Q&A

# 'Mathematics is an unknown land': meet Fields Medal winner Maryna Viazovska

**On 5 July, Ukrainian mathematician Maryna Viazovska became the second woman in history to earn a Fields Medal, one of the top prizes in the field. Viazovska, who is based at the Swiss Federal Institute of Technology in Lausanne (EPFL), is most famous for solving the problem of how to pack spheres in the most efficient way in a space with eight dimensions. *Nature* spoke to Viazovska about the award's significance and her vision for mathematics.**

**How does it feel to be one of the winners of the Fields Medal?**
Of course, I was extremely happy and honoured, because very few people get this award. I have actually known about it for a while: Carlos Kenig, the president of the International Mathematical Union, contacted me and told me the news in January.

**Why did you become interested in the problem of sphere packing?**
It's a very natural, very nice geometric problem — a problem with a very simple formulation, and often very difficult to solve. There are still many open questions surrounding it. Also, what made me interested in the packing problem in dimensions 8 and 24 was, of course, the work by Henry Cohn and Noam Elkies, where they proposed how to solve it, and came very close to a solution. So it seemed like low-hanging fruit. Even now, after it is solved, we still have infinitely many dimensions for which the problem is still open and the same methods don't work. There are still so many discoveries to be made.

**Calling it low-hanging fruit sounds very modest.**
Yes, but it's maybe in the nature of mathematics that to make a big breakthrough, you have to chase low-hanging fruit — and some of our low-hanging fruits are still pretty high! In mathematics, when we think of open problems, we don't think in terms of months and years to solve them — often, we think in terms of decades and centuries.

**Does the prize have a special significance at such a hard time for the Ukrainian nation?**
I hope so. Maybe this news made somebody's day better. But compared to how much we are losing right now, of course it's not comparable.

I was chosen as a winner before the Russian invasion of Ukraine began in February. I believe that this decision is about mathematics and not about anything else — that's how it should be.

EPFL/FRED MERZ

**Maryna Viazovska won the Fields Medal for work on sphere packing.**

## "My dream is that women getting major prizes will be a routine event, not a special occasion."

**And it's also an important win for women in mathematics?**
My dream is that women getting major prizes will be a routine event, not a special occasion. It should not be. Maybe this prize could have a positive effect on young women, but what is much more important is what happens early at school — the hard, everyday work that is done by parents, teachers, university professors.

Mathematics is one of the fields where we can just enjoy our diversity — where it's not a problem but an advantage.

**How does diversity enrich the mathematical community?**
Everything we do is in some very indirect way connected to our everyday experience. Even in a very abstract field, people with different backgrounds might have different working habits, or important core beliefs that are not directly related to mathematics but can influence the way they attack problems.

**How would you describe your style of doing mathematics?**
I prefer working on concrete examples, not on big, abstract theories. My view of mathematics is that I am like a pioneer discovering an unknown land. So, I don't try to build castles, but rather I go into a jungle and follow a path, and hope that this path will lead me to new, undiscovered land.

**How is mathematics research evolving? Do you see any particular trends?**
On the one hand, mathematics — at least, pure mathematics — is very conservative and does go its own way. But now we live in this exciting time when technology is changing our lives, and, of course, it is changing mathematicians and mathematics.

A topic that is attracting more and more attention is mathematical aspects of machine learning. There are many directions; one that interests me is how I could use some of these new exciting tools in my own research. Another very ambitious and noble goal is to create a mathematical theory of machine learning: when does it fail, and when can we hope for good results?

Also, the idea of quantum computing comes with a big number of interesting mathematical problems.

**Is there a big role for mathematics in quantum error correction, which is crucial to making quantum computers work?**
Studying sphere packing is very close in some ways to the problem of error correction — many approaches and methods translate from one to the other.

As mathematicians, we cannot build a quantum computer, but maybe, motivated by the possibility of its existence, we can prove interesting, meaningful theorems.

**Interview by Davide Castelvecchi**
This interview has been edited for length and clarity.