PROCEEDINGS OF SCIENCE

The rapporteur report on the diversity session at the ICRC2023

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The Diversity Session at ICRC2023 marked a significant step towards enhancing inclusivity within the astroparticle community. This report not only documents the lively discussions of the session but also highlights a cornerstone of our efforts: the outcomes of the pre-conference diversity survey. Professor Hiromi Yokoyama's thought-provoking presentation illuminated a pivotal aspect: the factors affecting the attrition of female students, particularly in the field of physics.

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∗Speaker

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1. Introduction

The initiatives for Diversity, Equity, and Inclusion (DEI) have become increasingly important in recent years. The ICRC introduced a diversity program in 2019 Madison[1]. Despite transitioning to an online format in 2021 Berlin[2], the initiative persisted. This year, we organized an on-site lunchtime session, preceded by a survey. We invited Professor Hiromi Yokoyama, Deputy Director of the Kavli IPMU at the University of Tokyo, to discuss the gender balance issues in Japan.

2. The Diversity Session

The diversity session was held on July 28th during lunchtime. The session saw an impressive turnout of over 130 participants. The content of the session is shown in Table 1. After Prof. Ishihara explained the purpose of the session, Prof. Yokoyama gave a keynote lecture, followed by a Q&A session that included the audience. Then, the author reported on the analysis of the preliminary survey.

To encourage attendance, lunch boxes featuring Nagoya's famous "Uiro-bar"[1] were provided free of charge.

Table 1: Timetable of the Diversity Session

2023-07-28	Title	Speaker
11:50 - 12:00	Session Introduction	Aya Ishihara (ICEHAP / Chiba-U)
12:00 - 12:20	Keynote: "What is Holding Female Scientists Back?"	Hiromi Yokoyama (Kavli IPMU / U-Tokyo)
12:20 - 12:35	Q&A Session + Real-time survey (with Slido)	
12:30 - 12:45	Result of pre-surveys	Shota Takahashi (KMI / Nagoya-U)
12:45 - 12:50	Closing	

3. Keynote : "What is Holding Female Scientists Back?"

Prof. Yokoyama spotlighted gender studies within science in Asia. Her team's research focused on the perceived masculine nature of physics and math. While many studies have been conducted in the US and Europe, she presented a study with a regional perspective from Asia. She shared intriguing data contrasting Japan and England, highlighting societal factors that deter females from pursuing these fields in Japan.

According to the results of the PISA math test taken by 15-year-old students, the scores of both Japanese male and female students are high relative to the average of OECD countries. However, the number of Japanese female students entering university in STEM fields is quite low compared to other OECD countries. Why does this disparity exist? That is a question we are facing in Japan.

[1]Uiro is a traditional Japanese steamed cake made from rice flour and sugar, known for its chewy texture. It comes in a variety of flavors, including red bean, green tea, and chestnut.

Figure 1: Photo collage of the diversity session. Despite being held during lunchtime, many people joined. Participants showed a high level of interest, leading to lively and fruitful discussions.

Figure 2: Photo of the lunch boxes provided. (Bottom-Left) "Uiro-bar" refers to a bar-shaped version of Uiro, which is a speciality of Nagoya.

There was prior research that summarized three categories of factors contributing to the masculine image of physics[3]. Prof. Yokoyama and her team expanded on this by adding a regional factor named "social climate" and conducted an online survey on the "masculine images of physics and math" [4]. They compared the results between Japan and England. The slide she showed us is shown in Fig. 3.

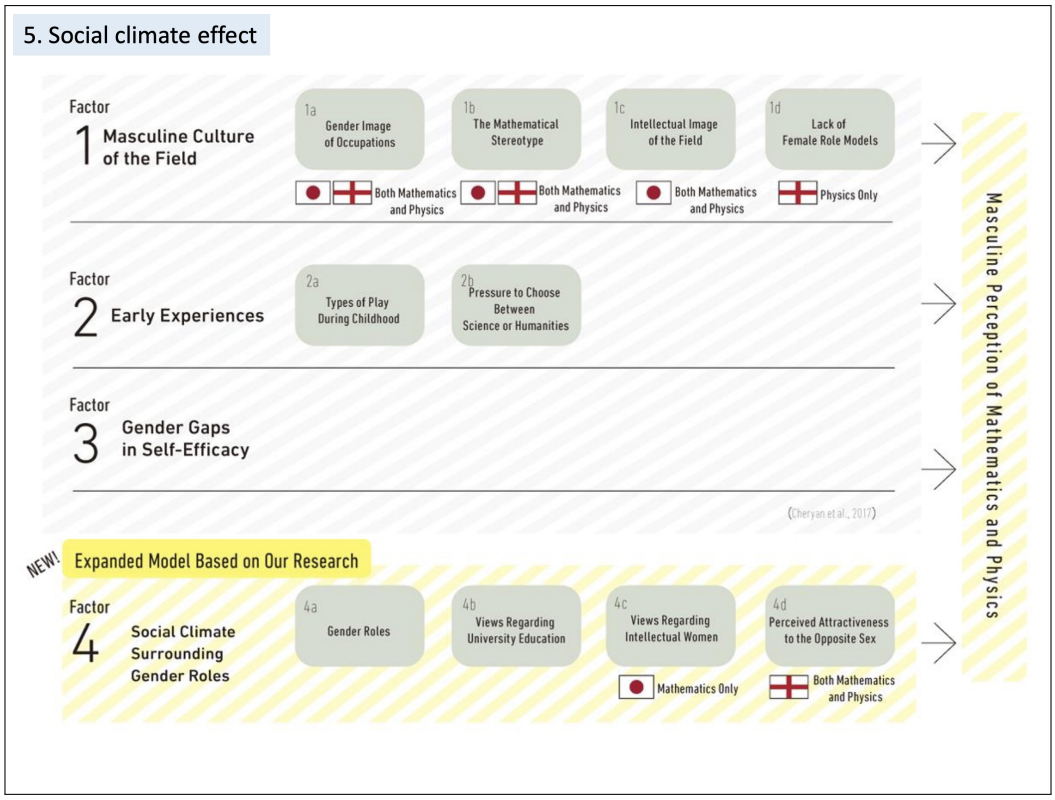

Figure 3: A regional factor named "social climate" was added to three categories of factors summarized by prior research. The flags indicate items with a significant contribution to the masculine image of physics and math. (Credit: RISTEX Yokoyama PJ/ Design: Makoto Tomita)

In both countries, "occupation" and "mathmatical stereotype" that female students are not good at math are significant factors contributing to the masculine image of physics and math.

The "lack of role model" was significant only in England. Although England is perceived to have many active females, it is still considered to be lacking in this area. This is interesting because, while there are fewer females in physics in Japan, other factors are more significant there.

Regarding Factor 4, which is a Social Climate factor, the perception that "smart women are not liked" is significant in Japan, while the perception that "mathematics is not attractive" is significant in England.

To examine the influence of stereotypes on mathematics, a further study was conducted with a survey that eliminated these stereotypes. The percentage of students choosing STEM for higher education increased among those who were not influenced by stereotypes. For this reason, we need to assure female students that they too can pursue math and physics. It is essential to let those who enjoy these subjects know that they can continue to engage with them. Providing such encouragement is very important.

To summarize, different countries have different social climates, so separate approaches are required. However, it is still important to encourage female students that it is okay to like science and that it is okay to be themselves.

4. Real-time Survey during the Session

Right after the keynote session, we asked the audience a few questions using Slido[2], a real-time audience interaction tool. Approximately 100 audience members responded. We were delighted to see that many students joined the session. Furthermore, the ratio of males to females was balanced, indicating active participation from both genders. It's also worth noting that the number of non-binary/gender-queer participants was significant and should not be overlooked. We need to ensure that we are creating an environment where all voices are heard.

We asked the audience about the age at which they think female students drop out of the science track. The results are shown in Fig. 4. It appears that this trend starts in middle school in many countries. It may be necessary to provide continuous educational support and opportunities to encourage them at this age.

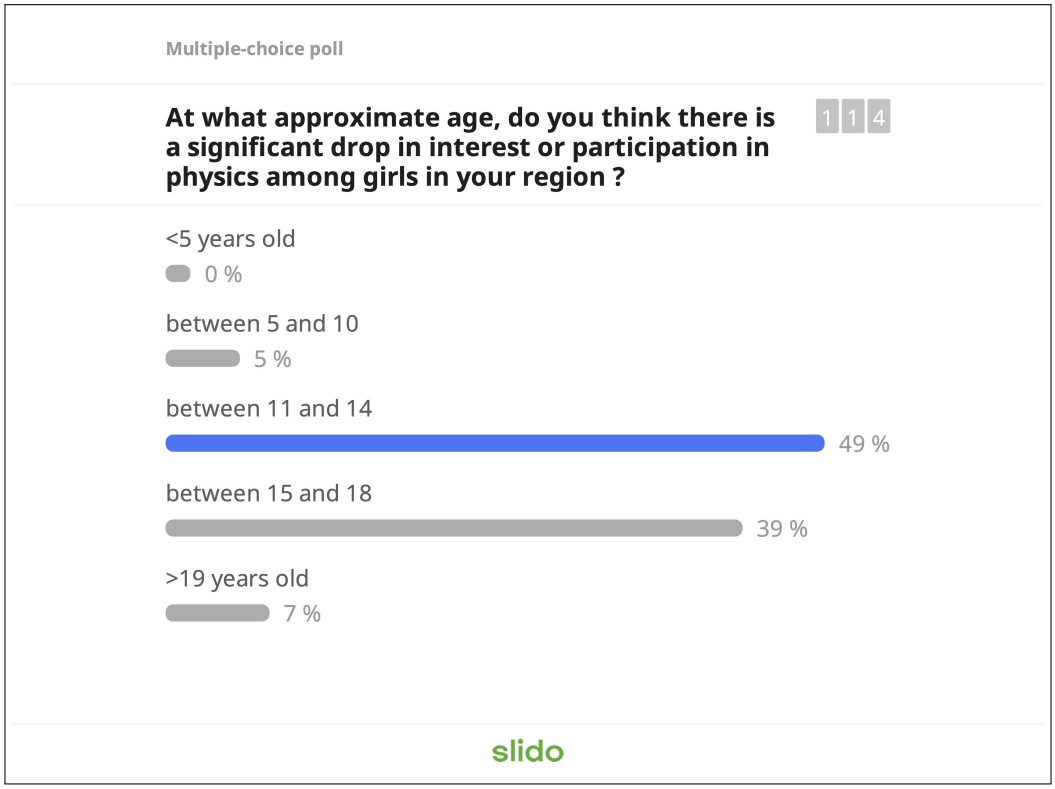

Figure 4: The age at which the audience thinks female students drop out of the science track is shown. It seems to start in middle school in many countries.

We also asked about the factors they think cause female students to lose interest in studying physics. The results are shown in Fig. 5. A word cloud was generated in real-time during the session. The larger the words, the more they were agreed upon. As a result, "Parents" and "Teachers" were identified as potential inhibitory factors. This aligns with my impression.

[2]https://www.slido.com/

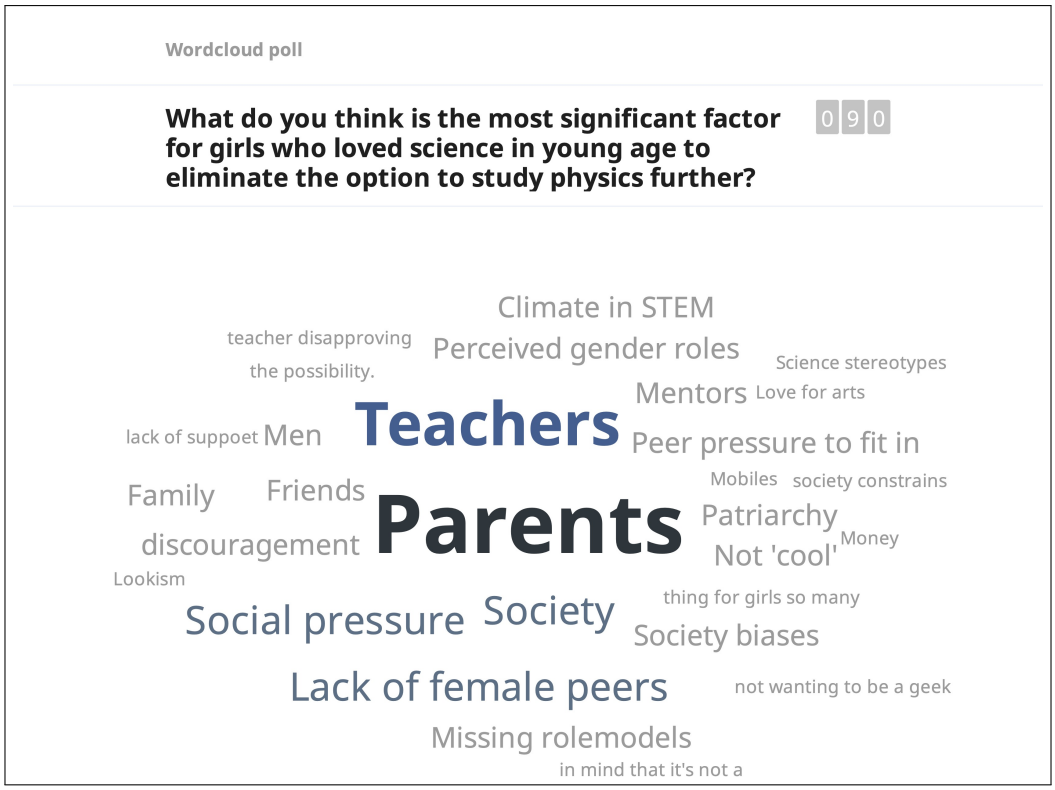

Figure 5: The factors which the audience thinks cause female students to lose interest in studying physics are shown. The larger the words, the more agreement they received.

5. Results of the Pre-survey

The questionnaire was sent to all registrants prior to the conference. The results from the pre-survey were reported at the end of the session.

5.1 Methods

We used Google Forms to conduct the survey. The survey period was from July 8th to 21st, 2023. We did not collect email addresses to allow respondents to answer freely. Please refer to the appendix for a list of questions asked. For analysis, we used Python packages[3].

5.2 Overview

Table 2 shows a summary of the gender ratio among participants. We sent requests to 1429 registrants, and about 20% responded. The gender distribution among respondents revealed a higher female participation rate in the survey than at the conference.

5.3 Demographics

We collected responses from a wide range of ages, from the 20s to over 90s. We will show just a couple of demographics here.

[3]Pandas for data aggregation, SciPy for Chi2 test, and Altair for visualization

Table 2: Overview of the pre-survey

2023/07/08 - 21	Entries	Ratio	Remarks
Request Sent	1429		ICRC2023 Registrants
Male	1085	76.0%	Entries / Registrants
Female	335	23.4%	Entries / Registrants
Others	9	0.63%	"N/A"
Responded	295	20.6%	Responded / Request Sent
Male	195	66.1%	Entries / Responded
Female	90	30.5%	Entries / Responded
Others	10	3.40%	include "Prefer not to answer"

The percentage of female respondents decreased as the age group increased (Fig. 6). In many research domains, young researchers in their 20s and 30s responded (Fig. 7). We should not overlook the fact that some people responded with "non-binary" and "self-identify" (Fig. 8).

More plots can be found on our GitHub Pages [4] [5].

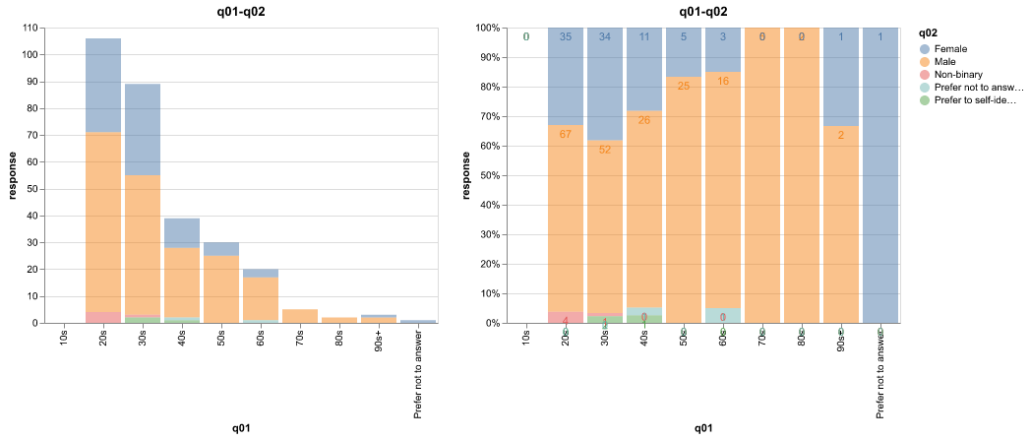

Figure 6: Ages and Gender Identities: (Left) Bar chart showing age distribution. The colors denote gender identity. (Right) Stacked bar chart of the age distribution by gender identity with number of entries overlaid. The percentage of female respondents decreased as the age group increased

[4] GitHub Pages: https://www.icrc2023.org/surveys/diversity/

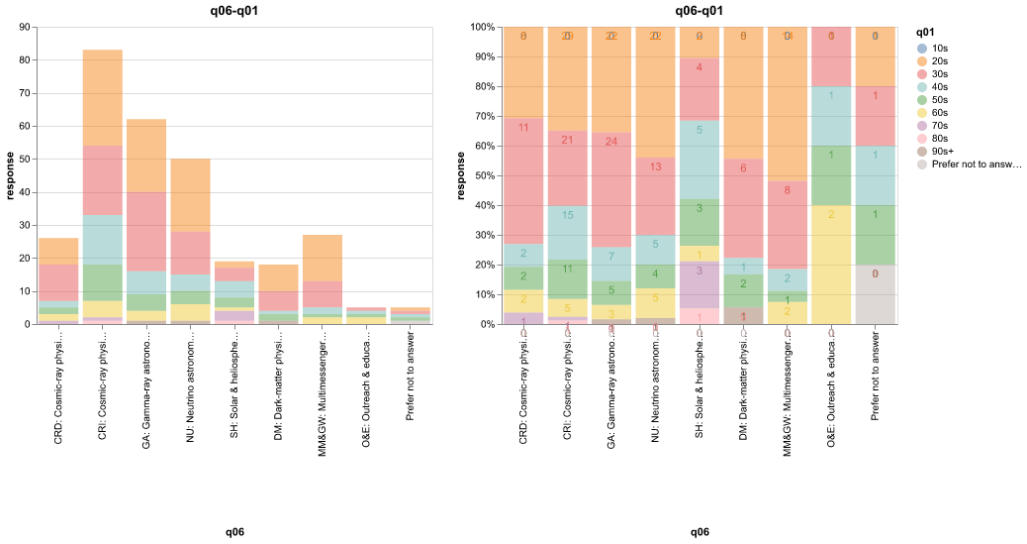

Figure 7: Research Domains and Ages: (Left) Bar chart showing research domain distribution. The colors denote ages. (Right) Stacked bar chart of the research domains by ages with number of entries overlaid.

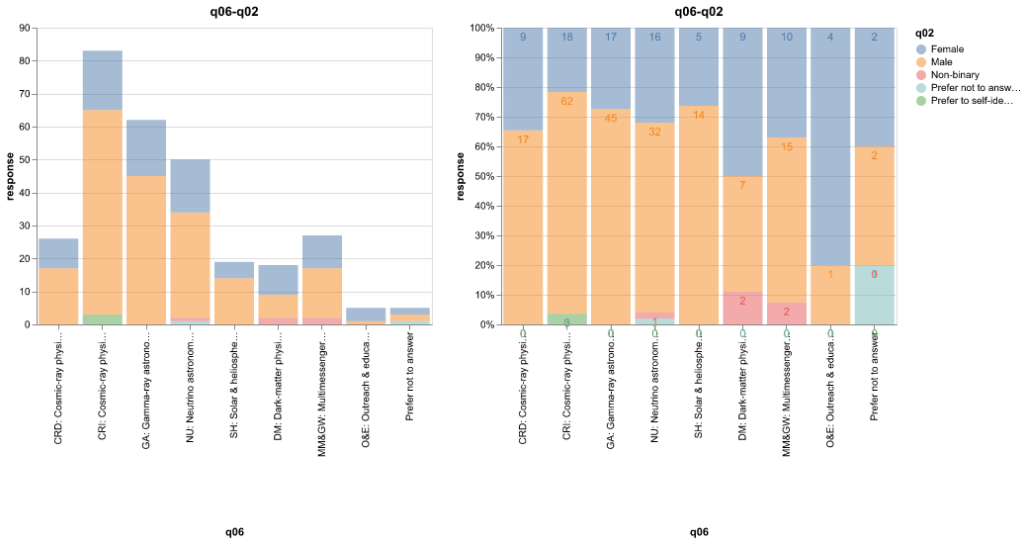

Figure 8: Research Domains and Gender Identities: (Left) Bar chart showing research domain distribution. The colors denote gender identities. (Right) Stacked bar chart of the research domains by gender identities with number of entries overlaid. Some people responded as "non-binary" in NU, DM and MM&GW.

5.4 Pickups

Here, we will discuss what we noticed about the relationship between the percentage of female researchers and the region.

In the pre-survey, we asked respondents to fill the percentage of female researchers in their groups and their intuition (very good, good, poor, or very poor) about that fraction. We then divided the responses into five clusters based on the percentage ranges: 0%–10%, 10%–20%, 20%–30%, 30%–40%, and over 40%. The results are shown in Fig 9. The horizontal axis represents the respondents' intuition on the percentage of female researchers, and the colors denote the clusters defined earlier.

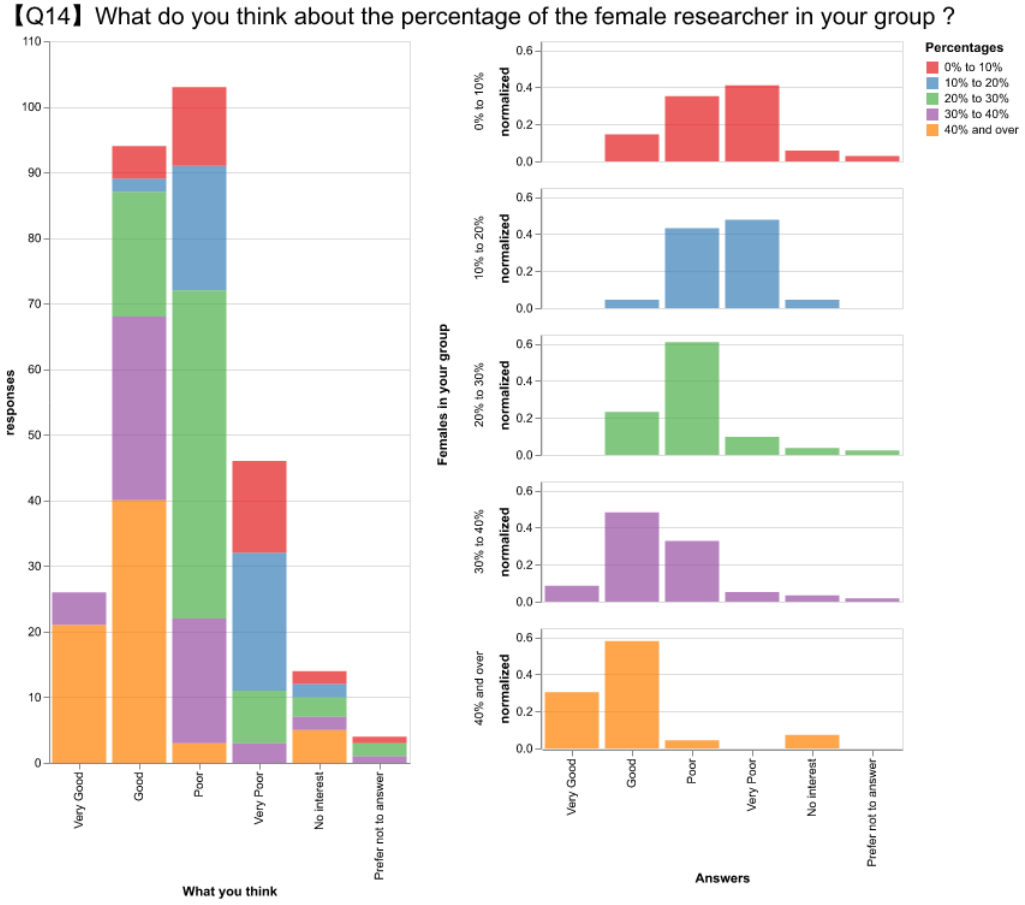

Figure 9: Histogram of intuition about "how they feel/think about the female fraction of the group", with colors denoting the clusters.

We noticed that when the fraction is less than 20% (red & blue), the responses tend to be on the dissatisfied side. Conversely, when the fraction is more than 30% (purple & orange), the responses lean towards the satisfactory side. There seems to be a boundary between 20% and 30% when determining whether the percentage of female researchers is considered sufficient or not.

To understand the reason for this difference, we examined the percentage of female researchers by region. The results are shown in Fig. 10. The horizontal axis indicates the percentage of female researchers, and the colors denote the regions.

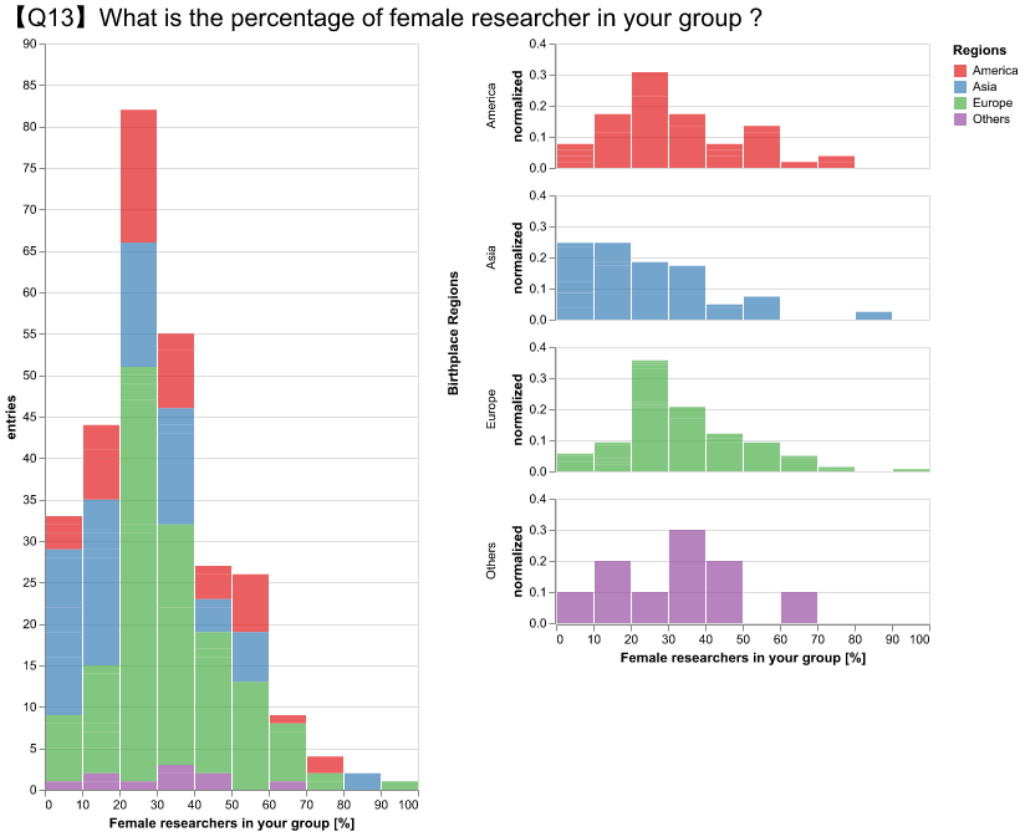

Figure 10: The horizontal axis indicates the percentage of female researchers, while the color denotes the region.

Looking at the plots, we have learned that Asia tends to have a lower ratio of female researchers compared to other regions. In line with Prof. Yokoyama's keynote, this could reflect regional characteristics, possibly highlighting social issues. Researchers in Asian institutions needs to be aware of this situation.

5.5 Remarks

These results are part of the analysis of the pre-survey. We have prepared a repository on GitHub for continued analysis. If you are interested, please visit our page and send us a comment or a pull request.

6. New in ICRC2023

Since it was held in Japan, the diversity session focused on the topic of gender balance. However, ICRC2023 is not only about that. We would also like to point out initiatives that we felt were new at this conference.

6.1 Poster presentation on the diversity survey

There was a poster presentation on the MAGIC Collaboration's internal diversity survey[6]. The details of the survey were not disclosed because it was for internal use, but we felt that it is really important to have a place where these kinds of initiatives can be presented.

We have heard that more and more DEI groups are being set up in many collaborations these days. We hope international conferences will provide a good opportunity to share their efforts across collaborations.

6.2 Guidelines for Color Universal Design

Encouraging other forms of diversity is also important. The inclusion of "Color Universal Design" in its material guidelines underlines the multifaceted nature of diversity challenges.

Figure 11: Guidelines for Color Universal Design

7. Summary and Thoughts

DEI events tend to increase the burden on the parties involved. While the first author was aware of DEI initiatives like "Women in Science" and efforts to increase the number of female students in science fields, there was personal hesitation due to uncertainty about what role could be played. Through the preparation for the session, it became clear that individuals from the majority side have many opportunities to cooperate and contribute.

Considering diversity might seem like extra work; however, we should all collaborate to improve this situation. The author reaffirmed that it is very important for male researchers, who are the majority, to take more actions. Senior researchers play a crucial role in shaping the perceptions of younger generations.

Let's make the astroparticle community more welcoming and attractive to young and talented researchers.

8. Acknowledgement

Thank you very much to everyone who responded in the pre-survey and to everyone who joined the diversity session. It was a great honor to be involved in the diversity session of ICRC2023 as a member of the LOC.

A. List of questions asked at the real-time survey and pre-survey

A.1 Questions asked at the real-time survey

List of questions asked in the real-time survey. The last question was suggested by Prof. Yokoyama as something she wanted to ask.

Q1. What is your current career stage?

Q2. What is your gender identity?

Q3. At what approximate age, do you think is a significant drop in interest or participation in physics among girls in your region?

Q4. What do you think is the most significant factor for girls who loved science in young age to eliminate the option to study physics further?

A.2 Questions asked at the pre-survey

List of questions asked in the pre-survey. (Q1 - Q11) Asked about basic demographic information of the respondents. Workplace and Birthplace/Hometown were asked separately. All questions were set as mandatory, but leaved an option to select "Prefer not to answer". (Q12 - Q16) Asked about the actual status of the group to which the respondent belongs. The term "group" refers to laboratories at universities, working groups within collaborations, etc. (Q17 - Q21) Asked how individuals feel about DE&I initiatives.

For a complete list of questions, please refer to GitHub Pages[5].

Q1. What is your age group?

Q2. What gender do you identify as?

Q3. Which geographical region are you currently working or attending school/university in?

Q4. Which geographical region do you most strongly associate with?

Q5. What is your job title?

Q6. Which group do you belong to?

Q7. What is your research type?

Q8. How long have you been in this field?

Q9. Are you satisfied with your career to date ?

Q10. How many hours, on average, do you spend on housework, childcare, and caregiving per day?

Q11. Did you already sign up for the diversity session in ICRC2023?

Q12. What do you think about the initiatives on DE&I of your group?

Q13. What is the percentage of female researchers in your group?

Q14. What do you think about the percentage above?

Q15. (Optional) Please let us know if your group has any good practice examples related to DE&I. We would like to introduce good initiatives to other groups, too.

Q16. (Optional) Please let us know if there is anything your group needs to work on or if your group has any problems related to DE&I. We would like to find commonalities in issues and share them with other groups to find clues for a better community.

Q17. What do you think about current initiatives for diversity, equity & inclusion? Do you agree or disagree?

Q18. (Optional) Could you tell us more about your thoughts?

Q19. When did you first become interested in science?

Q20. (Optional) Do you have any concerns/problems related to DE&I initiatives in science?

Q21. (Optional) What reasons do you think are hindering DE&I initiatives in science?

Q22. (Optional) Please leave a comment or remarks if you have any regarding this survey.

References

[1] ICRC2019, "36th international cosmic ray conference - diversity panel & ice cream social." https://www.icrc2019.org/agenda.html, 2023. Website.

[2] ICRC2021, "37th international cosmic ray conference - diversity video." https://indico.desy.de/event/29256/, 2023. Website.

[3] S. Cheryan, S. A. Ziegler, A. K. Montoya, and L. Jiang *Psychological Bulletin* **143(1)** (2017) 1–35.

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[5] ICRC2023, "Pre-survey for the diversity session." https://www.icrc2023.org/surveys/diversity/, 2023. GitHub Pages.

[6] J. van Scherpenberg, L. Heckmann, J. Striškovič, A. Berti, D. Dorner, D. Elsaesser, J.Green, M. Manganaro, and K. S. for the MAGIC collaboration, "A survery to evaluate diversity, equity and inclusions in large collaborations," in *Proceedings of Science*. 2023.