

## Celebrating 100 years of International Women's Day Women ~~for~~ in science through the decades

This year marks the 100th anniversary of the first International Women's day (IWD). In this article we will go through the decades up to now and see-look at the role of many-some women related to our field.

Thinking of women scientists, obviously the name of Marie Skłodowska-Curie jumps to mind, especially since 1911 also marks the 100th anniversary of her Nobel prize for Chemistry for the discovery of two chemical elements, radium and polonium. This was actually the second time she was called to Stockholm since eight years earlier, she had received the Nobel prize in Physics, shared with Pierre Curie and Henri Becquerel.

Madame Curie made several "first": first woman to receive the Nobel prize in 1903, first person to receive it twice, first female professor at the University of Paris, and, as seen in the photograph, the only female to attend-participate in the first international physics conference, the Solvay conference in 1911 in SolvayBrussels. A century later, the situation has dramatically changed, with 20-30% women at-aHattending major physics conferences.

After Marie Curie's prize in 1911, the Nobel prize for Chemistry was awarded, in the following century to three other women: her daughter Irène Joliot-Curie, in 1935, Dorothy Crowfoot-Hodgkin in 1964 and Ada E. Yonath in 2009. And in 1963, Maria Goeppert Mayer received the Physics Nobel Prize for her work on the structure of atomic nuclei.

### Pioneers in the 40's and 50's

The 40's and 50's were exciting in physics: first accelerators, first developments towards modern particle physics, ...first-of-everything. This is also when many women joined various physics groups around the world, during very challenging times, around WWII, becoming role models for many aspiring young women.

~~One great example is Leona Marshall Libby (1919–1986), a very innovative developer in nuclear technology. Leona built the tools that lead to finding cold neutrons and researched isotope ratios. She became professor of physics at the University of Chicago, balancing her scientific and family work, and left behind a legacy of exploration and innovation.~~

Marietta Blau (1894-1970) pioneered work in photographic methods to study particle tracks and was the first to use nuclear emulsions to detect neutrons by observing recoil protons. Her request for a better position at Vienna University was rejected because she was a woman and a Jew. Marietta left Austria after the war and with a recommendation from Albert Einstein, was appointed professor in Mexico City. She was nominated for the Nobel Prize several times.

Nella Mortara (1893-was) one of the most beloved assistant professors of physics at the University of Rome in the late 30's when she was expelled because of being Jewish. She escaped to Brazil but returned secretly during the war, living in great danger. She eventually came back to Rome as a professor, for the great joy of her students.

Leona Marshall Libby (1919 - 1986) was a very innovative developer in nuclear technology. Leona built the tools that lead to finding cold neutrons and researched isotope ratios. She was the first woman to be part of Fermi's team of scientists. Eventually she became professor of physics at the University of Chicago, balancing her scientific and family work, and left behind a legacy of exploration and innovation.

Maria Fidecaro has spent a lifetime of dedicated research at CERN, where she still works. She came in 1956 after working for several years in Rome on cosmic rays experiments, and for a year at the synchrocyclotron in Liverpool, was the first female physicist hired at CERN in August '56 where she still works, after a lifetime of dedicated research. Maria fondly remembers what it meant to be a scientist-physics student right after the war, the difficulties-challenges of balancing a scientific career with family, and collaborating with other pioneers of modern physics from all over the world,

including many women. [“I always worked with my soul and conscience”, she says.](#)  
~~She succeeded thanks to her enthusiasm, curiosity toward science and positive attitude, working with her “soul and conscience”.~~

Hildred Blewett (1911–2004), an accelerator physicist from Brookhaven, collaborated in the early 1950's to the design of CERN's first high-energy accelerator, the Proton Synchrotron, while also working on the similar machine proposed for Brookhaven.

Maria Goeppert Mayer (1906-1972), lectured at prestigious universities, published numerous papers on quantum mechanics and chemical physics, and collaborated on an important textbook with her husband. Despite her accomplishments, anti-nepotism rules forbade her from receiving an official appointment, and for many years she taught physics at universities as an unpaid volunteer. In 1959, four years before receiving the Nobel Prize, she was finally offered a ~~paid~~, full-time position by the University of California at San Diego.

These are just some of the many prominent women, [all great role models for the next generations of women in science.](#) ~~who helped open doors for the next generations of women in science.~~

### **When all was done by hand...**

From the 60's up to the mid 80's, dozens of women worked at CERN and elsewhere as “scanners”. Their job consisted in finding interesting events among the many tracks left by particles in bubble chambers and captured on photographs.

Madeleine Znoy recalls how tedious it was: “Initially, the work was all done manually, using a pencil and a sheet of paper to note down the coordinates of where the interactions had taken place.”

“Scanning took place around the clock as the quantity of films to be scanned was enormous! From 7:00 to 22:00, female scanners studied the films and from 22:00 to 7:00, men took over, often ~~times~~ students.” Each shift only lasted four hours since the work was so strenuous, working in complete darkness, with three projectors illuminating the films.

Anita BJORKEBO started as a scanner in 1965. After her scanning shift, she compiled data and classified events, all by hand, including making histograms!

Madeleine once beat a record, scanning more than 750 photographs in one day!  
“At first, some physicists thought this was impossible, that surely I had missed interesting events. But all was fine and they were very surprised!”

Even though these women did not get their names on publications, they felt appreciated. “We were part of the team, we had a role to play”, says Anita proudly.

Later, the scanning got more automated and the measuring equipment was linked to a computer. Scanners moved on to operating them. Some like Anita and Madeleine would set them up for other scanners or streamline the operation for new experiments.

Anita got so interested in her work that she signed up for two particle physics classes, attending lectures and doing homework after work. “This Swedish physicist only had five students here so he invited the technical staff to join”, she explains.

As Madeleine says: “With the scanning, we could really see the particles. I really enjoyed working with the physicists and technicians, and collaborating with other laboratories. We were young and full of enthusiasm. It was a great period!”

### **Life for non-scientists at the lab**

CERN's convention was among the more forward-looking policies when the Organization was founded in 1954 since it mentioned all professional categories needed to form a large international collaboration such as we are today. Of course, women were recruited mostly in the support professions for the administration but as post WWII education got underway and women expanded into all areas of university training, physics and technical professions inherited many women candidates. CERN was willing to provide and encourage working opportunities so badly needed for them to be able to flourish in the professions opening up for women.

However, the situation of women at CERN, especially in the intermediate administrative categories where they are most represented, has not evolved much since the 80's; from a certain viewpoint, one could even say that it has deteriorated. Recruitment is now often based on standardized job criteria that leave less room for the appreciation of the level of education and professional skills needed in the post. And yet, no need to demonstrate how this staff category is essential to the day-to-day life at CERN, its proper functioning depending so crucially on good communications and dedication at all levels.

How would the administrative staff be treated and perceived if most of them were men? It would certainly be very interesting to compare the career evolution of say, a female administrative assistant and a male technician of equivalent educational levels. Unfortunately, CERN is not different from the rest of the world in this aspect.

In spite of this, we are proud to belong to an organization that now welcomes a gender mix at all levels and to participate in our own way to its great and passionate adventure.

### **Education and women as role models**

In the year 2000, an alumna of the CERN summer student program returned to the program to give a lecture on "Classic Experiments". Melissa Franklin participated in the program in 1977. She went from there to become the first tenured female professor of physics at Harvard University, and now works on the ATLAS experiment at CERN.

Her story is just one of many you can find of alumni of the CERN Summer Student program who went on to have amazing careers. Started in 1962 by then director general of CERN Victor Weisskopf, the program began with just 70 students. Nowadays, walk through any of the buildings at CERN in mid July and you can see evidence of the ~140 students participating in the program ~~littered all over around~~ the site.

Today, although at least half the students are women, female lecturers are still few and far between. Last year, only three of the 31 lecturers were women. Giving the Summer Students adequate role models is just as important as allowing diversity in their ranks. The teachers, authors and educators we encounter are always great influences in our lives and careers, and having role models has always been so important for all young women.

### **Women scientists in the LHC era**

In 1911, Marie Curie was the only ~~women-woman~~ out of 24 participants attending the first international physics conference. In 2011, women make up about 20 percent of the several thousand scientists, engineers and technicians working on the LHC experiments. More astonishingly, almost half of those women are younger than 30. We have come a long way in 100 years! We discuss with women from the LHC about their experiences on building the world's most-complex scientific apparatus.

The day-to-day operation of the LHC is in the hands of eight Engineers in Charge (EIC), a group that is an equal mix of men and women. To Dr. Giulia Papotti, one of the EIC, this distribution was due to the management having an open mind about evenly distributing the scientific background of the group. "They were looking for someone with radio-frequency expertise, which is my field. Other considerations such as nationality or gender were secondary". As a result the group is 50/50 men and women but "we are also four Italians", Giulia quips. She had to hit the ground running with her position at CERN. "I started work on November 16th. When was the first beam? November 20th. I had to learn fast!" It proved the greatest challenge of her career; having the responsibility to run the LHC while simultaneously learning to do so. The workload was additionally taxed due to two people still in training and two people on ~~maternity-parental~~ leave. She reckons that everyone made a few mistakes but what is important is what they learned. "Our work is to think about how to improve things. We are meant to be critical. We are paid to think."

Dr. Amalia Ballarino, a scientific engineer on the magnet cooling system, designed and managed the production of the high temperature superconducting connectors used for the LHC. For this work, she won the Superconductor Industry person of the year [award](#) in 2006. "We had to work under a tight schedule," she says of building a system that consists of 3000 components made across the world. Every time the LHC turns on, the current must flow through these connectors. "At first, this was total stress. Now that the LHC has been running smoothly, I can relax." Amalia was drawn to the field when she came to CERN to do her Masters. "This field requires creativity, rationality, and communication with others. Working here is an opportunity to create something new." As for combining science and social life, Amalia says, "it is naive to say it is easy. The previous generation was used to seeing women at home. It takes effort to combine work and family [together](#)."

On this International Women's Day, we find that women in science today are passionate for the field, undertake tasks with great responsibility, frequently work in high pressure situations, and they wouldn't want it any other way. Lene Norderhaug, a CERN fellow working on software development, thinks this day can be an opportunity to continue the growth of women in the field. "If more women are [needed-desirable](#) in the higher positions, then we have to make sure that women **try** for these jobs, suggest that they apply, show them that this is a good place to work." Looking back on 100 years of International Women's Day, we have come from only one woman at a conference to representing twenty percent of the field. Where will we be in the next 20 years? "Twenty years is too long of a perspective for me", Lene says, "but in five years, I hope to have my PhD and my second job at CERN. We like it here!"