

Demographic study of major conferences in heavy ion physics

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We present a study of the demographics of major conferences in heavy ion physics. We look at the distribution of talks by gender for Quark Matter, Strangeness in Quark Matter, Initial Stages, and Hard Probes between 2011–2022. We find that women are often underrepresented among plenary speakers and usually underrepresented among parallel speakers. At Quark Matter, women are more likely to be given a poster presentation in lieu of an oral presentation. The Quark Matter summary talk has never been given by a woman. We discuss the collection of data and possible approaches to make the field more equitable and, therefore, more scientifically productive.

1 Introduction

An equitable distribution of talks at conferences is key to an equitable field, with a vibrant scientific discussion where scientists have an opportunity to be heard. It is difficult to stay in science if you are unable to present your work, and conferences are the primary means in science for networking so that one can get the next job. Conference attendees frequently notice a disparity in the representation of male and female speakers. This is so frequent that there are internet meme deriding "manels" (an all-male panel) and "manferences" (an all-male conference) [1]. Some conferences compile statistics for individual conferences. Individual data points indicating dramatic underrepresentation of women are frequently disregarded as statistical fluctuations, but, oddly, these are usually statistical fluctuations downward. There is even an online calculator to estimate the probability of underrepresenting women [2], demonstrating that the observed results are highly improbable if talk allocation were equitable. However, it is difficult to infer the state of the field from data on these isolated conferences.

We compiled data on major conferences from heavy ion physics listed in in tab. I using the steps outlined below:

1. Use a python script to scrape participant data from Indico timetable
2. Upload data to database
3. Remove chairs, student lectures, non-physics talks¹, and flash talks²
4. Separate plenary talks, parallel talks, and poster presentations
5. Organize all ~ 2500 names in a central database and identify gender identity and whether a theorist or experimentalist. Crowd source to assist with identification.
6. Determine uncertainties by assuming all unidentified presenters (excluding known non-binary physicists) are either male or female.

We recognize the limitations of identifying gender through crowd sourcing rather than through self-identification, however, this study would not be possible otherwise. We did not attempt to study geographical location or career stage, as these change over time and would be trickier to study. We focus on major conferences, but include some minor conferences in the database of all speakers to counteract possible biases in speakers at major conferences. People removed

¹ This includes welcome/closing addresses, talks by program managers, diversity talks etc

² A flash talk is a talk given as an award for a poster presentation.

³ These are variously called the talks committee, speakers' bureau, or conference committee, but will be referred to here as speakers' bureaus for simplicity.

in step (3) are also included in this database when they are physicists in the field. We can then use these data to get a good sample of the field, look at the distribution of talks over time for different conference series, and track an individual's presentations over time. Note that the numbers here are preliminary, as we continue to check for errors and identify additional participants.

Year	Conferences
2011	Quark Matter
2012	Quark Matter
2013	Strangeness in Quark Matter, Initial Stages
2014	Quark Matter, Initial Stages
2015	Quark Matter
2016	Hard Probes, Strangeness in Quark Matter, Initial Stages
2017	Quark Matter, Strangeness in Quark Matter, Initial Stages
2018	Quark Matter, Hard Probes
2019	Quark Matter, Strangeness in Quark Matter, Initial Stages
2020	Hard Probes
2021	Strangeness in Quark Matter, Initial Stages
2022	Quark Matter

TABLE I. Conferences studied

2 Theory vs experiment

There are a number of practical differences in the selection of theory and experimental speakers. Experimental heavy ion physics is dominated by large collaborations with hundreds of collaborators, which have speakers' bureaus³. For all high profile conferences, the vast majority of experimental speakers are selected by experimental speakers' bureaus, with only a few speakers selected by the organizers for topical talks. Speakers' bureaus, in principle, are responsible for overseeing fair allocation of talks, particularly among more junior collaborators. Talks on behalf of an experiment are typically marked as such, and generally the emphasis is on elevating students, post docs, and tenure track faculty.

In contrast, theory is dominated by single-PI groups or few-PI collaborations. Theorists comprise a smaller fraction of the field and are on average receive less funding than experimentalists. Theory does not have speaker boards or any regulatory body (beyond individual conference organizing committees) and they tend to write papers with significantly fewer authors. In addition, few faculty give parallel experimental talks, while it is common for faculty to give

parallel theory talks.

3 Demographics of the field

Our database of people in the field is approximately 40% theorists and 60% experimentalists. Women are approximately 32% theorists and 68% experimentalists and men are approximately 42% theorists and 58% theorists. The statistics from the database, however, could be skewed because it represents people who are already giving talks at high profile conferences and would not include people who do not get the opportunity to speak at conferences.

Overall, approximately 19% of all speakers are women, and our data indicate that the number of women has increased during this time period. There is a greater fraction of female experimentalists than female theorists. We investigate alternate measures of the fraction of women in the field. Each experiment maintains a list of authors, so it is fairly straightforward to estimate the fraction of experimentalists who are women. We contacted several experiments to get the fraction of female authors, listed in tab. II. The weighted average of the numbers in tab. II is 21%, which is comparable to the 22% in our sample overall. Note that while tab. II includes most female experimentalists, we do not have data from some experiments represented at major conferences in the field, including CMS, SHINE, and the experiments at GSI/FAIR. However, talks are not uniformly distributed across the field; tab. III lists the fraction of women by their job type. PhD students and post docs give the vast majority of parallel experimental talks so the fraction of female experimental parallel speakers should likely be higher than 23% if they were weighted by the seniority of the speaker.

	Collaborators	% women
ALICE	1005	23%
ATLAS	~ 50	~ 30%
PHENIX	104	21%
STAR	370	15% (7% undeclared)

TABLE II. Fraction of female authors on several experiments. Only heavy ion authors are listed for ATLAS.

The fraction of female theorists is harder to quantify, as the sample is less well defined than experimental authors. In our sample of all speakers, 15% of all theory speakers are women. We hypothesize that the low percentage of female theory speakers may be attributed to the underrepresentation of female theorists in allocated presentations. To test this hypothesis, we investigate alternate measures of the fraction of women in theory. We can estimate the number of young theorists in the field by studying conferences that cater to early career scientists. Theory participants at Hot Quarks, which skews towards younger scientists and towards the US and Europe, have ranged from 14–18%, increasing over time (last held in 2018 so one anticipates further increases by 2022). Students and post docs in theory who participated in the

JETSCAPE school online in 2020 were 20% female. The JETSCAPE school was scheduled to accommodate people around the world and, since it had no costs associated with it and was open to all interested participants, removes many barriers to participation. We, therefore, consider 15% to be a minimum fraction of female theory speakers, with up to 20% women among current students and post docs in theory.

Category	% women
PhD Student	31.3%
Post doc	23.2%
Physicist	17.9%
Senior Engineer	12.7%

TABLE III. Fraction of women on ALICE author list by job type.

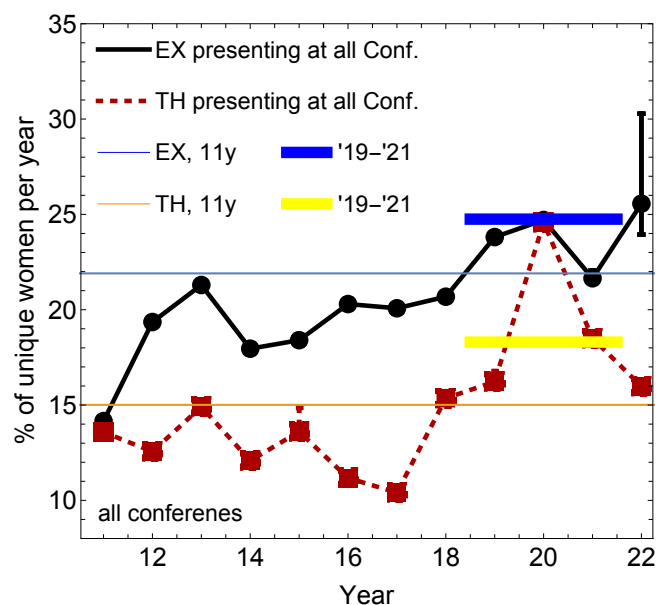


FIGURE 1. Fraction of female presenters in theory and experiment over time compared to the average over the entire sample and in recent years.

We can then check our assumptions about the increase of women over time by looking at the percentage of unique women speakers in a give year, divided by theory and experimentalists. To be clear “unique speakers per year” implies that is a women presents twice in a given year, she will only be counted once in this statistic for that specific year. In Fig. 1 one can see the breakdown by year for experiment in black and theory in red. Averages over all years are shown by a black line (experiment) and an orange line (theory), also a recent average from 2019–2021 is shown in blue (experiment) and yellow (theory). It is quite clear that there is an overall increase in time of both experiment and theory. Experiment shows a steady increase of women over time and the more current average is close to 25% of the field. Theory has much larger fluctuations, which can often be attributed to certain conferences in a give year that significantly underrepresented theory women. It’s also interesting to note that during

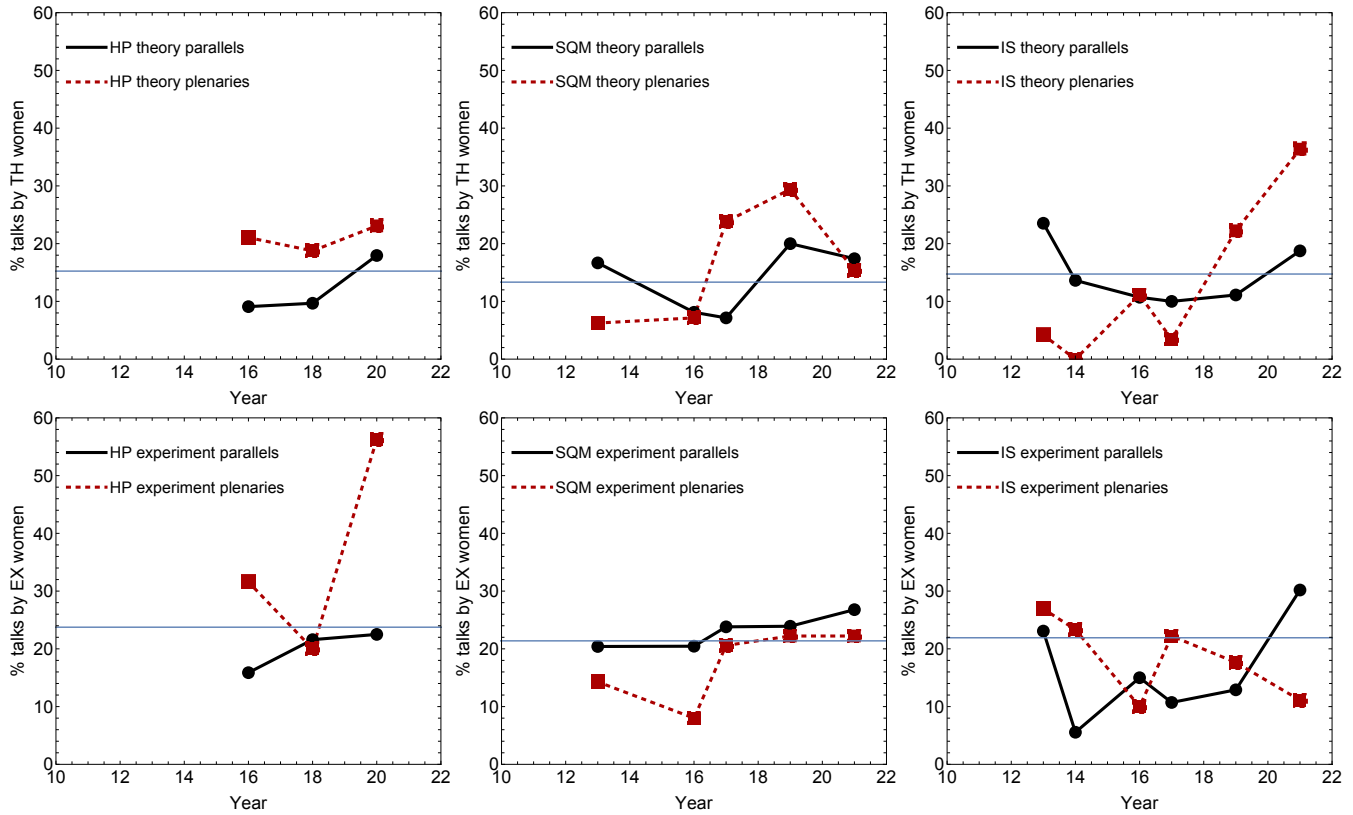


FIGURE 2. Fraction of parallel and plenary talks given by theorists and experimentalists at Hard Probes (HP), Strangeness in Quark Matter (SQM), and Initial Stages (IS). The lines show the average of the sample over all time.

COVID, when there were a number of virtual conferences, that theory has a large upshoot in women. However, now that most conferences have returned to in-person venues or hybrid, the percentage of theory women has decreased again.

Quark Matter is the highest profile conference in the field, with a talk at Quark Matter often a significant factor in whether or not a graduate student can continue on to a post doc and whether a post doc can continue to a faculty po-

Figure 3 shows the fraction of plenary and parallel talks given by female theorists and experimentalists. There are fewer plenary talks, so the fraction of talks given by women is more likely to have large statistical fluctuations. How-

The fraction of poster presentations given by women provides an interesting benchmark. Most poster presenters submitted an abstract for an oral presentation, but they were of-

4 Results

The fraction of talks given by women at Hard Probes, Strangeness in Quark Matter, and Initial Stages is shown in fig. 2 for both plenary and parallel talks. While there are fluctuations upwards, generally women are more likely to be underrepresented. Some individual conferences have extremely low fractions of female speakers, particularly Initial Stages and particularly for female theorists.

This is particularly true in theory, as experimentalists can develop their reputation within their collaboration. Quark Matter therefore deserves special attention.

ever, some conferences have particularly low fractions of talks given by women. Both theorists and experimentalists are generally underrepresented among parallel speakers.

ferred a poster instead. Poster presenters typically do not get to write proceedings. Data are not available for all Quark Matter conferences, as they are not always listed online, but

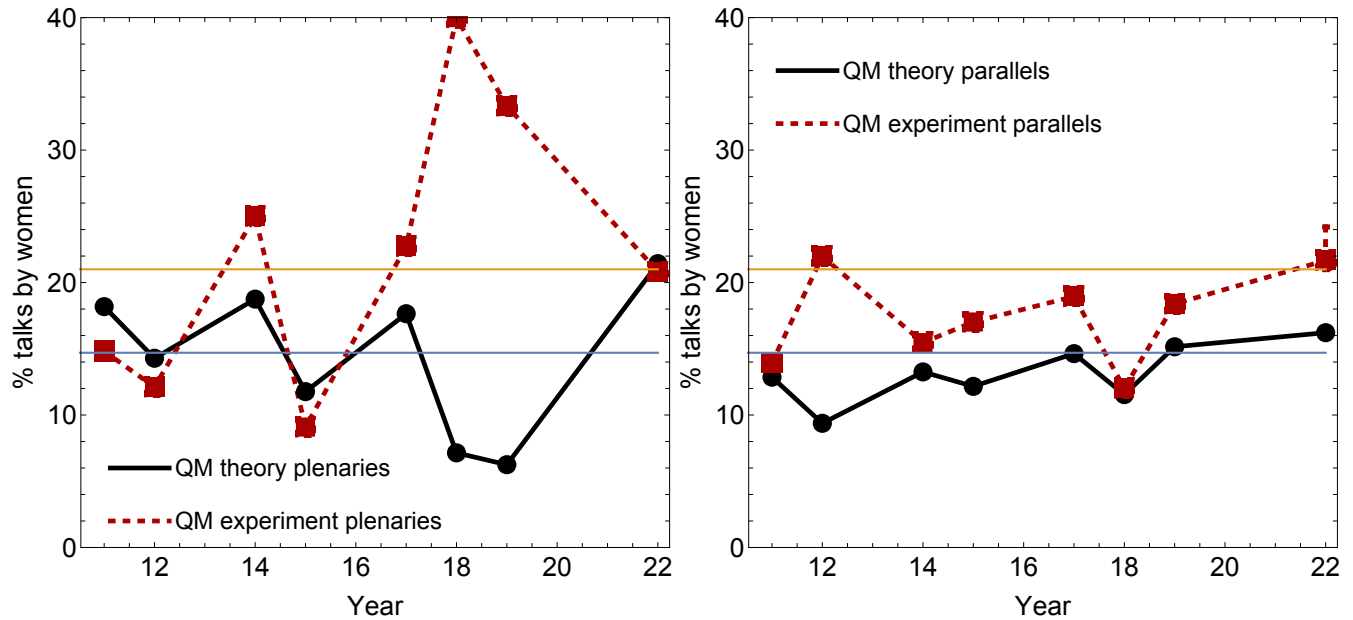


FIGURE 3. Fraction of plenary and parallel talks given by female theorists and experimentalists at Quark Matter (QM).

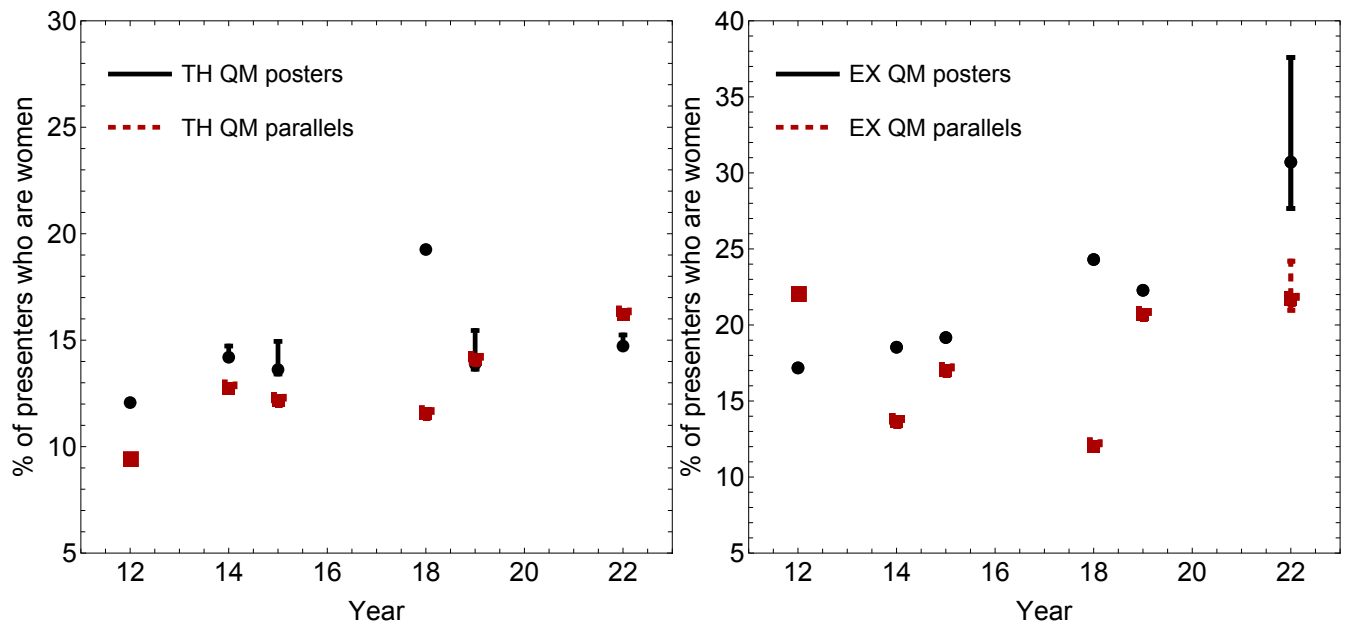


FIGURE 4. Distribution of poster presentations given by women compared to parallel talks given by women at Quark Matter for both theorists and experimentalists.

they are available for most. Many presenters would turn down the presentation opportunity instead, and some groups and funding agencies will only fund participation for an oral presentation. This therefore provides a chance to see if there is a disparity in abstract acceptance, as poster presenters are determined to present despite the lower prestige forum. Furthermore, experimental speakers' bureaus generally allow most or all people interested in submitting a poster to do so, provided that minimum standards are met, so experimental poster presentations are more representative of interest in

presenting. Figure 4 shows the fraction of poster presentations given by women. For 5/6 Quark Matter conferences, the fraction of women giving posters is higher than the fraction giving parallel talks for both theorists and experimentalists. While not conclusive, this indicates that abstracts submitted by women are less likely to be accepted for oral presentations.

We also noticed that some speakers are more likely to be repeat speakers, both for plenary and parallel talks. This effect is more pronounced for female theorists. Organizing committees seeking to ensure that there are female speak-

ers are more likely to invite a female speaker who has given another talk than to invite someone new. This is less pronounced for experimentalists because of speakers' bureaus. It is difficult to come up with metrics which demonstrate this which follow the practice that data should not be presented which identify individuals. However, we can compare the fraction of unique talks to the fraction of unique speakers, shown in fig. 5 for both theorists and experimentalists. When the fraction of unique speakers who are female exceeds the fraction of talks given by women, women are underrepresented. This may underestimate the effect, as people had to give a talk at one of these high profile conferences to be in the sample.

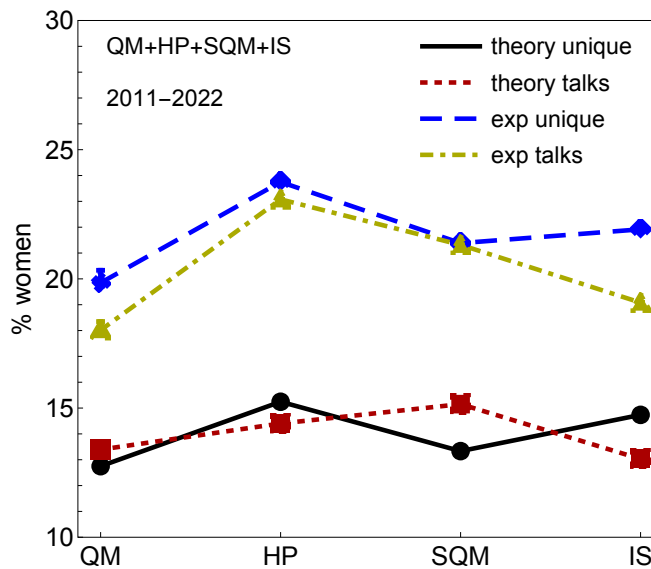


FIGURE 5. Fraction of theory and experimental talks given by women compared to the fraction of unique theorists and experimentalists at Quark Matter, Hard Probes, Strangeness in Quark Matter, and Initial Stages.

We also observed that, while women may be represented among experimentalists, they are less likely to be invited to give vision talks – those which ask for her opinion on a subject – than men. The prime example of this is that, in all 29–31 Quark Matter conferences since 1979⁴, the conference summary talk has never been given by a woman.

5 Discussion

Given the importance of talks in developing young scientists' careers, it is particularly important that talk allocation gives all scholars a fair chance to present their work. There are other inequities in talk distribution which we did not study here, including by race and ethnicity and the participant's geographical location. This inhibits the fair consideration of the

⁴ There is some ambiguity in the early years, as there are three conferences which have some claim to being the first Quark Matter [3].

ideas developed by these scientists and impedes progress in the field.

We assume that, in most cases, conference organizers do not openly harbor attitudes against women or their work and do not consciously aim to underrepresent women among speakers. Indeed, many organizing committees make a concerted effort to find female speakers. The underrepresentation of women among speakers may arise partly because women are more likely to be at institutions which cannot support their travel, women may be less likely to receive adequate support or mentorship from their supervisors, and, consistent with extensive social science research indicating that women are less confident [4, 5], women may be less likely to submit abstracts for high profile conferences. Structural obstacles women disproportionately face, such as more extensive and critical review of their scientific work [6], may inhibit women developing work which can be presented at a high profile conference. This could partially explain why women are underrepresented among experimental parallel speakers, as these disparities surely happen inside collaborations as well, which could lead women to be less competitive for talks at high profile conferences. The subjects women study may also be less valued by the field [7].

A standing body to oversee major conferences could lead to significant improvements in these conferences. Such a body could oversee developing more consistent and clear policies. It would also be useful for addressing the persistent issues with harassment at conferences and help ensure that serial harassers are not put in positions of power. Policies such a body could consider include:

1. Double blind review for first round of abstract review
2. Use a rubric for evaluation of abstracts
3. Use a multi-stage process for determining candidate plenary speakers for major conferences
4. Use a database of speakers to ensure that a wider range of plenary speakers is considered
5. Open call for (anonymous) speaker nominations
6. Require conference hosts to address procedure for allocating talks in host proposal
7. Explicit rules for how frequently someone can give a plenary talk
8. Increase the number of talks and posters

Double blind review has been shown to lead to more papers accepted by women [8] and double blind applications for telescope time not only increased the fraction of women receiving time but also increased the fraction of first-time users [9]. Having double blind review for at least the first round would likely address multiple forms of inequity, as

well as leading to a greater perception of fairness and more confidence in the process in the community. A double blind first round does not preclude considering other factors, such as experiment, geographical location, or career stage of the speaker, at a later stage, but would help ensure that the abstract is evaluated for its content. A rubric for evaluation of abstracts would also help with more consistent evaluation, perhaps with reweighting of scores as done by the National Science Foundation for panel reviews.

A multistage process for determining plenary speakers would help ensure that a wide range of candidates are considered. When women and minorities are interviewed for faculty positions, they are more likely to be hired [10]. This should translate to consideration of conference speakers, so a data based can be used to help ensure that a complete list of candidates is considered. Inspirehep.net maintains a database of all researchers in high energy physics. Features which would enable searches for possible speakers in different topical areas would be useful for multiple conferences, as well as for job searches. Particularly for high profile conferences, there could be an open call for speaker nominations, including anonymous and self-nominations. This would also help ensure that a complete pool of speakers is considered.

Furthermore, conference hosts should be required to address how talks will be allocated in their host proposal. This would help prevent surprises and mistakes repeated over multiple conferences. Explicit rules about repeat plenary talks would also ensure fairness. Finally, the total number of talks and posters could be increased. The size of the field has increased significantly, and that may mean that these conferences should grow as well.

We hope that at least some of these ideas will be considered, but at the very least, we hope that this will begin a robust discussion in the field about who deserves a chance to be heard.

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