

THE IMPORTANCE OF MENTORSHIP

OVERCOMING LABELS AND BIASES,
TOWARDS EMPOWERMENT AND POSITIVITY

An interview with Margarita Karvoska
Senior Astrophysicist at
Center for Astrophysics | Harvard & Smithsonian



Margarita Karvoska is a Macedonian astrophysicist specializing in observational astronomy, particularly spectroscopy and direct imaging of celestial objects. Her interest in astronomy began as a young child, and after completing her undergraduate and doctoral astronomy degrees in Serbia and France, she accepted a position at the Harvard-Smithsonian Observatory in the United States. In her 39 years at the Harvard-Smithsonian Center for Astrophysics, she has made significant advances in the field of astronomy and advocated for greater representation of female astronomers.

As an immigrant and as a woman in astronomy at a time when only about 3% of astronomers were women, Karvoska has firsthand experience with the inaccessibility of STEM careers to members of minority groups. Her experience has led her to firmly believe that inclusion of historically underrepresented groups leads to better scientific outcomes. To this end, she has been heavily involved in Harvard's mentorship programme, through which she encourages and guides young scientists over the barriers they face as women in astronomy and in return is herself inspired.

In this interview, Karvoska discusses the importance of empowering and listening to individuals from underrepresented groups, parallels between gender and ability diversity, the role of funding in increasing inclusion, and changes institutions must make to prove accessible to persons who are "differently abled," drawing on examples from her own mentor, Dr. Wanda Diaz-Merced. She stresses both the incredible increase in diversity within the space sciences she has witnessed over the course of her career and how many more changes must be made for the field to become truly inclusive.

“Let's focus on empowerment, on positivity. Instead of dwelling on victimhood, let's embrace our abilities and work together to achieve our goals.”

UNOOSA: *You are a very accomplished astronomer. Could you tell us about your background and give a brief trajectory of your career?*

Karavska: I'm originally from Macedonia, which is now called Northern Macedonia. I went to high school at Ohrid, one of the best high schools in the world, where I received a strong background in math, humanities, and physics. From there, I went to Belgrade to study astronomy and physics, which I had wanted to do since I was very young.

Unfortunately, there weren't many women studying science at the time, especially not astronomy, but I was lucky to have my parents' support. After a few years as an assistant professor at the university in Skopje, I went to France for my PhD, then came to the Harvard-Smithsonian Observatory in Boston. It was supposed to be a three-month visit but ended up being almost 40 years.

around 800 scientists, engineers, and administrative staff. When I started in 1984, only about 3% of the individuals involved in astronomy were women, but that number has since increased to about 30 to 40%.

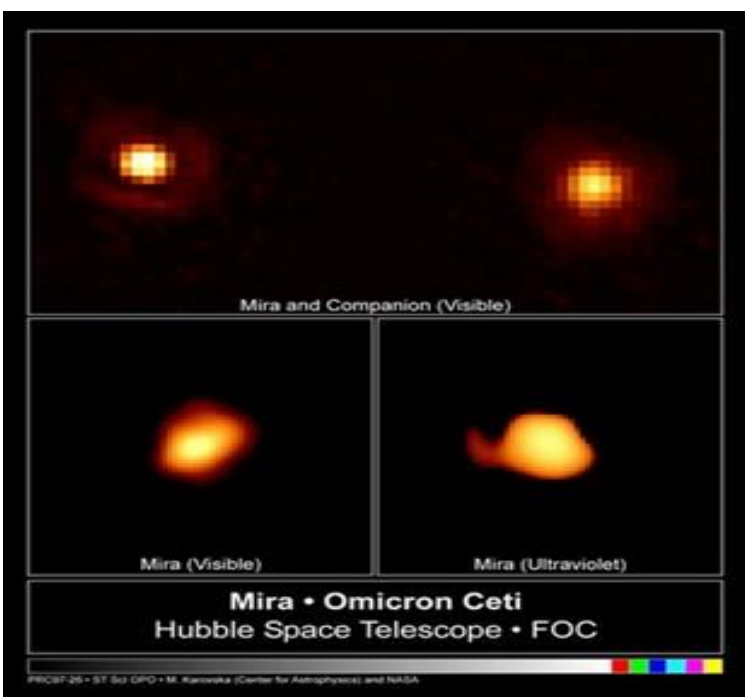
Despite the challenges of being a woman in a male-dominated field, I have had a successful career in astronomy and am proud to be a part of the Harvard-Smithsonian Astrophysical Observatory, now known as the Center for Astrophysics | Harvard & Smithsonian.

Do you believe that diversity makes for better science? Diversity in terms of not only gender, but also inclusion of marginalized or disadvantaged groups.

As a scientist, I firmly believe that I can't make a statement without first seeing the data. However, I also believe that excluding any segment of humanity, whether it's due to their gender, abilities, disabilities, or anything else, is a mistake. Even if it's just one group that's being left out, it's still a significant portion of the population that could contribute to the betterment of humanity.

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This is a NASA/ESA Hubble Space Telescope image of the cool red giant star Mira A (right), officially called Omicron Ceti in the constellation Cetus, and its nearby hot companion (left) taken on December 11, 1995 in visible light using the European Space Agency's Faint Object Camera (FOC). Credit: Margarita Karavska and NASA

The observatory is in Cambridge, which is very close to Boston and is known for having a high concentration of universities. The observatory itself is one of the largest in the world, with

When we put people aside because of external factors like their skin color or physical abilities, we are missing out on valuable contributions that they could have made. For example, a female thoracic surgeon is currently one of the best in the world, whereas people previously believed that women couldn't open the chest because they lacked the strength. This just goes to show that we shouldn't be categorizing people based on their external traits, but rather provide everyone with equal opportunity, respect, and dignity.

So you would say that inclusion in the workplace is a human right?

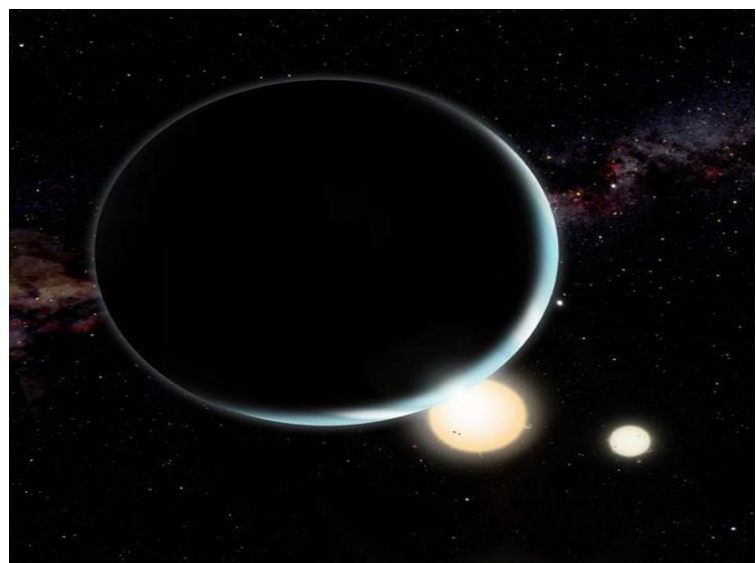
Yes, and it's not just about white-collar workers or people in my workplace. There are many areas where bare minimum dignity is not respected. For instance, women with children who need to write papers while taking care of their babies require support and assistance to do their job. As a stepmom without children of my own, I can't manage balancing work and personal life, even with a helpful husband. I was involved in the team that built and made the Chandra Space Observatory work, but I can't see how I could have done it all with young children. I wouldn't want other women to also have to choose not to have children because they don't see how they could manage both personally and professionally.

As a senior professor, you may have witnessed what it takes for a young person with disabilities to access STEM education and employment, especially in scientific research. How would you describe the current state of disability inclusion in STEM and in particular in astronomy? What are the barriers to disability inclusion in astronomy in general?

As a woman in astronomy, I was part of a marginalized group. There were very few women in the field, especially women from Yugoslavia like me. Despite this, I never saw myself as marginalized. I loved astronomy and worked hard at it, even with the added challenge of having an accent. While there were very few women in the field, I have seen progress over time, and efforts are underway to bring even more women into the field. This progress is important because not using almost half of the world's population is a wasted

opportunity.

While my mom left her job to raise my sister and me, I understand that women having the choice to pursue both a family and a career in the hard sciences is important. With the help of mentoring programmes, like the one I was a part of at Harvard, women can progress and excel in roles that were not originally made for them. I'm proud of the progress we have made so far, and I hope to see even more women succeed in the field.



This artist's conception shows Kepler-34b, a newfound gas-giant planet that orbits a double-star system. Its two suns are both yellow, G-type stars that swing around each other every 28 days. The planet circles them both in 289 days. The discovery of Kepler-34b and Kepler-35b shows that circumbinary planets are common in our Galaxy.
Credit: David A. Aguilar (CfA)

How did you become a mentor for these women in science?

I was at a talk at MIT where a high-ranking individual from Harvard made a comment about women not being as gifted in theory, which caused several senior women to leave the audience in protest. As a result, a group of senior women from Harvard started a mentorship programme to support women in science and engineering.

Anyone can sign up to be a mentor and support the bright mentees who have chosen science and engineering as their career path.

Each mentee is different and faces their own stumbling blocks along the way, but the programme aims to provide guidance and support.



Seen in this image from NASA's Chandra X-ray Observatory, Eta Carinae is a system consisting of two extremely massive stars. Interactions between the stars produced an outburst that temporarily made Eta Carinae into one of the brightest objects in the sky in the 19th century.
Credit: NASA/CXC/GSFC/K.Hamaguchi, et al.

There were three women who initially started the programme, but over time, it has expanded to include younger graduate students and postdocs. The matching process is based on the preferences of both the mentor and mentee, and I have found it helpful to mentor individuals in the field of astronomy, as that's where my expertise lies. My mentees and I still keep in touch and remain friends.

The programme requires initiative, organization, and the ability to identify the groups of individuals who need support. This model can be applied to other groups, such as those with disabilities or those facing other structural impediments, to connect them with mentors who can provide guidance and support.

Can you provide an example of potential barrier to inclusion for women in STEM?

I heard a troubling example once, although I can't share any names. It was about a senior student pursuing her thesis who attended a meeting with a colleague who was working on a similar project. The colleague told her that it

would be easy for her to get a job because she was a woman. It was disheartening to hear because this student has a natural talent and has worked incredibly hard to get to where she is. It's frustrating when people try to downplay someone's achievements by attributing them to their gender, disability status, or any other factor outside of their merit and hard work.

I decided to become a mentor because I didn't want other women to experience the same struggles I had to go through. If I can be of assistance, I'm more than happy to help.

It is also crucial to mentor individuals with disabilities, and I think it would be great to have a mentoring programme connecting those who have been through similar experiences. I also believe it would be beneficial for persons with disabilities in STEM to give talks and presentations to those who are just starting out on this path to put a face and a human element to the struggles that come with having a disability. This approach could be helpful on a global scale, but I also believe that one-on-one mentoring is incredibly valuable.

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Whose influence has shaped your perspective on disability in the field of astronomy?

I met one of the most positive human beings in my life, Dr. Wanda Diaz-Merced, at the observatory. She is visually impaired and uses a cane to get around. Wanda is also a professional astronomer and has developed a system to help her study astronomy despite her visual impairment. She is also my mentor and teacher, and we have become friends.

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Wanda was working on a project at the observatory on sonification and data analysis, and she needed guinea pigs to test it out. As someone who analyzes things visually, I was curious to learn more about this project. She showed me a light curve and added noise to it. At first, I relied on my eyes to find variability in the signal, but then I started relying on my ears more and found that I made fewer mistakes. This was a huge learning experience for me.

What is required for a paradigm shift in mindset and attitudes towards persons with disabilities? Beyond accommodation, what can be done to integrate persons with disabilities?

I believe that it's important to go beyond just using words like equity and inclusion and instead bring in individuals who can demonstrate their abilities. That's why I prefer to use the term "differently abled" rather than "disabled". It's about bringing in individuals who can show us what they can do, rather than just assuming we need to help them. We can learn from them and their experiences.

For example, when I was at Harvard, I had the opportunity to work alongside a woman who was differently abled. We both had different strengths and together we were able to accomplish a lot.

My hope is that people will understand that deep down, most individuals have good intentions and do not want to discriminate or hurt anyone. However, sometimes we may have unconscious biases that affect our

thinking. This is where mentorship becomes important, especially for marginalized groups like women or individuals with disabilities. It's about bringing people in to show what they can do without being labeled or limited by their differences.

I also understand that tokenism can be a problem, so it's important to approach this with sincerity and understanding. We need to recognize the historical marginalization of certain groups and work towards creating a more equitable society.

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Regardless, I believe that it's important to avoid thinking of ourselves as victims.

When we see ourselves as victims, we limit our potential and prevent ourselves from achieving our goals. Instead, we need to focus on empowerment. We need to believe in ourselves and combat the negative thoughts that hold us back.



An artist's impression of a spinning black hole surrounded by an accretion disc. Astronomers have used X-ray spectroscopy to measure the spin of a solar-mass black hole in the Milky Way. Credit: ESO, ESA/Hubble, M. Kornmesser.

It's like being told that we can fly when we've never flown before. We can't just jump and fly on our own. We need someone to guide us and show us that it's possible. We need to empower ourselves and others to realize the tremendous power we have within ourselves when we believe in ourselves.

How do you feel now that you are a mentor guiding women entering the field of astronomy?

My mentees are amazing. They juggle so many things in their lives and still manage to pursue their dreams. They share their personal milestones with me, from ultrasound photos of their babies to their achievements in their careers. It's a joy to see them find their path, even if it means changing their domain.

As their mentor, I am their biggest cheerleader. I encourage them to keep pushing and believe in themselves. It's incredibly rewarding to see them grow more confident and successful in their pursuits. I am so proud of them and all they have accomplished.

What practical steps can institutions and stakeholders take to enhance inclusivity and create a more inclusive environment in STEM-

related academia, research, and work settings?

There are ways to accommodate visually impaired people in scientific research. For example, a Braille printer or a tactile printer can be used to print images and graphs. Braille printing alone is not sufficient for visually impaired individuals to understand graphs, images, or equations, but they are an excellent first step.

While small institutions may not be able to afford equipment for accessibility, rental options are available to promote inclusion. Renting printers that can produce tactile images is a potential solution, and institutions should have procedures in place to make this equipment accessible to visually impaired colleagues who cannot read papers in the same way as others.

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The weight should be put on publishers to ensure their papers are inclusive, and they should reach out to people who cannot see to ensure that their papers are accessible.

There should never be a conference without a person trained in the scientific subject who can translate the content. I recently read an article that pointed out that there are no such translators in astrophysics, physics, and other sciences, and the situation is even worse for sign language for certain scientific terms such as 'black hole,' 'jet,' or 'cosmological constants.'

We need to address this linguistic aspect of diversity and inclusion.



The collision of two clusters of galaxies as seen at multiple wavelengths (low energy X-ray in blue, high energy X-ray in red, and optical light in yellow). Astronomers were able to use X-ray spectroscopy to re-measure the redshift distance to a colliding cluster and found it to be much farther away than previously thought, resolving several puzzles.

Credit: X-ray: Chandra: NASA/CXC/SAO/E. O'Sullivan, XMM: ESA/XMM/E. O'Sullivan; Optical: SDSS.

We need those in positions of power who are constantly preaching about diversity, inclusion, and equity to put their money where their mouth is. This means investing in the necessary infrastructure to support these initiatives. When building a house, you don't start with the roof, you start with the foundation. If society is serious about inclusion, this means investing in linguistics and developing infrastructure for those who are hearing impaired. This includes specialized printers, specific publishing, and a translator who is literate in the same scientific language as the conference or talk.

If we want to bring these people in, we need to build the necessary infrastructure. People with disabilities often do not ask for accommodations, so we must proactively build them.

Are new tools likely to change work environments in the future, making astronomy more inclusive and accessible?

Yes, it's truly incredible.

The observatory has certification programmes that are becoming increasingly advanced. For example, they have developed tools that allow visually impaired individuals to "see" Hubble

Space Telescope images through sound signals. It's truly amazing. This is the perfect time to continue developing these tools and identifying persons with disabilities who are passionate about this work. They can work to secure grants and government support to further develop the necessary infrastructure.

Would you say there is a need for grants dedicated to inclusivity projects?

Absolutely, yes. And I believe we need to establish serious grants and interdisciplinary groups that employ persons with disabilities to guide us. Often, people think they know what's best for disabled individuals without consulting those who have experienced it firsthand.

That's where individuals with lived experiences can offer valuable insights. We should have special funds to cover their expenses so they are able to give talks and share their knowledge.



A false-color infrared image of the Central Molecular Zone in our Milky Way galaxy. Astronomers have used infrared spectroscopy to confirm for the first time the presence of very young, massive stars in this unusual region.

Credit: NASA/JPL-Caltech

What advice would you give to a person with disabilities who wants to join a STEM field or astronomy?

The first piece of advice I would give is to connect with a mentor or someone who understands you and your situation. This connection can be made by yourself or through someone else who can make the connection for you. Having someone who has already gone through the same struggles can guide you through the obstacles and help you avoid making the same mistakes.

It's important to make sure that these people who are willing to help are available and can allocate some time for mentoring, even if it means including it as part of their job responsibilities.

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Secondly, it's essential to find organizations and networks of like-minded individuals who have had similar experiences and can provide support and guidance. It's also important to know that financial support may be available to help you achieve your goals.

It's crucial to raise awareness not just about the issue, but also about the organizations and policies in place that can help. This is where speeches and traveling around the world can make a significant impact in spreading awareness.

As someone who acquired a disability with age, I understand the importance of awareness and not being seen as a marginalized group. We

want to be recognized as individuals who are capable and willing to make efforts. It's not about receiving charity; it's about forming partnerships to create a better world for all.

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Do you have anything you want to add on the subject of inclusivity in astronomy?

Let's focus on empowerment, on positivity. Instead of dwelling on victimhood, let's embrace our abilities and work together to achieve our goals. It's easy to feel discouraged when someone tells you what you can't do, but imagine the power of someone telling you what you can do and offering their hand to help you achieve it.

That's the kind of world I envision, where we come together as one, without any marginalization.

We all have areas of our lives where we struggle, and that's okay. It's important to remember that we are all in this together, and sometimes we just need a little support and encouragement to keep going.

Let's offer each other a shoulder to lean on and a hand to hold as we work towards creating a better future for ourselves and for the world. ■

BIO

Dr. Margarita Karovska, an astrophysicist at the Center for Astrophysics | Harvard & Smithsonian, has utilized both spectroscopic and high-spatial resolution imaging techniques to study astronomical sources. These sources range from our Sun and young stellar objects to evolved variable stars and binary systems, supernovae, supernovae remnants, and extragalactic sources, including active galactic nuclei. Her research focuses especially on the physical characteristics of accretion in systems at scales that range from stellar interacting binaries to supermassive black hole environments. She has led numerous collaborative projects that use multi-mission ground- and space-based observations across wavelengths that range from X-ray to UV-optical to radio. Dr. Karovska has mentored many students, including graduate and postdoctoral students.

RESOURCES

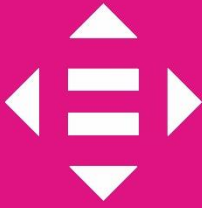
- Center for Astrophysics | Harvard & Smithsonian: [\[Link\]](#)
- Patient develops a braille printer to analyze graphs to keep working as a scientist: [\[Link\]](#)
- 3D printing allows blind scientists to visualize data using touch: [\[Link\]](#)

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10 REDUCED INEQUALITIES



ABOUT

This article is part of the “Space+: Pathways for All Abilities” interview series under the United Nations Office for Outer Space Affairs Space for Persons with Disabilities project. The aim of this interview series is to raise awareness of the importance of disability inclusion and to advance inclusive and equitable development in the space sector through sharing the experiences of and lessons from disability advocates and persons with disabilities in space.

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This publication has not been formally edited.

United Nations Office for Outer Space Affairs
Space for Persons with Disabilities project
October 2023