**4.1 Videoconferencing**

It is indispensable to approach a scientific community in which ordinary operations are carried out in a sustainable fashion. We do not even have a choice in this regard.

In our present framework, scientific exchange is organised in the form of workshops, conferences and seminars, all of which are typically conducted in a single location to which the remote participants travel. Visiting these events is a key way for young scientists to obtain recognition in their field, and established researchers benefit from the opportunities to promote their research via these channels. At present, the initiation and continuation of careers in science depends decisively on travel.

However, with current transportation means there is no way that we can keep travelling as much and as far, neither as a community nor as individuals. Hence, we need to find and establish sustainable ways to uphold scientific exchange and to connect and communicate within our community. And in order to protect future generations of researchers, we need to achieve this in such a way that not even the establishment of a career will violate principles of sustainability. For instance, it must not be that young researchers will travel extensively and are thus forced to accumulate an enormous GHG footprint if they want to stand a reasonable chance of finding continued employment in academia, as is currently the case.

It is evident that videoconferencing (VC) will be a vital tool in a future sustainable science environment.

By construction, this technology enables the active participation in all forms of scientific exchange over large distances. Fortunately, the benefits brought forward by VC are strategically aligned with several societal challenges such as inclusiveness, social obligations, financial considerations,

work-life balance and others:

* Facilitate the inclusion of scientists from less resourceful universities, developing countries or adverse political circumstances.
* Allow scientists with children or family care duties, scientists with particular disabilities and (at present) scientists with environmental concerns to participate in conferences according to their capabilities and needs.
* Online participation bears substantially lower costs than on-site participation. This fact easily boosts the reach of the event (e.g. the annual international conference “Amplitudes” quadrupled its registrants from 175 to 706 when it moved to a VC platform in 2020).
* At a personal level, attending virtual events (or selected talks) can be less time demanding and jet-lag and travel-related stress is avoided (yet, this can be viewed as lowering the commitment or require participation at night-time).
* Remote delivery of talks may attract a broader pool of potential speakers. Virtual events may thus increase the amount of inter-disciplinary communication.

These benefits on their own are a significant motivation for offering virtual conferences.

It is clear that virtual workshops are not the same as physical workshops, and there are widely held reservations against this mode of transmission throughout the community. Virtual events cannot provide all of the positive effects of physically being at a workshop and effortlessly connecting to nearby people. They are (probably) less effective in encouraging and maintaining interactions among the participants during breaks and after sessions. Nevertheless, the 2020 coronavirus pandemic vividly demonstrated the power and viability of VC in conducting virtual conferences and webinars with high-profile participants and a large attendance. It will be a challenge to find suitable virtual replacements for the elements that are otherwise eased by physical proximity.

Altogether, we prefer to shape the way in which we conduct scientific exchange by ourselves instead of waiting and being forced. Time is an important factor. For these reasons, we intend to take the lead in enabling VC to become a realistic alternative to travelling to conferences. We all need to gather experience in this regard and get used to virtual conferences. They need to become a habit and making them a useful experience requires developing new habits. Importantly, virtual conferences need to become recognised and well-attended by established researchers to pave the way for a sustainable career path for youngsters.

We will therefore develop formats for scientific exchange that combine the positive aspects of physical and virtual events. A key element of our strategy is to conduct scientific events at least in a semi-virtual fashion, and to offer the option of remote attendance and remote talks as a matter of principle. With this inclusive approach we will help establishing a scientific environment operating at net-zero carbon emissions in which the need for physical presence at inter- and transcontinental workshops will increasingly be the exception.

In the following we present measures to approach the aforementioned goals.

**4.1.A Workshops at D-PHYS**

All scientific meetings, workshops, conferences at D-PHYS offer the possibility of online participation for speakers and participants.

Comments

* As a standard at D-PHYS this principle represents a distributed effort to consider, explore, work out and improve online formats which are inevitably needed to maintain an excellent level of scientific exchange.
* Participation by VC can be available at a fee (for the use of VC infrastructure) which may be different from physical participation fee (e.g., to fund coffee breaks). A typical fee for the use of VC infrastructure at ETH Zürich could be around 400 CHF per hour of online conference including the preparatory testing prior to the meeting with 3 speakers and 1 chair.
* The option for remote participation should be communicated in invitations and advertisements so that the option will be made use of by a considerable fraction of contributors and participants in order to avoid the GHG emissions for their travel.
* Implementation of this standard has a natural outreach component: It will have a broader impact, it will automatically be communicated across the physics community, and we can actively advertise it.

**4.1.B Research Seminars and Colloquia**

Scientific seminars and colloquia at D-PHYS are open to remote talks.

Comments

* Seminars and colloquia serve a similar purpose as workshops and conferences and due to the implied travel they are subject to similar considerations towards virtualisation. It will therefore be essential to facilitate the transition towards a virtual platform.
* Next to avoiding travel-related CO2 emissions, invited speakers may have other valid reasons to avoid travelling altogether and/or to avoid spending an extended period of time away from their home or family. These reasons should not represent an obstacle in their ability to present their research.
* Hence, the option to deliver talks virtually should be mentioned in the initial invitation.
* Setting up seminars to receive remote talks can be done with some efforts including booking the adequate rooms with the corresponding technical supplies. Recording of talks and/or a live transmission are options which may or may not be advisable depending on the situation or preferences.
* The overall experience of an actual visit vs. a virtual talk will be different, but our experience has shown that the scientific content can be transmitted at comparable quality, and immediate interaction with the speaker works well.
* Our principal scientific communication activity, the Zurich Physics Colloquium, was suspended during the coronavirus pandemic. With some experience, (some of) the scheduled talks could have been transferred to a virtual platform right away towards maintaining an important activity. It would therefore make sense to gain experience by permitting some of the talks to be delivered virtually.
* The reach of local seminars can be widely enhanced by using VC and by advertising the events in community lists or directories (one recent example is the lecture series on Ultrafast nonlinear optics and spectroscopy given by Prof. Giulio Cerullo from Politecnico di Milano in the framework of the EPFL Doctoral Program in Physics in June 2020 with more than 70 participants from the whole ETH domain). VC seminars may also facilitate the active participation of researchers from developing countries in topics of current interest.

**4.1.C Committee Meetings and Doctoral Defences**

Committee meetings including doctoral defences are open for external members to participate remotely by videoconferencing.

Comments

* As a general rule, remote participation in committee meetings by VC should be offered to external committee members (at least as an alternative to travelling) unless the particular occasion mandates a site visit.
* Allowing external members to join by VC will allow a broader range of experts to participate in these meetings (e.g. in the case of care-taking obligations, teaching duties, travel restrictions); it will also save a significant amount of resources; similar provisions as for remote participation in scientific workshops apply, please see above.
* For doctoral defences, remote participation of external co-referees by VC is explicitly encouraged. In view of the expected change of doctoral regulations to require at least one external university professor as co-referee, this default option will have a significant effect.
* For doctoral defences, it would be worthwhile to consider allowing colleagues and family members to attend the public defence talk by VC.

**4.1.D Participation in VC Workshops**

All D-PHYS members make efforts to participate in virtual conferences regularly, at least at one event per year.

Comments

* There was practically no supply of virtual conferences before the coronavirus pandemic. The demand for such activities promotes and supports the supply. A number of shortcomings of virtual meeting and workshops may be mitigated by measures we have not developed and established yet. Therefore we have to gather experience from attending. Participation at VCs will provide very important insights to enhance their functionality, find necessary basic rules, and to get ideas and inspirations for own conferences.
* Department may conduct regular (annual) surveys as an implicit reminder to participate in virtual events and towards collecting and sharing worthwhile experiences in this regard.

**4.1.E Credit Points for Doctoral Studies**

Doctoral students will earn 3 of their 12 credit points through VC-related activity or service.

Comments

* Useful activities include assisting in setting up or conducting VC components of a workshop (or a research seminar or lecture series), participation in a workshop through VC or delivering a VC talk in a remote seminar or conference.
* Fluency in VC skills will be relevant in the doctoral student’s future working environment and it will help her/him to thrive.
* The gathered experience will be exported to other universities and institutes, or branches of the economy and society.
* As usual, supervisors would be in charge of and responsible for awarding credit points.

**4.1.F VC Infrastructure**

D-PHYS will take care of planning and initialising the installation of major shared VC infrastructure.

Comments

* With an increased frequency of events conducted by VC (fully or in parts), there will be an increased demand for dedicated rooms equipped with VC hardware. Planning efforts for the new HPQ building are taking this into account.
* The ETH unit ID MMS typically takes the lead in installing and maintaining VC infrastructure.
* Depending on future developments and demand, D-PHYS may decide to operate dedicated VC servers and software.
* Standard and supplementary VC equipment should be acquired as needed by individuals rather than preemptively. This strategy worked well in maintaining teaching during the coronavirus pandemic.
* It may make sense to pool specialised equipment for conducting VC events for general use (e.g. dedicated cameras, throwable microphones to enable a reliable transmission of comments and questions from a local audience).
* Conducting a virtual event for hundreds of participants with the assistance and infrastructure of ETH ID MMS can amount to 400 CHF/hour including the software licence and the pre-event test with with 4 speakers/hour.
* It could be a possible incentive for VC pioneers to obtain financial support by D-PHYS for covering the IT costs of the virtual meeting or conference.

**4.1.G VC Implementations**

D-PHYS discusses and collects hints, suggestions, instructions, best practices and references to optimise the implementation of VC aspects of (fully or partially) virtual events.

Comments

* Typical drawbacks of virtual conferences and meetings, such as people living in different time zones or connection and bandwidth issues, can be mitigated by a number of measures.
* A D-PHYS wiki may list suggestions and references.

Suggestions

A list of suggestions includes the following items:

* It is good practice to record all talks and to make them available to the participants at least during and somewhat beyond the duration of the workshop. This will compensate for time zone and connection issues.
* Similarly, making talk slides available to the participants ahead of the talk will compensate for ubiquitous connection and bandwidth issues, especially for participants in countries with a less developed networking infrastructure.
* Talks can be streamed to non-interactive services (e.g. YouTube) to have a broader reach and to minimise particular software requirements (may improve bandwidth issues). The option of audio-only transmission (together with the availability of slides) can serve as a backup solution for bandwidth-issues.
* A chat channel (potentially separate from the VC solution) could be used for discussion and interaction.
* Depending on the nature of the event or the preferences of the speaker, talk recordings may be kept indefinitely (for future references) or be removed shortly after the meeting (for confidentiality of current research).
* An international meeting can be organised with a set of hubs to transmit the event to a local community of researchers (e.g. Photonics Online Meetup). This enables on-site interactions while reducing the travel to the local/national level.
* Online collaboration tools (e.g. slack) are good means to subsequently discuss the contents of a talk or session among the participants. This can be a valuable tool, record and reference to replace part of the on-site interactions at breaks and after sessions.
* Random breakout sessions during breaks (small groups of participants are assembled at random into separate rooms of the virtual meeting) may encourage new interactions among participants.
* Monitoring of the various virtual channels can be challenging (raised hands, chat contributions, cyberspace attacks, audio/video control, technical aspects of streaming), and it makes sense to have some people dedicated to specific tasks.
* One may engage a small group of participants to initiate and intensify connections with other participants over the course of the event.

References

Further information and details can be found in the following references:

* Handbook for Nearly Carbon Neutral Conference (University of California at Santa Barbara): <https://hiltner.english.ucsb.edu/index.php/ncnc-guide/>
* Feral conference (online-only conference): <http://perc.ac.nz/wordpress/feral/> plus LSE-blog on experience: <https://blogs.lse.ac.uk/impactofsocialsciences/2019/05/03/running-a-nearly-carbon-neutral-conferencelessons-from-the-feral-conference/>
* Handbook for a semi-virtual conference: <https://static.uni-graz.at/fileadmin/veranstaltungen/music-psychology-conference2018/documents/Semi_Virtual_Conference_Guidelines.pdf>
* How to Organize an Online Conference. Nature Reviews Materials 2020: <https://doi.org/10.1038/s41578-020-0194-0>