2025 INTERNATIONAL TEACHER WEEKS PROGRAMME AT CERN

SUMMARY: Participation in the CERN International Teachers Workshop was a once-in-a-lifetime experience to join an international community of educators focused on better understanding not just particle physics, but how its inclusion in the curriculum can engage and motivate future physicists, engineers and technicians. Thank you CAP, Perimeter Institute, and the Institute of Particle Physics for your generous support!

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In August 2025, with the generous support of the Canadian Association of Physicists (CAP), the Perimeter Institute (PI), and the Institute of Particle Physics (IPP), I had the privilege of attending the two-week International Teachers Programme at CERN in Geneva, Switzerland. I joined 39 other educators from 31 countries to dive into the world of particle physics to deepen our understanding of and explore strategies for bringing this advanced content into high school classrooms.

The programme offered a full and varied schedule of lectures, workshops, and site visits. Hosted by Jeff Wiener (CERN) and Milena Vujanovic (University of Leeds), we began with warm welcomes from Charlotte Lindberg Warakaulle (CERN) and Sascha Schmeling (CERN), followed by an overview of particle physics from Jonathan R. Ellis (King's College London). Throughout the two weeks, we heard from leading experts in the field: Simon Albright (CERN) spoke on the design and operation of particle accelerators, Veronika Kraus (Vienna University of Technology) explained the function and architecture of particle detectors, and Luis Roberto Flores Castillo (Chinese University of Hong Kong) walked us through the intricacies of the Higgs boson, Feynman diagrams, and antimatter. We also heard from Raymond Veness (CERN) on the engineering challenges at CERN, Bettina Mikulec (CERN) on the realities of running a particle accelerator, and Piotr Traczyk (CERN) on the Compact Muon Solenoid (CMS) detector. One particularly memorable talk came from Manjit Dosanjh (University of Oxford), who spoke about the medical applications of particle physics, particularly in cancer treatment. Her

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lecture highlighted the need for cross-curricular collaboration and served as a powerful reminder of how fundamental physics can have profound real-world impact.

In our second week, Markus Joos (CERN) presented on the computing infrastructure required to process and analyze the vast amounts of data generated by the LHC, while Flavia de Almeida Dias (Nikhef National Institute for Subatomic Physics) focused on the statistical methods and data analysis tools used in modern particle physics. Patrick Koppenburg (Nikhef National Institute for Subatomic Physics) introduced us to "beauty" physics and the study of B-quarks, Panagiota Chatzidaki (Uppsala University) shared insights on heavy ion physics from the ALICE experiment. Maurizio Pierini (CERN) explored the use of machine learning in high-energy physics research, Claudia Ahdida (CERN) addressed radiation protection measures at CERN, and Michael Benedikt (CERN) gave an overview of the Future Circular Collider (FCC) project and the process for selecting its potential location. This final lecture emphasized the importance of large-scale scientific projects engaging with all stakeholders affected by their outcomes, and underscored the necessity of incorporating equity and justice into discussions surrounding international scientific infrastructure.

Direct teaching strategy discussions were led by Jeff Wiener, who shared research on best practices for introducing particle physics into the classroom. His work included practical resources like the "Mystery Boxes" activity, which encourages students to hypothesize and infer based on limited evidence—mirroring the methods used by physicists themselves. Additionally, Milena Vujanovic's research on the use of Concept Maps was revisited throughout the programme, and she shared important considerations of their use in the classroom.

Alongside the lectures, we participated in several site visits. We toured ATLAS, CMS, ALICE, LHCb, the antimatter factory, and LEIR, and visited the CERN Control and Data Centres, as well as the Cryogenic Test Facility. Although the LHC was running during our stay and we couldn't enter the tunnels, we still went underground at CMS (90 plus metres) to experience the magnetic fields—still perceptible through thick concrete walls. At CERN's Science Gateway (an educational and outreach science centre), we built cloud chambers and observed particle decay tracks of electrons, protons, and muons.

Figure 1. Inside the Cryogenic Test Facility at CERN.

Figure 2. Extra Low Energy Antiproton ring (ELENA) in the Antimatter Factory at CERN. ELENA slows antiprotons to make them easier to trap.

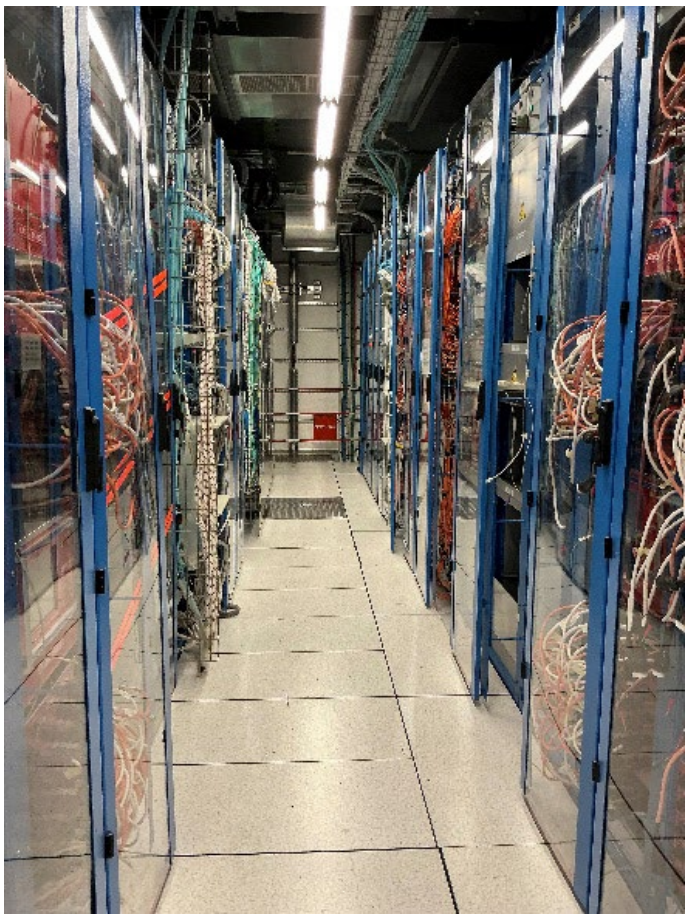

Figure 3. The Counting Room, 87.9 m underground at the Compact Muon Solenoid (CMS) at CERN.

Throughout the programme, I was repeatedly struck by how well the Ontario science and physics curricula align with the foundational concepts explored at CERN. Topics such as law of conservation of energy and momentum, nuclear energy, the motion of charged particles in electric and magnetic fields, and the Standard Model are all critical for understanding particle physics. For my final group presentation on the specific experiments run at CERN, I reflected on how these curricular components join together to form a strong base for students to begin engaging with this exciting field.

One of the most profound takeaways from the programme was the sense that particle physics is not a finished story, but an evolving pursuit. As Jonathan Ellis remarked in his opening lecture, “I hope there is a difference between theory and experiments.” The field of particle physics thrives not on confirming what we already know, but on seeking what we don’t. This mindset – that the unknown is not a limitation but an invitation – is something I am eager to bring back to my students. Physics becomes far more meaningful when presented not as a set of answers, but as a field driven by open questions.

There is space for everyone in this pursuit, and that in itself is a powerful message to carry into the classroom.

ACKNOWLEDGEMENTS

I am deeply grateful to the CAP, the Perimeter Institute, and the Institute of Particle Physics for making this experience possible. Opportunities like these help keep Canadian science education globally connected and forward-thinking, and I'm excited to maintain the international connections I built at CERN to better support and inspire my students moving forward.