

Episode 29 - Maryam Mirzakhani

Hi, my name is Laura Messick. I'm a computer science major at Washington State University and today I will be telling a little about Maryam Mirzakhani.

Maryam Mirzakhani was born in May of 1977 in Iran. When she was younger she wanted to be a writer. By her teen years she became more interested in mathematics. She said that she liked the challenge of it.

When she was just 17 she was awarded a gold medal in the International Mathematical Olympiad. She was the first female Iranian student to achieve this medal. A year later in the International Mathematical Olympiad she was the first Iranian student to have a perfect score and won a second gold medal.

She graduated with a Bachelor of Science degree in mathematics from Sharif University of Technology in Iran. Then started her graduate work in the US, receiving her PhD from Harvard University in 2004.

She said that while she was a graduate student at Harvard she had to explain to some that while women have many restrictions in society and must wear hijabs in public, herself and other women were allowed to attend the university in Iran.

At Harvard she was said to be distinguished by determination and relentless questioning. In her dissertation, not only did she solve two long standing problems, which would each be newsworthy on their own, but she connected these two problems in her thesis, which took her paper to a whole new level.

She used this work from her dissertation to find a new proof for the Witten conjecture, which is important to String Theory. She later taught at both Princeton and Stanford University.

To date she is the only woman and only Iranian to have ever won the Fields Medal, which is called the Nobel Prize for mathematics, and it's the highest honors in mathematics.

The Fields Medal is awarded by the International Mathematical Union to up to four people under the age of 40, every four years, since it began in 1936. She received the Fields Medal in 2014, a year after she was diagnosed with cancer. She was concerned about going to receive the award because she felt under the weather from having chemo and knew there would be a lot of press. So a small group of her female colleagues went with her to help her out.

She was never left alone and they got her away from the press when necessary.

One woman who nominated her for the Fields Medal described her as doing mathematics for the pure joy of mathematics, and hoped she brings the same inspiration she felt to her students.

The President of Iran posted his congratulations to Maryam for winning the Fields Medal on Twitter, with two pictures of her. One was without her hijab. This was unprecedented and even today in Iran women must have their hair covered in public.

Maryam described herself as a slow mathematician saying, "You have to spend some energy and effort to see the beauty of math." She said she didn't have a specific way of creating new proofs but expressed, "It's like being lost in a jungle and trying to use all the knowledge that you can gather to come up with some new tricks and with some luck you might find a way out." I think this describes patience and perseverance.

Maryam is known for her study of structures and surfaces and her work was mostly theoretical in nature. In one example related to billiards called The Magic Wand Theorem, if you started a point and hit the ball and supposing it continues forever, you want to see its trajectory. You want to know if the trajectory covers the whole table and if you can find closed billiard paths.

She used different polygonal shapes, not just a rectangle, for these billiard tables. A second example, she would have different geometric shapes with holes in them. If you started at a point and

then created a line going in a certain direction, she had a probability formula on if that line would eventually go back on itself, which would be called a Closed Geodesic.

She liked working with dynamic complexities of curved surfaces. Her discoveries have implications for cryptography and the study of prime numbers, as well as String Theory.

Sadly, she passed away in 2017 at the age of 40 leaving behind a husband and a daughter. Iranian law does not permit women to marry non-Muslim men. Since her husband was from another country, and non-Muslim, her marriage is not recognized or is considered invalid, and her daughter does not have Iranian nationality.

After she passed there were many in Parliament trying to amend that law, trying to make it easier for her daughter to visit Iran. One of the reasons I chose Maryam to do a biography on is because her accomplishments are much more recent and there are videos of her speaking and working out problems. It's easier to feel a connection and be inspired by her.

She would use a big drawing pad for her sketches. The mathematical work looked like art. Her daughter called it painting. I definitely encourage you to watch some of her videos online.

I hope you enjoyed learning about Maryam Mirzakhani and thank you for listening.