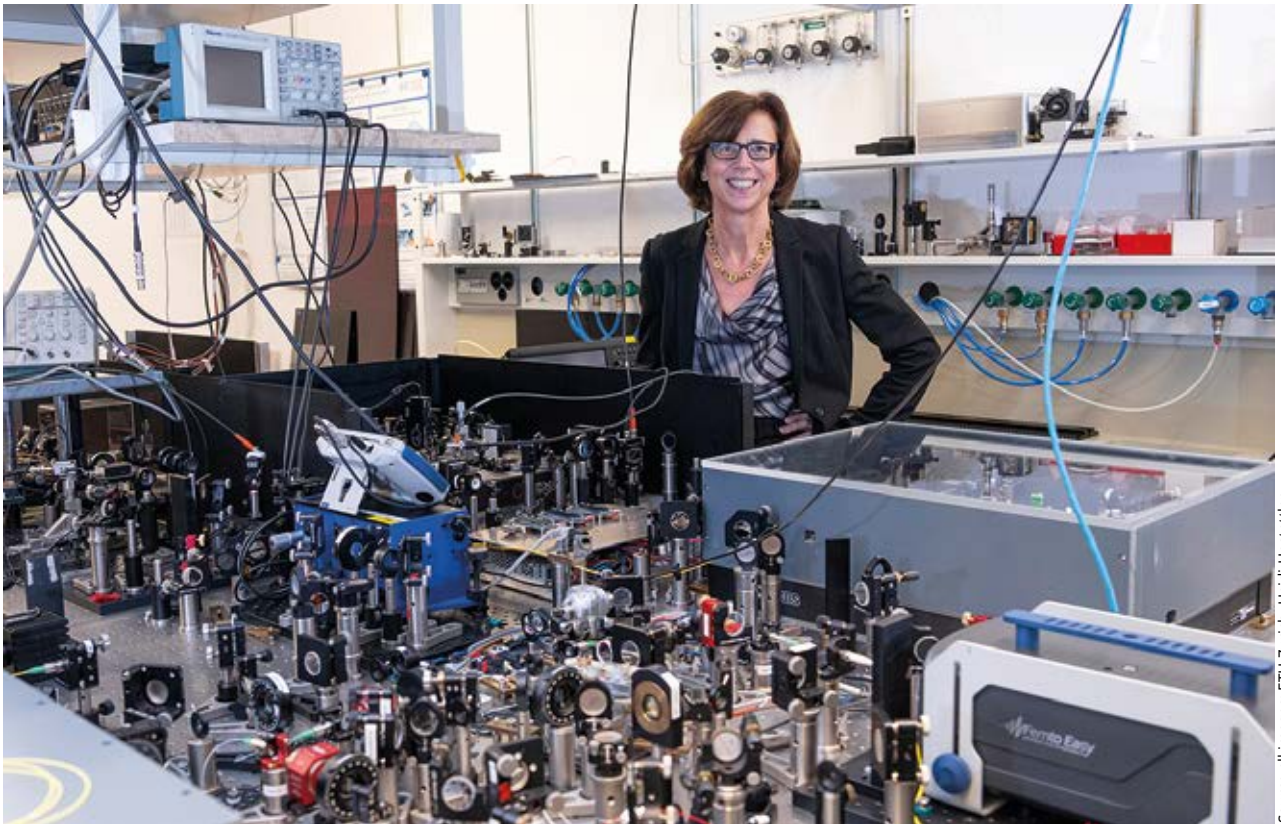
"Open the door to something better"

Prof Ursula Keller on the challenges of being a woman in STEM – in Europe and abroad



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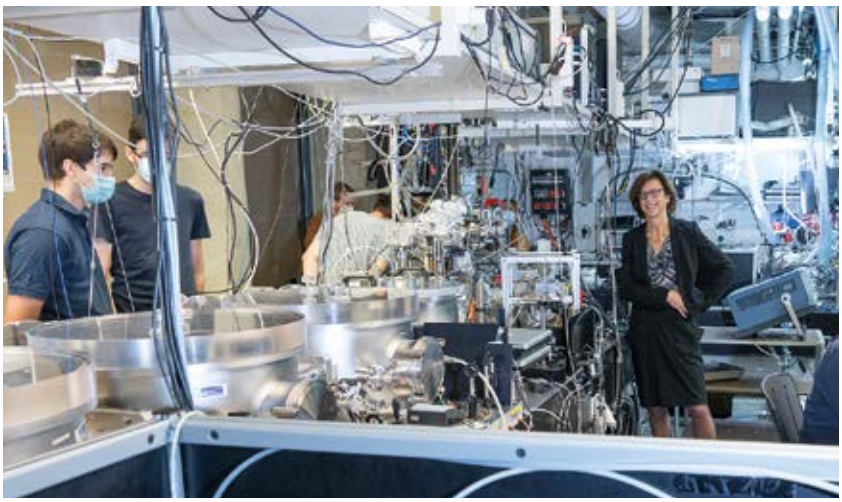
The first tenured woman physics professor at ETH Zurich, and a career-long campaigner for fair play and a level playing field for women in science, Ursula Keller, talks to Francesca Moglia, EPIC's former photonics technologies program manager.

What is the background to your appointment as professor of physics at the ETH?

Coming from a working-class background, I was the first ever in my family to go to university. In 1984, I graduated top of my class with an MSc in physics from the Swiss Federal Institute of Technology (ETH) in Zürich. I then began a PhD in applied physics at Stanford University in the US where I worked on a novel high-speed optical measurement technique of charge and voltage in GaAs integrated circuits and low-noise ultrafast laser systems. After my PhD, I joined AT&T Bell Labs at Holmdel, New Jersey, as a member of the technical staff and began my independent research career right after my PhD, exploring and pushing the frontiers in ultrafast science and technology in relation to photonic switching, ultrafast laser systems, and semiconductor spectroscopy. In 1991, after a national demonstration by Swiss women, the ETH, which at the time was almost entirely male dominated, came under political pressure to hire more women, and in 1993 I was one of the first ten 'quota women' to be hired as a tenured Professor. In 1997 I became a full professor and in 2010 I was appointed director of the Swiss National Science Foundation's MUST program, i.e. National Center of Competence in Research (NCCR) Molecular Ultrafast Science and Technology – a 45 million euro interdisciplinary research program on ultrafast science in the fields of physics and chemistry [1].

How and why do you think Bell Labs was better at recognizing merits than ETH?

While I was at Stanford doing my PhD, we had regular one-to-one meetings with recruiters from IBM and Bell Labs. In general, since they knew I had the necessary academic and technical ability by being at Stanford, they were more interested in getting a feeling for my personality to determine if I would be a good fit for the company. I chose Bell Labs because they had a long tra-



Ursula Keller and some of her PhD students in the attoline laboratory at ETH

dition of ultrafast and because I would have the complete freedom to run my own lab. This simply would not have been possible at ETH because until 1993 there were no women leading physics research.

What support systems were there at Stanford for women students?

At that time, women physics and engineering PhD students were still a rarity. At Stanford I could benefit from a peer mentoring program which I found very helpful, and which motivated me to establish something similar in the physics department at ETH Zurich with the help of the NCCR MUST outreach officer Dr Anna Garry [2]. At Stanford we shared offices with other students from different groups, and were able to talk to each other and get help and advice. My professor expected me to manage myself. If I needed help, I could ask the senior students or senior postdocs or go directly to my professor, so help was available from both the top and from the bottom. Some students were more independent than others, but everybody could choose who to approach and how to proceed.

What support did you get from women in leadership positions at Stanford?

I was lucky to be taken on by a visiting professor, Geraldine Kenney Wallace, to undertake a theoretical directed study, and of course I got to know her. At Stanford, we had a rotation system where students were encouraged to join different groups, and once she understood that I didn't want a micromanager and what was important to me, she convinced me to go into Dave Bloom's group – even doing a pitch for the professor to take me on. She heavily influenced my choices back then and my future, but they were the right things to be done.

How did you apply your experience at Stanford to your approach for supervising students at the ETH?

I saw my time as a PhD student as a process of growing up – taking charge of my career and learning how to manage myself and when and how to ask for help. From this, I have two guiding principles: flexibility and never to micromanage. All of my students have a particular project when they start, get a copy of the proposal and I always say, if you have a better idea, let me know. I have had graduate students who redefined their PhD because there was a surprise along the way, and I give this flexibility because I don't believe in micromanagement. Someone was able to solve problems and make a success where others had more difficulties and needed more help while someone else joined the group with already clear goals for their careers and I supported them in the best way they required. Not every professor is a perfect fit for every student. In my case, I am always happy to meet students when they encounter a problem or want to discuss their results, but I don't normally have regular fixed meetings, as I think it is best to meet only when there is a need to resolve a particular issue. When we do meet, I expect the student to have a short summary or something else written up. The preparation of the meeting with me usually helps the student a lot to have a better overview of the experiment and the things that have been done, and sometimes the solution or a new idea to overcome the challenge comes up exactly during this process.

Of course, I don't always have the perfect solution and I sometimes tell the student to talk to other students, postdocs and even external collaborators. It can be frustrating when something doesn't work out, but I think that is part of the learning process because you need to learn to develop some frustration tolerance.

How can we get more women into STEM and keep them there?

I would say we need more STEM people, both men and women. Of course, women are still disadvantaged by gender

Organization

EPIC – European Photonics Industry Consortium

EPIC is the world-leading photonics industry association representing more than 780 members across 35 countries. EPIC promotes the sustainable development of organizations working in the field of photonics, EPIC fosters a vibrant photonics ecosystem by maintaining a strong network and acting as a catalyst and facilitator for technological and commercial advancement. EPIC publishes market and technology reports, organizes technical workshops and B2B roundtables, supports EU funding proposals, advocacy and lobbying, education and training activities, standards and roadmaps, pavilions at exhibitions.

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Ursula Keller won the European Inventor Award in Lifetime Achievements in 2018, organized by the European Patent Office.

stereotyping and young girls and women need to be encouraged by having more female role models who are using physics to solve problems in areas that get a broader group of people excited. I personally believe that lasers and photonics in general are very attractive for many interdisciplinary applications in energy, climate change, health, and biology for example.

Then, of course, we have to make sure that those who are actually interested in doing well in STEM don't leave because they are not treated well, for example due to an unsupportive work environment and an informal power structure with limited access to resources and decision making. We also need to better implement support for family and work-life balance issues. It can be done, but it is not business as usual and we need extra support during the baby phase, such as, for example, no teaching for one year after the birth and an additional PhD student to support a postdoc mother, a new program successfully implemented in the physics department at ETH Zurich to keep postdocs employed 100 % with more work-time flexibility and keep them working on a hot topic [3]. This is a great success because studies have shown that pregnant postdocs were very often encouraged to go part-time, take a break or were not even hired. Now you can argue that one pregnant postdoc plus one PhD student is more than one postdoc. This is a win-win situation for all.

How important is it for women to network with other women?

I think it is important for women to network with both women and men. But there is a special need to talk to women when the numbers are well below thirty percent. From my experience as a student, I learned not to mention my weaknesses to my male colleagues. They seldom talked about their own weaknesses and when I mentioned mine, being scared of exams for example, it just fulfilled their female stereotypical bias, and it was used against me. So I learned very early on to keep any fears or doubts to myself.

For this reason, I was always happy when I saw another woman somewhere. In fact, when I arrived at Bell Labs, they had just started organizing formal women-only lunch research sessions once a month after a woman had won a big sexual harassment case. Having had to pay a large financial settlement, the company implemented additional measures whereby all the women scientists and members of technical staff were assigned a personal mentor. Both programs were very helpful for me.

How should the need for women quotas be presented to men who feel victims of reverse discrimination?

Some men are not comfortable with women, especially after the spreading of the 'me, too' movement. For this reason, some of my male colleagues have told me they don't like having a meeting with a woman alone in their room, and if they do, they always keep the door open. A consequence of this is that where men have the choice, they will hire someone who looks like them. That is why women quotas are important. In the physics department at ETH after hiring two 'quota women' professors in 1993, every professor selection committee for the following 22 years resulted in selecting a man with a ratio of 24:0. Only after a crisis with having a woman professor fired, five female tenure-track professors were recruited, within only two years from 2018 to 2020. By 2019 ETH Zurich still had only 14 percent tenured women professors with 32 percent incoming female students [4].

So I have a little bit of a problem when men tell me they feel they are being discriminated against because they don't have any chance to become a professor as only women are being hired. Based on the data, this is simply not true. Men still dominate science and attempts to level up the playing field for women to give them greater equality should not be seen as reverse discrimination. In any event, I think that questioning the status quo is good because it can open the door to something better. We need mandatory education on these issues for both men and women.

Why are transparency and accountability key for good governance?

While women quotas and grants specifically for women are a step in the right direction, they don't address the root causes of the problem. In my view, these are the lack of effective control systems, and the need for greater transparency and accountability in resource allocation and decision making. These more open systems need to replace the current culture of informal, mostly male-dominated power networks with inherent gender and ethnic biases, limited accountability and transparency of decision making.

Unfortunately, the culture of gender bias affects women as well as men. For

example, some women say they would never want to have a woman boss because they are too bossy. This, of course, comes from gender stereotyping in that while it is okay for a male boss to be demanding and questioning or critical of performance, when a woman behaves in the same way she is considered harsh and domineering. In actual fact, it's been proven that women managers spend more time supporting, counselling, and advocating women than men do. A lot of young women need to be aware that they have the same gender bias as men, and they need to guard against being used as a weapon against senior women and women leadership.

Transparency and accountability are also necessary to counter bias in allocating resources to competing sciences. Traditionally, particle physics has always received more money with the argument that it's 'big science' and it has been a struggle to get other areas, such laser science and solid-state, to be recognized as being also more expensive.

If you started again, what would you do differently?

Given where I came from, I have achieved more than I ever dreamed of. I am happily married, I have two great kids and I don't have any major regrets. It has not always been easy, but I think the struggles I have had made me a stronger and better person.

Of course, I have made my share of mistakes, but on the big calls such as going into physics, becoming a professor and starting a family, I made the right decisions. It is important to remember that I only got the chance to become a tenured professor because of all the efforts of many pioneering women before me.

At this point in my career I want to help to leave ETH better than I found it. Through my NCCR MUST directorship I got a direct mandate and resources from the Swiss National Science Foundation to do something for the advancement of women for the last twelve years. We have achieved a lot getting women networked and implementing some real change. I hope that the increasing number of women can support each other for a measurable culture change in the future.

[1] A detailed description of Ursula Keller's career and commitment for a more gender-equal academia at any hierarchy level can be found here: https://ulp.ethz.ch/news/ulp-news/2022/01/what-makes-me-tick-why-do-i-still-want-change-for-more-women-in-stem.html
[2] https://learningteaching.ethz.ch/ Especially the article "Improving the learning environment in the Department of Physics: a peer mentoring program for first-year female physicists alongside changes in the lecture program"
[3] http://www.nccr-must.ch/equal_opportunities/opn_column_reflections_in_diversity/opn_column_december_2016.html
[4] ETH gender statistics, https://ethz.ch/services/en/employment-and-work/working-environment/diversity/strategy-and-numbers.html

Author

Francesca Moglia is is former technology manager at EPIC, the European Photonics Industry Consortium. She has a background in crystal growth, spectroscopy, optics and laser development for research and large research facilities. Before joining EPIC, she moved from R&D to scientific management to coordinate a consortium of funding agencies in the field of astroparticle physics. She graduated in physics from the University of Pisa in Italy, acquired her PhD (Dr. rer. nat.) in laser physics at the Universitaet Hamburg and pursued her postdoctoral activities at DESY, Deutsches Elektronen-Synchrotron in Hamburg, Germany.

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