

### **Editorial To The Eighth Issue**

Dear Reader,

It is our great pleasure to welcome you to the eighth issue of the CWM newsletter. We usually distribute our newsletter in November. This issue delayed a bit since we wanted it to be a farewell to the CWM members of 2018-2022 term and a welcome to the new members of CWM for the term 2023-2026.

This issue starts with an article of the chair of CWM(for the term 2015-2022) Marie-Françoise Roy. She tells us about the interdisciplinary activities of CWM for reducing the gender gap in science. This article is focusing on one of the many activities of CWM that took place under the leadership of Marie-Françoise. We cannot thank her enough for all the work she has done for the CWM and the community.

We then continue with news from CWM, starting with the introductions of the new members for the term 2023-2026. New CWM chair is a familiar face, Carolina Araujo(IMPA, Brazil), previous vice-chair of CWM and the new vice-chair is Hélène BARCELO (MSRI, USA). Other members at large are: U.K. Aandavardhanan, (Indian Institute of Technology, India), Tony Ezome (Université des Sciences et Techniques de Masuku, Gabon), Catherine Greenhill (University of New South Wales, Australia), Motoko Kotani (Tokyo Univeristy, Japan), Matilde Lalín, (Université de Montréal, Canada), Selma Negzaoui (University of Monastir, Tunisia), Carola-Bibiane Schönlieb (University of Cambridge, UK) and myself, Ekin Özman(Bogazici University, Istanbul). Then comes the announcement of the annual CWM call for 2023 and a summary of the second meeting of (WM)<sup>2</sup>.

In the other news and announcement section we have the most exciting news of the year, Maryna Viazovska winning the Fields medal! You can find the links of lots of material related to this e.g. articles to read, videos to watch if you haven't seen them already.

We end this issue with a wonderful article by Olga Paris-Romaskevich. She describes a remarkable mathematical outreach activity: Cigales. We think that this article will be inspiration to many others!

We invite your feedback and suggestions about the Newsletter. Hope you enjoy reading it! Please distribute it in your country and your scientific network. Ekin Özman

# A few remarks on interdisciplinary activities for reducing the gender gap in mathematics

## Article written by Marie-Françoise Roy

I have been the chair of the International Mathematical Union(IMU) Committee for Women in Mathematics(CWM) from its creation in April 2015 and my term is ending on December 31 2022, in a few days from now. This activity as CWM chair has been extraordinarily rewarding as well as time consuming and I am grateful to Ekin Ozman, the Newsletter editor, for the opportunity given to me to say a few words about it inside this issue of the CWM Newsletter, after having had the privilege of being interviewed in its first issue.

Since is not possible to give in two or three pages a complete overview of my activities in CWM covering the whole period I decided to focus on some interdisciplinary activities : the <u>Gender Gap in Science project</u> and its perennial follow up, the <u>Standing Committee for Gender Equality in Science</u>. One reason for this choice is that I have been personally deeply involved in the definition, conduct and



Marie-Françoise Roy

outcome of these initiatives. Another reason is the leading role and active participation of mathematics in this effort, thanks to the high priority given to it by IMU and the strong support of the network of CWM ambassadors. This choice of focus means that several important topics such as the <u>CWM annual</u> <u>call</u>, the <u>CWM website</u>, the <u>CWM</u> <u>ambassadors continental and global</u> <u>meeting</u>, the film <u>Journeys of Women in</u> <u>Mathematics</u>, the dissemination of the <u>Remember Maryam Mirzakhani</u> <u>exhibition</u>, (WM)2 the World Meetings for

<u>Women in Mathematics</u>, or the participation of <u>CWM in ICM panels</u>, in 2018 and 2022, are not included in this short paper.

### The Gender Gap in Science project

The main goal of this ambitious and extensive project, funded by the International Science Council (ISC, formerly ICSU, International Council of Scientific Unions), was to investigate the gender gap in science from different angles, globally and across disciplines. The full title of the project was <u>"A Global Approach to the</u>

### Gender Gap in Mathematical, Computing and Natural Sciences: How to Measure It,

<u>How to Reduce It?</u>" The aim was to produce sound data to support the choices of interventions that ISC and member unions can feasibly undertake to address the barriers to achievement by women in mathematical and natural sciences which persist in all parts of the world.

The idea of this project was discussed at the 2017 CWM meeting in Berlin. It was decided to join forces with the International Union of Pure and Applied Physics

A Global Approach to the Gender Gap in Mathematical, Computing, and Natural Sciences : RESULTS AND RECOMMENDATIONS Science inversal wriversal Move Francisc Ros Move Francisc Ros Move Francisc Ros Move Francisc Ros

Colette Guillopé

() léa Castor

Women should have

opportunities in science

More applied

disciplines seem to be more women inclusiv

Mank Gesa

(IUPAP) and the International Union of Pure and Applied Chemistry (IUPAC) to make a bid to ISC, which had launched a call for interdisciplinary projects. The IMU and IUPAC were the lead applicants with IUPAP, ICIAM (International Council of Industrial and Applied Mathematics), and seven other scientific bodies as partners. Becoming one of the two lead applicants was a significant decision for the IMU since it meant prioritizing the project with respect other significant initiatives for mathematics. Indeed it was not possible to be lead unions in two different ISC projects. The project was awarded ISC funding of 100,000 euros per year over 3 years.

The purpose of the project was to collect evidence for informed decisions and to provide easy access to materials proven to be useful in encouraging girls and young women to enter these fields. Regional information was collected, highlighting the contrasts

and common ground across regions and cultures and more developed countries, men and women, mathematical and natural sciences. Project participants carried out a global survey of scientists of all genders, with more than 32,000 responses from more than 130 countries using seven languages. This survey was a follow up of previous surveys by physicists.Thanks to the efficient dissemination of the questionnaire by CWM ambassadors, the share of answers coming from mathematics was much more than the proportion of mathematicians in the science community. A group of researchers conducted a joint study on publication patterns which analyzed comprehensive metadata sources corresponding to several millions of scientific publications since 1970 relative to gender and location. These researchers had worked previously for ZbMATH and were able to extend their methodology to several other scientific disciplines. Finally a list of best-practice initiatives which address the gender gap in mathematical computing, and natural sciences at various levels was put together. I was one of the main organizers of the final conference which was held in late 2019 in ICTP Trieste to report on the findings and achievements, discuss and evaluate the results and to formulate recommendations and discuss new initiatives. There were 110 participants (90% female, 10% male) from more than 50 countries. Once again the proportion of mathematicians among the attendees was high, thanks to the network of CWM ambassadors. The project concluded that the gender gap is



very real in mathematical, computing, and natural sciences. Women remain little visible and discriminated in many ways inside the scientific community. With regards to publications in mathematics worldwide, there has been a regular increase in the proportion of female authors over the last 50 years. Currently, about 30% of authors of mathematical papers are women. However with respect to the top journals the situation is very

different: despite the growing proportion of women among authors, their proportion is stagnating as authors in top journals. Moreover the gender gap evolution is much worse in mathematics and theoretical physics than in other disciplines such as astronomy, astrophysics, or chemistry, where more positive changes can be observed.

I coedited with Colette Guillopé the final report of the Gender Gap Project which is freely downloadable on the Zenodo platform <u>here</u>. It can also be ordered as a printed book through many retailers worldwide. The report presents methodologies, insights, and tools that have been developed throughout the project, as well as a set of recommendations for different audiences: instructors and parents; educational institutions; scientific unions and other organizations responsible for science policy. I particularly enjoyed the work with the cartoonist Lea Castor. I am proud to report that it was published by the International Mathematical Union and licensed under a Creative Commons Attribution 4.0 International License. It has been downloaded more than 9 400 times.

#### The Standing Committee for Gender Equality in Science

A number of international organizations who took part in the Gender Gap in Science project, including IMU and ICIAM, wished to act together to further promote gender equality in science by continuing and enlarging the work accomplished so far, in particular by supporting women and girls' equal access to science education, fostering equal opportunity and treatment for females in their careers. For this purpose, they established a Standing Committee for Gender Equality in Science (SCGES) in September 2020. It is chaired by Catherine Jami from IUHPST who initiated the idea, and I am its communication officer. SCGES has already issued two annual reports where each individual union member reports on its initiatives. Starting with nine members in 2019 it has now 20 international unions as members. Launched in 2022, SCGES webinars are organized every other month by one of the international unions.

The achievements of the Gender Gap in Science project and the success and rapid growth of the Standing Committee for Gender Equality in Science illustrate the importance of interdisciplinary projects.



### As a conclusion

Reaching gender equality in mathematics and in science all over the world will take tremendous effort, and a lot of time. When institutions such as ISC or IMU support the international community of women in science, this transformation can be accelerated. I am confident that CWM is in good hands and will remain instrumental in moving forward the network of women in mathematics all over the world.

### If you want to know more about other CWM activities

#### Here are two references.

- Caroline Series and I were invited to write a paper entitled « International Initiatives for Women Mathematicians », which is included in « Fifty Years of Women in Mathematics », (AWMS, volume 28). Our paper contains an overview of CWM activities up to July 2020.

- I was also invited to contribute a paper for the section « A word from ...» by the Notices of the American Mathematical society, which will appear in the March 2023 issue. I decided to focus on the World Meeting for Women in Mathematics initiative launched by CWM and its first two venues, before ICM Rio 2018 and before vICM 2022 in a hybrid mode.

### Acknowledgements and thanks.

Over my whole period as CWM chair I worked in close connection with the successive CWM vice-chairs Caroline Series and Carolina Araujo. All initiatives of mine have been carefully discussed with both of them and I enjoyed continuously their wisdom and enthusiasm.

CWM is a collective enterprise, so all CWM members as well as the broader community of CWM ambassadors played a key role in what we have been able to develop in these few years. My sincere thanks to all of them, as well as to the members of the Gender Gap in Science project and of the SCGES.

CWM is an IMU committee, and not an independent organization for women in mathematics, and it is crucial to maintain efficient connection with IMU leadership and office. Each IMU committee or commission has an IMU EC liaison person and the work with our liaisons, John Toland then Carlos Kenig was both ideally smooth and very productive. The support of IMU Secretary Helge Holden and IMU managers, Sylwia Markwardt and Scott Jung was equally very precious.



## Welcome to the Committee for Women in Mathematics 2023-2026

Chair : Carolina ARAUJO (IMPA, Brazil) Carolina Araujo is full researcher at IMPA (Institute for Pure and Applied Mathematics), Rio de Janeiro, Brazil. Her area of research is Algebraic Geometry. She was Invited Speaker at ICM in 2018, and received the Ramanujan Prize in 2020. She served as member of IMU's CWM from 2015 to 2018, and as vice-chair from 2019 to 2022. She served as a member of the



UMALCA's Committee for Gender and Diversity from 2020 to 2022, and she is currently part of UMALCA's Scientific Council.

#### Vice-chair : Hélène BARCELO (MSRI, USA)

Hélène Barcelo is Professor Emerita at Arizona State University, has been the Deputy



Director of MSRI/SLMath since July 1, 2008. In her position, she oversees all scientific activities at the Institute. Her research interests lie in algebraic and topological combinatorics, She is the former Editor-in-Chief of the Journal of Combinatorial Theory, Series A and is now a Handling Editor for the Combinatorial Theory journal. She is a Fellow of the American Mathematical Society (AMS), of the Association for Women in Mathematics (AWM) and of the American Association for the Advancement of Science

Page 6 of 17

(AAAS). She currently serves on the Board on Mathematical Sciences and Analytics (BMSA) of the US National Academies of Sciences, Engineering and Medicine.

### Members at large (in alphabetic order)



# U.K. ANANDAVARDHANAN, (Indian Institute of Technology, India)

U.K. Anandavardhanan is Professor at the Department of Mathematics of the Indian Institute of Technology, Bombay, India. His area of research is Automorphic Forms and Representation Theory. He received the NASI-Scopus Young Scientist Award in 2015, and was awarded the Shanti Swarup Bhatnagar Prize in 2020.

### Tony EZOME (Université des Sciences et Techniques de Masuku, Gabon)

Tony Ezome is Associate Professor in Franceville, working on Algebra, Geometry Number Theory and Applications. An associate of ICTP Trieste, he is the leader of the Pole of Research in Mathematics and Applications in Africa (PREMA) created in 2012, which has joint initiatives with the African Women in Mathematics Association. Tony has served as member of IMU's CWM from 2019 to 2022.





### Catherine GREENHILL (University of New South Wales, Australia)

Catherine Greenhill is Professor at the School of Mathematics and Statistics of UNSW Sydney. Her area of research is Combinatorics. She received the 2015 Heyde Medal of the Australian Academy of Science, and was elected in 2022 as a Fellow of the Academy. She is an Editor-in-Chief of the Electronic

Journal of Combinatorics. She was Chair of the Women in Mathematics Special Interest Group of the Australian Mathematical Society in 2021 - 2022. She is currently CWM Ambassador, and has been involved in the recent creation of the Association of Asian and Oceanian Women in Mathematics.

### Motoko KOTANI (Tokyo Univeristy, Japan)

Motoko Kotani is Executive Vice President for Research, Tohoku University, Japan. Her area of research is Discrete Geometric Analysis, and she is active in communication with researchers in other scientific fields, in particular bridging mathematics and materials science. She was awarded the 25th Saruhashi Prize in 2005, and was appointed



Director of the Advanced Institute for Materials Research, Tohoku University in 2012. She has served as member of IMU's CWM from

2019 to 2022. She is currently President-elect of the International Science Council (2022 - 2024), and executive member of the Council of Science, Technology and Innovation of Japan.

### Matilde LALÍN, (Université de Montréal, Canada)



Matilde Lalín is full professor at Université de Montréal, Canada. Her area of research is Number Theory. She has been involved in the organization of "Women in Numbers" workshops, and the "Women In Number Theory" network. She is currently Vice-President of the Canadian Mathematical Society (2019-2023). She is a CWM Ambassador, and was one of the organizers of the Pan-American Meeting of CWM Ambassadors in 2021. She received the 2022 Krieger-Nelson prize from the Canadian Mathematical Society and has been recently named Fellow of both the American Mathematical Society and the Canadian Mathematical Society. She has been a member of the

Committee for Women in Mathematics of the Canadian Mathematical Society since 2019.

### Selma NEGZAOUI (University of Monastir, Tunisia)

Selma Negzaoui is Associate Professor at the Department of Mathematics and informatics of the University of Monastir, Tunisia. Her area of research is Harmonic Analysis. She received the young researcher prize from the Tunisian Academy of Sciences, Humanities and Arts in 2021. She is currently the Chair of the Tunisian Women Mathematician Association, and CWM Ambassador and a member of the Standing Committee of the African Women in Mathematics Aassociation-AWMA(2020-2024).





### Ekin ÖZMAN (Boğaziçi University, Istanbul, Turkey)

Ekin Özman is a Professor at Boğaziçi University, Turkey. Her research is in Arithmetic Geometry and Number Theory. She received the Bilim Akademisi Young Scientist Award in 2016. She has been involved in the organization of "Women in Numbers" workshops, and the "Women In Number Theory" network. She has served as member of IMU's CWM from 2019 to 2022, and has been the Editor of the CWM Newsletter.

# Carola-Bibiane SCHÖNLIEB (University of Cambridge, UK)

Carola-Bibiane Schönlieb is Professor at the Department of Applied Mathematics and Theoretical Physics of the University of Cambridge, and head of the Cambridge Image Analysis group. Her research interests focus on partial differential equations, optimization and machine learning for image analysis, image processing and inverse imaging problems. She



was awarded the Whitehead Prize by the London Mathematical Society in 2016, the Philip Leverhulme Prize in 2017, and the Calderón Prize in 2019. She has been convener of the European Women in Mathematics Association from 2016 to 2020, and is CWM Ambassador and member of the SIAM diversity advisory committee.

# **CWM Funding Call for 2022**

The IMU CWM invites proposals for funding of up to €3000 for activities or initiatives taking place in 2023, with deadline 23 December, 2022. Applications should be sent to applications-for-cwm@mathunion.org aimed at either:

- Establishing or supporting networks for women in mathematics preferably at the continental or regional level,

- Organizing research workshops geared towards establishing research networks for women by fostering research collaborations during the event,

- Other ideas for researching and/or addressing issues encountered by women in mathematics. Note that: There will be only one call for applications regarding activities in 2023. Priority will be given to events taken place in developing or emerging countries. Funding for individual research projects is not available. For further details please check the <u>CWM web page</u>.

# Success of the (WM)<sup>2</sup> 2022

The second edition of the <u>World Meeting for Women in Mathematics - (WM)2</u> - took place as a mostly virtual meeting on July 1-2 2022. More than 1100 people from more than 100 countries registered. An overview of the (WM)2 program can be found <u>here</u>. The program of (WM)<sup>2</sup> 2022 featured, on July 1, a virtual session with four plenary lectures by distinguished female mathematician: Maryna Viazovska, Natalia Maslova, Mina Aganagic and Eugenia Malinnikova. Titles and abstracts can be found <u>here</u>.

This was followed by a lively panel discussion "Girls and Mathematics: reflections and initiatives", dedicated to the memory of Yulia Zdanovska and moderated by Ekin Ozman and Olga Paris-Romaskevich. The names of the panelists and their abstracts can be found <u>here</u>.

The program of (WM)<sup>2</sup> 2022 on July 2 was devoted ti the Olga Alexandrovna Ladyzhenskaya (OAL) Celebration, in a joint session organized by (WM)<sup>2</sup> and the Probability and Mathematical Physicsconference in Helsinki. See <u>here</u>. The OAL celebration started with the world premiere of the film of Ekaterina Eremenko about OAL and her influence (trailer <u>here</u>) and continued with theawarding the OAL Prize: Presentation of the Prize by Ingrid Daubechies former IMU president, Announcement of the Prize Winner, Svetlana Jitomirskaya, Laudatio by Artur Avila and Lecture of Svetlana Jitomirskaya, which was also a plenary ICM lecture. The (WM)<sup>2</sup> has been recorded and can be seen on (WM)<sup>2</sup> <u>YouTube channel</u>.

# **Participation of CWM in the ICM**

The panel **Best Practices Towards a More Diverse and Inclusive Mathematical Community** was jointly organized by the Committee for Women in Mathematics (CWM) and the Committee on Diversity (CoD) during the virtual ICM 2022 with moderators Motoko Kotani (CWM) and Edray Goins (CoD). More information on the panelists and their abstracts can be found <u>here</u>. You can also watch the panel <u>here</u>.

Marie-Françoise Roy was also one of the panelists in the vICM CDC panel **Online cooperation inmathematics: challenges and opportunities for developing countries**. See <u>here</u> for more information and here for the <u>record</u> of the panel.

# Standing Committee for Gender Equality in Science (SCGES) second annual report

The 2021-22 SCGES report, compiled after the <u>Standing Committee for Gender</u> <u>Equality in Science (SCGES)</u> 's first year of existence, is evidence of its current and future work on this endeavor. Starting with a short synthesis by SCGES chair Catherine Jami, it contains short reports by each of the 11 members of SCGES, all of which have a stated commitment to promote gender equality and women in science. Exchanging information on all related issues and making them visible is a major motivation for the partners who work together in SCGES. You can download the report <u>here</u>.



## **OTHER NEWS AND ANNOUNCEMENTS**

### • Maryna Viazovska wins Fields medal

We are absolutely delighted to congratulate <u>Maryna</u> <u>Viazovska</u> on her achievement in being awarded the Fields medal "for the proof that the E8 lattice provides the densest packing of identical spheres in 8 dimensions, and further contributions to related extremal problems and interpolation problems in Fourier analysis". For more details see <u>here</u>:

citatio, video, popular scientific exposition,



CV&publications, interview, laudatio, proceedings, Plus magazine! article

### • Svetlana Jitomirskaya receives the OAL Prize

The <u>inaugural Ladyzhenskaya Prize in Mathematical Physics (OAL Prize)</u> is awarded to Professor Svetlana Jitomirskaya "for her seminal and deep contributions to the spectral theory of almost periodic Schrödinger operators" in a session jointly organized by the <u>World Meeting for Women in Mathematics</u> and the <u>Probability and</u> <u>Mathematical Physics conference</u> on July 2 2022.

### • Establishment of AOWM

Asia-Oceania Women in Mathematics (AOWM), the continental organization for women in mathematics in Asia and Oceania was established on August 1 2022 by an on line meeting. There are more than 200 founding members from 18 Asian and Oceanian countries (Australia, China, India, Indonesia, Iran, Japan, Kazakhstan, Malaysia, Nepal, New Zealand, Oman, Pakistan, Philippines, South Korea, Sri Lanka, Thailand, UAE, Uzbekistan). The CWM ambassadors and their continental meeting played a key role in the creation of AOWM. The preparation process was taken care of by a group led by Motoko Kotani and Kyewon Koh Park. The AOWM Executive Committee is the following:

President : Sanoli Gun (India)

<u>Vice President :</u> Melissa Tacy (New Zealand) and Polly Sy (Philippines) <u>Secretary:</u> Hyang-Sook Lee (Korea)

<u>Ordinary EC members:</u> Budi Nurani Ruchjana (Indonesia), Yukari Ito (Japan), Dongmei Xiao (China), Bakhyt Alipova (Kazakhstan), Zohreh Mostaghim (Iran) You can contact AOWM <u>here</u>.

### • Women in Mathematics, a conference in Japan

The online conference "Women in Mathematics", a RIMS conference of Kyoto University, took place from September 7th to 9th in 2022. There were more than 200 participants, from several countries, one third of them being male. The program featured mathematical talks, 1-minute speech by the Japanese female participants and discussion about women in mathematics including reports from CWM, EWM, WAM, MSRI and AWM. It was a good opportunity for participants to get to know each other and to learn about many good practices abroad. See more information <u>here</u>.

### • Women Mathematicians in South Asian and Middle Eastern Region

The hybrid event "<u>To constitute a network of Women Mathematicians in South Asian</u> and <u>Middle Eastern Region</u>" was held on 4 th -5 th October 2022 at the University of Technology and Applied Sciences-Suhar for two days. The first day (4 th October, 2022) of the hybrid event was in person at UTAS-Sohar, Oman and the second day (5 th October, 2022) of the event continued on virtual mode.

The event is sponsored by CWM-International Mathematical Union and UTAS-Suhar. Renowned mathematicians from ten countries with a high scientific caliber have participated in this prestigious event.

The main objectives of this event were:

- To build a network at the regional, national and an international level.
- To motivate and encourage participants for research and development activities
- To spread awareness about the funding and career opportunities available.
- To showcase the achievements of women mathematicians globally that can motivate them to pursue their careers in Mathematics.



# Towards mathematical outreach in phase with society: reflection around Cigales<sup>1</sup>

Article written by Olga Paris-Romaskevich

### Cigales, what is it?

*Cigales* (Cicadas in English) is a mathematical and sports week at *Centre International de Rencontres Mathématiques* or simply CIRM in Marseille. This week is offered to high school girls from 11th grade (in the US system). This means there are no boys. They are twenty six, two-thirds of whom come from Marseille and its region, and the others from all over France. A typical day at the school begins with research workshops in small groups on problems in mathematics and computer science. It continues after lunch with a sports session, then follows a meeting with a woman whose profession is related to mathematics. After dinner, it's a game evening, karaoke or even a dancing party - it's up to the girls to decide!

*Cigales* reaches fifty girls a year, help them gain self-confidence and flourish via supporting them in their interest in mathematics. Yet, carried out on this modest scale, it would be naive to think that this project reduces systemic gender inequalities in access to mathematics.

### A social science and a survey

Presently Clémence Perronnet and her collaborator Alice Pavie, doctoral student at the Labor Economics and Sociology Laboratory of the University of Aix-Marseille, are transcribing and analyzing a hundred hours of interviews as well as entire notebooks of observations... I will use here preliminary elements of the investigation that they entrusted to me.

### First argument for being only among girls: feeling safe

"And why don't you organize Cigales with boys?..."2

A colleague passing by.

How happens the exclusion of girls from science? First, by the feeling of insecurity, on the part of the girls or their parents, covering a range of different realities. It is not up to us, mathematicians and mediators of science, to decide whether this feeling is justified or not - the fact is that it is there. Our role is to deal with it, in a process of inclusion and access to science for all.

For the October 2021 Cigales course, 3 out of 26 girls said they would not have come to the course if it was mixed. Why ? Their parents don't let them sleep in the

[2] In response, I always refrain from making a small (radical ?) Lemma . If a>b, then to reduce the difference a-b, we must add to b and not to a.

<sup>[1]</sup> Translation slightly adapted of a text published in the number of the Gazette of the French Mathematical Society (October 2022, tome 17) and republished on the site Images des Mathématiques (in French)

same place as boys, for fear that something will happen to them. These prohibitions prevent these girls from doing any cultural or school activity for more than one day, which can be decisive in their exclusion from science <sup>3</sup>.

For the girls who take part in Cigales, the feeling of security is not assured either. A girl had a panic attack during a problem-solving session, brought on by the perceived overly invasive behavior of one of the course visitors. She managed to calm down thanks to the strength of her will, supported by her friend as well as by the supervisor of her group.

Imagine you've just saved yourself from a tiger, and you've been asked to solve a math problem! It may be hard to imagine... but that's what women experience (in terms of feelings) in a sexist environment. Sometimes the tiger is smaller, but he is rarely alone. But even if it was just a hamster: imagine a hundred hamsters chasing you! Easing the ever-present feeling of insecurity for girls who have gone through traumatic experiences by providing a nurturing environment allows them to think about math in security - and I seek nothing more, nothing less.

Following a survey at the end of the course, most of the participants (36 out of 41) are satisfied with the fact that it is



Photo is courtesy of Bertrand Paris Romaskevich, Creative Commons BY-SA

reserved for girls, 3 have no opinion and 2 would have liked to be mixed. The profile of the latter two is very privileged: they come from rather well-to-do backgrounds and have significant scientific capital.

### Fight against inequalities to reinforce others?

"I am always very critical of those people who fight for themselves, to overcome, for example, the glass ceiling. This bourgeois feminism assumes that you are already at the ceiling, and all you have to do is cross it and then share the space with the decision makers. Let's defend the interests of those who are most oppressed, this is how a new vision of society can emerge."

Angela Davis, during a recent meeting with feminist activists. A girl who wishes to apply to *Cigales* must write a cover letter and attach a letter of recommendation from her teacher. Applications for the internship come mainly from girls with a very privileged socio-cultural profile. Half of the participants have at least one parent who works in a scientific sector (engineering, IT, medical or science education). The most common profession for the father is engineer, and for

[3]This observation was made by Geetha Venkataraman, an Indian mathematician involved in initiatives for girls and women in mathematics throughout India, during a panel session at the World Meeting for Women in Mathematics 2022 on initiatives for girls in mathematics. This panel session that I had the honor of hosting together with Ekin Ozman is available for replay on Youtube. This round table gives voice to people involved in mathematical mediation for girls on all continents. We all came to the same conclusion: girls need single-sex internships to learn about science, because mixed educational initiatives exclude some girls.

the mother: school teacher. Only 10 percent of the participants come from the less privileged backgrounds. It seems to me very likely that most scientific internships with recruitment by cover letter have a social distribution of participants quite similar to ours. So, in the current state, our internship maintains or even reinforces socio-cultural and economic inequalities with the exception of those of gender.

I do not subscribe to an elitist view of mathematics, fueled by the spirit of competition and budgetary restrictions (very present in France). I think that the practice of living mathematics must be truly accessible to everyone, and not just to researchers. The elitist view of science systemically and violently excludes people around the world from the practice of science. To combat the violence produced by the system of institutions of which we are part, we are obliged to rethink our world-system and accept not to place ourselves in its center. This will inevitably require rethinking the functioning of our institutions.

### Second argument for single-sex: a space of self-confidence

"Do you want me to summarize why there are so few women in mathematics? [...] Here it is: capitalism and patriarchy. "

Clémence Perronnet, in response to questions from a working group on parity at the Assises de Mathématiques, a big "mathematics, industry and politics" event on 14-16 November 2022, held at UNESCO quarters in Paris.

Self-confidence is vital to actively participate in discussions (mathematical or not), by answering the questions of others, by asking one's own, by expressing oneself.

Despite very good marks in maths (18/20 for the most part), the girls all say they are not confident in their mathematical abilities <sup>4</sup>. Confidence is the key to free thought. Should we be satisfied for the explanation that the girls would have deprived themselves of it?

Single-sex internships and schools are opportunities for girls to gain self-confidence. For some, the experience of *Cigales* is the moment, oh so satisfying, of their first scientific discovery. I'm thinking of that Thursday evening at *Cigales*, when a team of girls finally managed to find the number of palindrome dates between 01/10/1001 and 09/29/9092. Too bad I can't add to this essay their cries of joy - much more convincing than any words!



Photo is courtesy of Bertrand Paris Romaskevich, Creative Commons BY-SA

Here is another testimony, that of Lyuba Konova, student in mathematics at the University of Sofia in Bulgaria, former participant and now organizer of the

[4] The explanations for lack of confidence are complex and I leave that to the many scholars on this topic.

European Olympiad for girls <sup>5</sup>. "EGMO above all gave me self-confidence. Math can be very difficult and all-consuming. Some classes are very hard, some easier. I don't feel like I'm on the right path every day. At my university, I don't have the support I need to feel good every day. When I want to quit, and there are definitely days when I do, I think back to my days at EGMO, and that helps keep me going. It was a selective event, and it gave me the opportunity to push myself. I solved more problems than I thought I could, and I will always remember that. "

These kinds of discoveries and insights can also happen at mixed events -- but these are exceptions to the rule. Society pushes boys to speak, and girls to stay silent. The monopolization of male speech leads to a monopolization of thought. The girls leave the place, keeping their thoughts to themselves. It takes a real effort for the boys to be quiet, and for the girls to speak up. And it's easier if you keep the confidence (for anybody). As Lyuba Konova says, *"I started answering our teacher's questions during class -- because now I have the experience of EGMO behind me, which gives me confidence. If I didn't have it... I would stay silent, like the other girls in my class."* 

### A word to conclude

There will always be great challenges internal to mathematics. But the world is knocking on the door of our offices, with its injustices and emergencies. We are now faced with a choice: rush into solving the Riemann Conjecture, or build a community whose very design ensures that it will be solved.

To know more about Cigales, I invite you to visit the site of our initiative including a presentation file, and lots of photos! I would like to thank Bertrand Paris-Romaskevich for his photographic work around the Cigales including a page where we collect photographs of girls doing math, his support for setting up the Cigales and his rereading of this text and so many others. And above all, my gratitude goes to all the girls I met thanks to Cigales, for their courage, their perseverance and their ideas that will shape the world of tomorrow.

[5] More information on the European Girls' Mathematical Olympiad site



#### **About the Author:**

Olga Paris-Romaskevich is a research fellow at the CNRS. Her research focuses on the study of dynamical systems in connection with physics, initially chaotic and for several years now with zero entropy, particularly in his work on billiards in tilings. She is a science mediator, co-founder of the association Mathematics Vagabondes committed to forging links between mathematics and society.