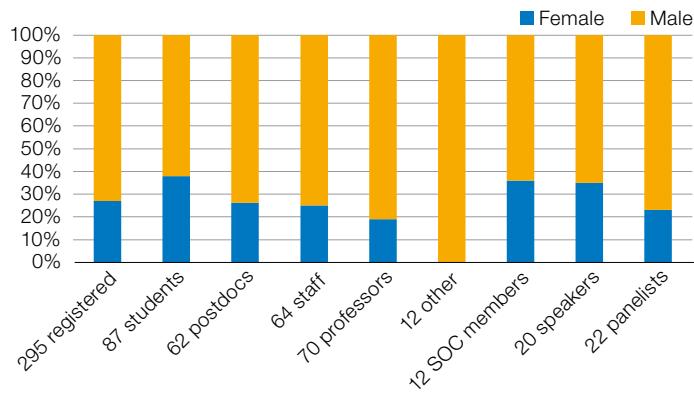


Figure 4. Career and gender demographics. Gender was assigned according to first names provided. One postdoc's name could not be assigned a gender.

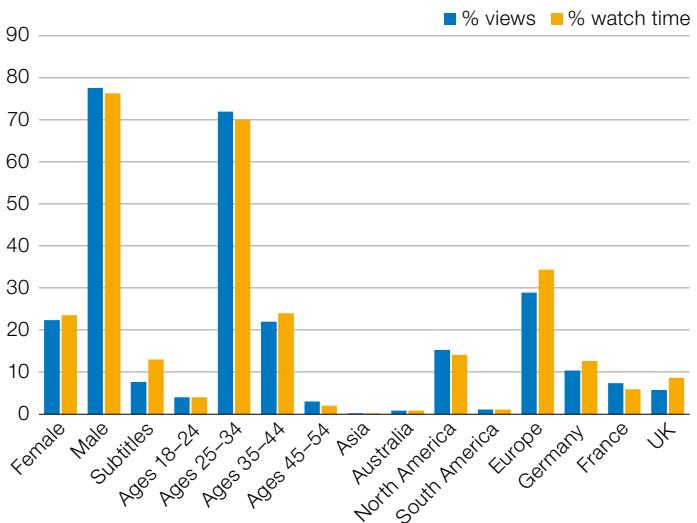


Figure 5. YouTube channel analytics.

### Goal 5: reducing access barriers to increase diversity, equity, and inclusion

We deliberately collected no registration fees in order to allow any interested parties to participate. For comparison, the in-person registration fee would have been 180 euros (80 euros for students). After converting our conference to an online format, we set up a new registration form. The registration served several purposes, including limiting access to the Zoom call and Slack workspace, collecting consent to being recorded/live streamed, and ensuring that participants pledged to abide by the ESO code of conduct. However, the entire conference was publicly accessible even without registration via the YouTube live stream and questions on Slido. All software tools used (Zoom, Slido, Slack) were free of charge to participants and compatible with a maximum number of operating systems with no installations required apart from a WebRTC capable browser (for example, Firefox, Chrome, Opera).

Most feedback mentioned that removing the need to travel was a key advantage of the virtual format, irrespective of the COVID-19 pandemic. Specific reasons given included childcare, teaching and other work-related duties, care of pets, visa-related issues, time saved by not travelling, avoiding exhaustion (for example, jet lag), health concerns, dietary considerations, and more. An Australian

participant emphasised that these benefits far outweighed the inconvenience of late-night sessions.

Anonymous questions were perceived by many as an important advantage over classical Q&A. With no need to fear embarrassment, many basic questions were submitted and voted for, in particular during more theory-heavy talks. Irrelevant questions — a concern for those opposed to anonymous questions — were not an issue because they were very few and did not get upvoted. The 160-character limit of Slido was considered a challenge by some participants, although lengthier questions could also be relayed to the Slack workspace.

A notable benefit of YouTube was the ability to enable closed captioning (English subtitles). The average view duration was 38 minutes 22 seconds with subtitles enabled, compared to 20 minutes 59 seconds without subtitles; the 7.6% of views with subtitles enabled accounted for 13% of the time watched on YouTube. This underlines the need to assist participants in engaging with the materials presented, especially in the case of persons with impaired hearing or non-native English speakers. George Jacoby (NSF's NOIRLab) further pointed out that participation conditions were more equal here than in usual meetings because everyone sat in the front row with an unobstructed view and adjustable speaker volume.

A frequently mentioned drawback of the virtual format is that it is less conducive to informal discussions than in-person meetings. However, survey feedback also revealed interesting potential benefits to those discussions that did take place on Slack. First, discussions on Slack were transparent to all participants instead of only a small group of people (for example, coffee-break clusters), helping non-specialists gain deeper insights “behind the scenes”. Second, discussions could later be synthesised from the recorded chat text. Third, one participant mentioned they felt more at ease entering into an online discussion with strangers than they would have done in person.

### Overcoming shortcomings

The possibility for young scientists to present themselves and their work is crucial to fostering their career development and to providing a forum for “hot-off-the-press” results that may revolutionise a field in the future. Unfortunately, in this instance we were not able to arrange for contributed talks by, for example, students and early career scientists. However, feedback offered two very attractive options for including early-career contributions despite a tight live schedule: a) pre-recorded contributed talks available for asynchronous viewing ahead of invited talks and discussion sessions; and b) online poster sessions on Slack. To pre-

vent exclusion by internet censorship, all essential content should be rendered accessible on platforms freely accessible worldwide.

While e-conferences are not subject to travel-related access barriers, several other barriers may apply to the same groups who would have difficulty attending in-person meetings. These include internet censorship, lack of broadband internet access, and the need for access to suitable personal devices (for example, 1 laptop per person), among other aspects that should be considered even before planning virtual meetings. One way of addressing such issues could be to create regional viewing hubs once health measures allow it, as outlined by Reshef et al. (2020).

Perhaps the most common negative feedback from participants was that they had wished for more opportunities for discussion. The key to improving this aspect of e-conferencing seems to be to motivate participants to commit to offline discussions. Obstacles to this include a lack of engagement (intentional or circumstantial) and the complexity of orienting oneself in a Slack workspace. During #H02020, we witnessed participants become increasingly engaged as they learned how to use this tool. In particular the ability of direct video calls amongst Slack workspace members seems to have been underused. Instructions for how to use Slack should therefore be part of the onboarding information, and using the same tools in all conference-related communications would lower the need for participants to familiarise themselves with new tools each time. Additionally, asking participants to specify keywords upon registration could help to assign discussion groups, connect participants according to interests, and foster networking.

#### Final thoughts and recommendations

The fact that e-conferencing is much more climate-friendly than classical conferences is widely known in the community and the carbon savings of e-conferences have been described in detail by, for example, Jahnke et al. (2020). Nonetheless, it took a worldwide health emergency to acceler-

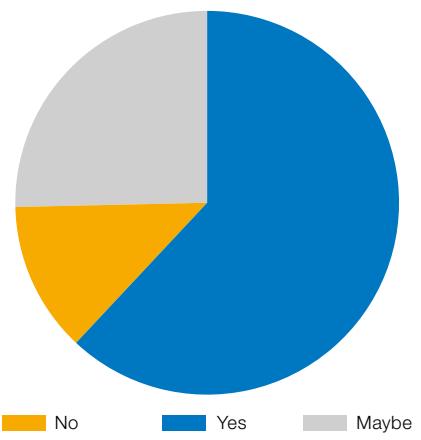
ate the adoption of e-conferencing. Now that the initial step has been taken, e-conferences are becoming commonplace and will likely become an integral part of scientific discourse, not least because they are cheaper and more convenient for participants. Targeting our goal number 6 above, we now close with some final thoughts and recommendations.

First and foremost, feedback clearly shows that participant satisfaction with this conference (on both the scientific and technical level) was high, and it is worth noting that no-one stated that the conference had been worse than expected. Instead, many were positively surprised, and a majority stated that this meeting increased the likelihood of their organising an e-conference themselves. The Q&A sessions on Slido in particular were a highlight for most, with 58% (46/79) saying the Q&A was very effective, 25% somewhat effective, and only 1/79 indicating that it was somewhat ineffective. Several people even stated they hoped for Slido-style Q&A to be incorporated in future face-to-face meetings.

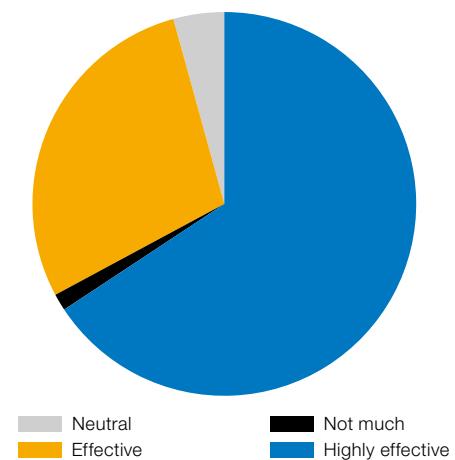
Of course, valid criticisms exist about e-conferences and their limitations, notably concerning the lack of direct human interaction. Participants particularly noted the following issues, in arbitrary order: a) the lack of body language; b) difficulty meeting new people; c) missing off-the-record discussions; d) the missing cultural elements of international travel that are crucial to fostering understanding across cultures, languages, etc.; e) missing networking opportunities; and f) missing opportunities for senior and junior researchers to meet. Some of these drawbacks that may seem unsurmountable now may be addressed by smart e-conference design or may evolve as social norms evolve, for example regarding (online) networking etiquette. However, the human aspect of conferences is vital to scientific exchange and must not be neglected.

E-conferences may also harbour long-term negative side effects. For example, privacy concerns remain underdiscussed, despite recorded live streams' drastically changing the dynamic and persistence of participant contributions. Additionally, e-meetings tend to shift the costs and

"Are you now more likely to host e-conference?"



"How effective did you find Q&A on Slido?"



effort of attending conferences from the professional to the private domain, for example regarding food & drink, physical (office) space, computing resources, etc.

At the same time, classical in-person conferences also have significant shortcomings that are easily forgotten or overlooked, perhaps because the community is used to them. Classical conferences are biased both implicitly (for example, stereotypes, personalities) and explicitly (for example, ability to travel), resulting in unintended exclusionary practices or situations. As a result, in-person meetings prioritise specific types of human interactions over other interactions that could lead to other benefits, such as transparent discussions, and foster equity, diversity and inclusion.

Social media are the native communication platforms for e-conferences. Organ-

isers should include social media in their announcement strategies and seek advice from press or outreach offices to make adequate use of social media, bearing in mind the possibility of censorship.

Another issue to solve is that of the complexity of conference software. At the time, our review of the available software revealed no single solution that would have incorporated all the functionality desired for our meeting, so we adopted a hybrid approach involving Zoom/YouTube, Slack, and Slido. Although corporate solutions do exist, they can be costly and were thus not applicable for an event with zero registration fees. A detailed comparison between different software solutions is beyond the scope of this article, but should certainly be conducted. The documentation and research gathered by the EuroPython conference series<sup>6</sup> offer substantial insights concerning the technical aspects of online conferencing.

It is not clear that this conference could have taken place perhaps just 5 years ago. Projecting this rapid progress into the future, new tools and solutions will become available that may lead to even more options to choose from, and thus more complexity for conference attendees. To facilitate virtual-domain scientific cooperation in the future, it may be useful to define or develop a platform or set of tools (perhaps an open source version of Slack, such as CERN's Mattermost<sup>7</sup>, hosted by an institute) that the community can adopt over a time span and that renders the learning curve worthwhile. Whilst the creative and competitive development of new tools certainly leads to innovation, standardisation would make it worthwhile for scientists to invest time in becoming familiar with such channels.

We believe that e-conferencing can replace a majority of in-person conferences in the future, and we see many good reasons for this development. These notably include environmental benefits, time savings, and opportunities for increasing diversity, equity and inclusion, as well as the ability to create new conference formats that allow improved global scientific discourse. Yet the human element of scientific exchange must also be satisfied for science to progress. Hence, in-person meetings will remain a

key aspect of scientific exchange. Combining the two options would benefit from the best of both worlds, and we believe this could be achieved by increasing coordination amongst conference organising committees. For example, one could imagine a few very large international meetings per year that primarily focus on networking and personal interactions, once health issues allow. These in-person networking events could be complemented by frequent e-conferences focused on presenting scientific results, with the possibility for networking events centered around regional screenings. At the same time, free online seminar series, such as the Golden Webinar series<sup>8</sup> or the ESO Cosmic Duologues<sup>9</sup>, are offering new opportunities for scientific exchange.

The scientific community has entered a new era of possibilities for scientific exchange. We argue that there could be immense benefits on the horizon, and reducing our carbon footprint is certainly one of them. However, the drawbacks, challenges, and potential dangers of e-conferencing should not simply be ignored. A larger conversation should therefore consider how e-conferencing will become a safe, inclusive, and carbon-friendly addition to the landscape of international scientific discourse.

#### Acknowledgements

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- Jahnke, K. et al. 2020, Nature Astronomy, 4, 812
- Reshef, O. et al. 2020, Nature Reviews Materials, 5, 253
- Verde, L., Treu, T. & Riess, A. G. 2019, Nature Astronomy, 3, 891

#### Links

- <sup>1</sup> Video explaining the e-conference setup: <https://www.youtube.com/watch?v=j2HkdQpc7fc&t=1s>
- <sup>2</sup> Webpage with details of the H02020 conference: <https://www.eso.org/sci/meetings/2020/H0.html>
- <sup>3</sup> Conference YouTube page: [https://www.youtube.com/channel/UCs0UoIX-xD\\_hU8RI-qSbLA](https://www.youtube.com/channel/UCs0UoIX-xD_hU8RI-qSbLA)
- <sup>4</sup> Slack workspace: <https://h02020.slack.com>
- <sup>5</sup> Canadian Astronomy Data Centre website: <https://www.cadc-ccda.hia-ihc.nrc-cnrc.gc.ca/en/meetings/>
- <sup>6</sup> EuroPython Society discussion of online events: <https://www.europython-society.org/post/617463429296472064/sharing-our-research-and-licenses-for-going-online>
- <sup>7</sup> Mattermost open source collaboration platform: <https://mattermost.com>
- <sup>8</sup> Golden Webinars: <https://www.uc.cl/en/news/golden-webinars-in-astrophysics>
- <sup>9</sup> ESO Cosmic Duologues: <https://www.eso.org/sci/meetings/garching/Cosmic-Duologues.html>
- <sup>10</sup> Conference reddit site: [https://www.reddit.com/r/cosmology/comments/hdwjgp/eso\\_conference\\_h0\\_2020\\_assessing\\_uncertainties\\_in/](https://www.reddit.com/r/cosmology/comments/hdwjgp/eso_conference_h0_2020_assessing_uncertainties_in/)