

REPORT ON THE RESEARCH VISIT IN NTNU

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In 2019 I obtained a visiting BFS (now called TMS/TFS) scholarship as a guest professor to pursue research within the program *Pure Mathematics in Norway*, in the Department of Mathematical Sciences of the Norwegian University of Science and Technology NTNU in Trondheim, to collaborate with Professor Kurusch Ebrahimi-Fard in the area of Multiple Zeta Values. During my visit, the whole month of May, I also held a lecture series, with a survey on my research in the field of Algebraic Combinatorics and Combinatorial Hopf Algebras. The abstracts of the lectures are here:

<https://www.ntnu.no/kalender/detaljer/-/event/6816a037-6c5f-3c97-a36e-11d610b8ac9f>

Furthermore, I participated to a Workshop in Non-Commutative Stochastic Analysis, organized by Ilya Chevyrev, Kurusch Ebrahimi-Fard, Hans Munthe-Kaas, and Nikolas Tapia.



View from the Mathematics
Department in Trondheim



Group Picture of the Workshop NCSA
2019

My full experience in Trondheim was simply great. The ambience was warm and cheerful, everybody in the department—from the secretary offices to the colleagues—were there to make the month of research smooth, pleasant, mathematically enriching.

However in this report I decided to tell my experience of the celebrations related to the Abel Prize, which is awarded every year in May, in the beautiful city of Oslo: a prize for outstanding scientific work in mathematics, to honor the greatness of the Norwegian mathematician Niels Henrik Abel. The idea of the prize was to celebrate 200 years from his birth. The first prize was awarded in 2003 to Jean-Pierre Serre. Being a recipient of BFS, I had the chance and the honor to be included and invited to attend and participate to all the celebrations around the Prize, which took place in Oslo from 19 to 23 of May.

This year the Abel Prize (the 17th since its inception) has been awarded to professor Karen Keskulla Uhlenbeck. It was the first time, since its establishment, that it was conferred to a woman, which made the experience even more thrilling and richer of relevance for me, being a member of the Equal Opportunity Committee of the UMI (Italian Mathematical Union): as women, we are aware of the difficulties surrounding a scientific career; however, most of the times the awareness of such difficulties starts much later than in the beginning of a researcher's career.

When I arrived in Oslo, together with the professors Elena Celledoni and Brynjulf Owren from NTNU, the city was in a festive mood: the main avenue *Kristian IV Gate*, leading to the Royal Palace (Det Kongelige Slott), was lined with the pink panels of the Abel Prize, even the buses carrying its logo, suggesting the idea, so to say, “Don't think that the Mathematics is confined to mathematicians!”, stating the importance of mathematics in the society recognized by the Abel Prize.

In 1908 Norway honored Abel's memory asking Gustav Vigeland, the leading modern Norwegian sculptor, to create a monument to him, erected in the park in front of the Royal Castle. For the opening ceremony, in the afternoon of May 20, after a speech of Robbert Dijkgraaf, director of the Institute of Advanced Studies in Princeton, the prize recipient Karen Keskulla Uhlenbeck laid down a wreath at the base of the monument. Soon after, we went to the *Abel Dinner*, reserved to mathematicians by invitation of the Norwegian Academy of Science and Letters, in the building of the Academy, with its beautiful halls and view on the marina. I was very glad I had a chance to talk to the Prize winner Karen Keskulla, and to many distinguished mathematicians, among which the members of the Abel Prize Committee: Hans

Munthe-Kaas, Irene Fonseca, Gil Kalai, Sun-Yung Alice Chang, and François Labourie. I was sitting near Olav Laudal, emeritus professor in algebraic geometry from the University of Oslo, and we talked about deformation of Lie algebras, and some common colleagues from Rome. The delicious dinner was followed by a toast in honor of the Abel laureate. The whole atmosphere of the evening was warm and cheerful, among members of the Academy of Science and Letters and prominent mathematicians.

On May 21 the Abel Prize award ceremony took place in the *University Aula*.



The entrance to the Oslo University Aula



Kristian IV Gate

It started with a procession accompanied by the “Abel Fanfare”, with the entrance of Karen Keskulla, His Majesty the King Harald, the committee, and authorities. A choir delighted the public with some music by Purcell. The opening speech was given by Hans Petter Graver, president of the Academy of Science and Letters, while the Abel Committee citation was given by its chair, professor Hans Munthe-Kaas from Bergen University, the Prize being given “for her pioneering achievements in geometric partial differential equations, gauge theory and integrable systems, and for the fundamental impact of her work on analysis, geometry and mathematical physics”. Then Karen Keskulla Uhlenbeck received the 2019 Abel Prize from His Majesty King Harald V, and gave a speech. Karen Keskulla has been the second woman to be a plenary speaker in the ICM International Congress of Mathematicians in 1990, the first being Emmy Noether, in 1928 and later 1932: a shocking statistics for the women in this field, revealing how dominated it was so far by males. Things however are slowly changing. In her acceptance speech, the Abel laureate stressed the importance of gender equality in academia.



An interview with Karen Keskulla



The Laureate receiving the Prize

In the evening of May 21 there was the Norwegian Government’s Abel Prize Banquet, in the fantastic location of the Akershus Castle in the presence of HM The King. It was a wonderful experience. After we all sat at the sumptuously laid table, a fanfare announced the arrival of the King, and everyone stood to greet His Majesty. Carlos Kenig, President of International Mathematical Union, and Iselin Nybø, Minister of Research and Higher Education, gave a speech on “Mathematics in Norway”. Before and after the dinner I had the opportunity to meet Irene Fonseca, from the Abel Prize Committee, Klas

Markström, in graph theory and combinatorics from Umeå University, David Gabai, head of the Mathematics Department of Princeton, and Arild Stubhaug, the writer of a very important biography of Abel: *Niels Henrik Abel and his Times: Called Too Soon by Flames Afar*, translated in many languages. Arild Stubhaug was also one of the promoters of the Prize when the 200 years anniversary was approaching.



At the Akershus Castle. From left to right: Sun-Yung Alice Chang, her husband, David Gabai, and myself



Music at the Abel Party

In the morning of May 22 there were the “Abel Prize Lectures”. Before them, a moving short film about Karen Uhlenbeck. Just to mention some of the sentences she said that stick in my mind:

- I’d never would have been able to have a job on the faculty without the women’s movements of the sixties: I took advantage of my luck.
- I write my journals in different colors, just because I like colors.
- I still like to do math.

Karen Keskulla lectured on “Glimpses into Calculus of Variations”. It was the most thrilling part! After that, she was interviewed by Ionica Smeets, in a conversation with the laureate. Ionica Smeets, PhD in Mathematics, is a very well known journalist in sciences, popularizing mathematics on radio and TV. I had a chance to talk to her in the banquet, she was my table neighbor: she is also involved in equal opportunity issues. The day ended with the Abel Party, a buffet dinner again in the halls of the Norwegian Academy of Science and Letters, with many people in a very relaxed atmosphere, with music playing and opportunities to talk to many colleagues.

The day after my return in Rome, I went to the Accademia Nazionale dei Lincei (the Italian Academy of Sciences) for a special event: “A Tribute to Maryam Mirzakhani”, organized by the Mathematics Department of the University of Rome 2, with the collaboration of the Accademia, in the project *May 12 Celebrating Women in Mathematics*, intended to honor the memory of another great mathematician, Maryam Mirzakhani: again the first woman to reach the highest recognition in mathematics, the Fields Medal, in 2014, and who so sadly died in July 2017. In the main beautiful hall of the Accademia dei Lincei, Professor Corinna Ulcigrai (from University of Bristol and Universität Zürich) gave a talk of great interest on “Billiards, Flat Surfaces and the Magic Wand Theorem”, mentioning by the way also some related work of Karen Keskulla Uhlenbeck. Corinna Ulcigrai underlined a frequent mental path of her colleague and friend Maryam Mirzakhani, always facing up the most difficult mathematical problems, expressed by Maryam with the sentence: “the determination of reach high”. I believe spreading this message among younger women in mathematics is so important, to avoid self-limiting in their aims. This conference was the best way to come full circle after my experience in Oslo of the Abel Prize.

I hope that the prizes to Karen Keskulla Ulenbeck, as well as to Maryam Mirzakhani, are only the first ones to women, with many more to come: they give a great inspiration for women in mathematics. I wish these experiences convey to all PhD female students in mathematics a lot of self-confidence and enthusiasm toward their studies and research.