



Laboratoire de Physique des Hautes Energies

**LPHE
for future
Master
students**

Fred Blanc
Laurent Dufour
Guido Haefeli
Radoslav Marchevski
Chiara Perrina
Olivier Schneider
Lesya Shchutka

April 28, 2026

- Experimental particle physics

- participation in several international collaborations

- LHCb at the LHC at CERN
 - NA62 at the SPS at CERN
 - SND@LHC at CERN
 - SHiP at the SPS at CERN
 - Future Circular Collider (FCC-ee) – future flagship CERN facility
 - DAMPE/HERD in space (astroparticles)

- 44 scientists

- 22 PhD students, 15 postdoctoral researchers

- 7 teachers

- Prof. F. Blanc
 - Prof. L. Dufour
 - Dr. G. Haefeli
 - Prof. R. Marchevski
 - Prof. C. Perrina
 - Prof. O. Schneider
 - Prof. L. Shchutska

BSP (=Cubotron), 6th floor + labs 1st and 2nd floor



Prof. Chiara Perrina



Prof. Olivier Schneider



Prof. L. Dufour



Prof. Fred Blanc



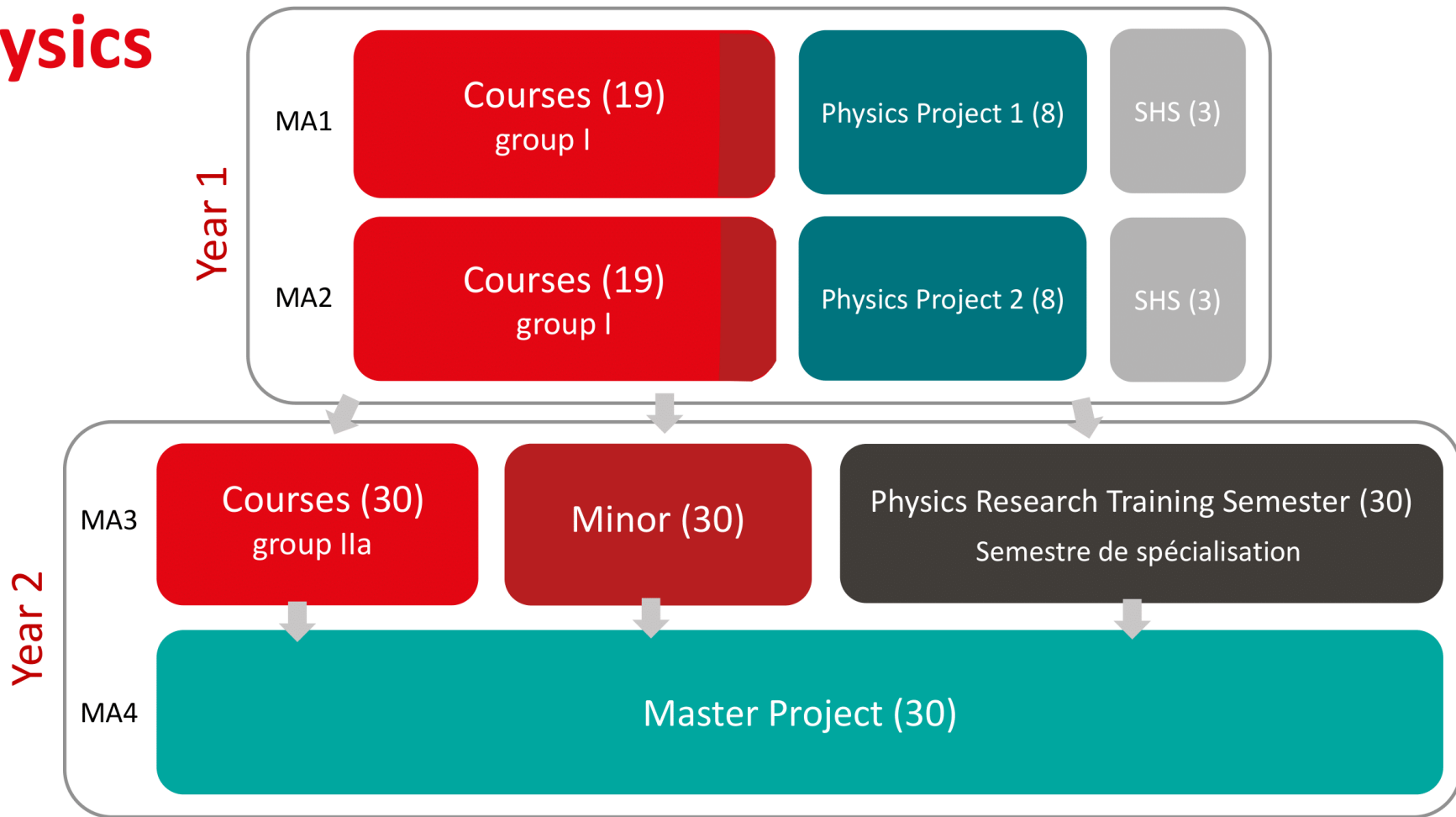
Prof. Radoslav Marchevski



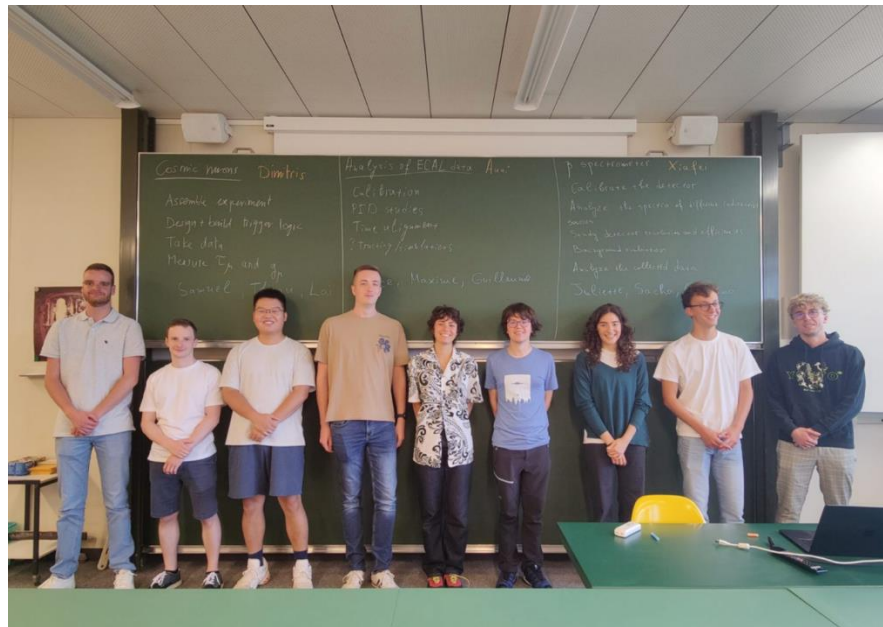
Dr. Guido Haefeli



Physics



- You can join our team of excellent master students for both Physics Project 1&2 (1st year) and specialization/Master projects (2nd year)



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- The students interested in doing their Physics Master degree at LPHE will
 - obtain general knowledge about particle physics phenomena and particle detection
 - be introduced to advanced concepts in modern particle physics with emphasis on relevant research topics
 - conduct small but complete particle physics experiments in teams of 2-3 students
 - beta spectrometer, “measurement” of the neutrino mass, measurement of muon lifetime and magnetic moment, development of a cosmic ray detector
 - get involved in particle physics research
 - working on small individual projects
 - completing a semester-long specialization
 - master thesis on a specific research topic
- At the end of the program the students will have the necessary skillset to pursue a doctoral degree
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EPFL Master courses offered by LPHE in 2026-2027

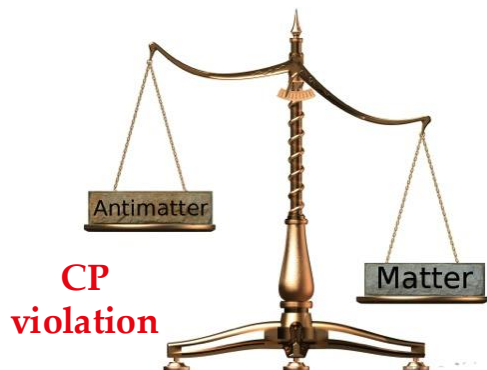
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- **Year 2026-2027:** all courses are optional
- **We encourage students interested in particle physics to look at theory or accelerator course**
 - e.g. Machine learning for physicists (Zdeborova), Quantum Field Theory (Rattazzi), Introduction to particle accelerators (Pieloni)
 - for more info see <https://www.epfl.ch/schools/sb/sph/en/master/master-in-physics/>

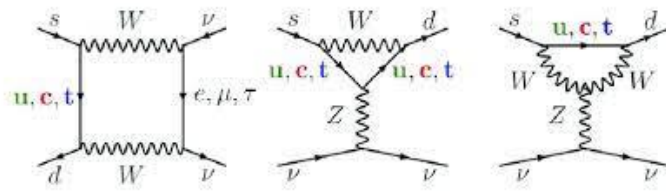
Course title	Code	Semester	Hours/week	Teacher(s)
Particle Physics I	PHYS-415	MA1	2C + 2E (4 ECTS)	L. Dufour
Particle Physics II	PHYS-416	MA2	2C + 2E (4 ECTS)	L. Shchutska
Particle detection	PHYS-440	MA1	2C + 2E (4 ECTS)	G. Haefeli
Selected topics in nuclear and particle physics	PHYS-400	MA2	2C + 2E (4 ECTS)	F. Blanc
Particle physics: the flavour frontiers	PHYS-471	MA2	2C + 2E (4 ECTS)	R. Marchevski
Introduction to astroparticle physics	PHYS-439	MA2	2C + 2E (4 ECTS)	C. Perrina A. Neronov

Particle physics: the flavour frontiers

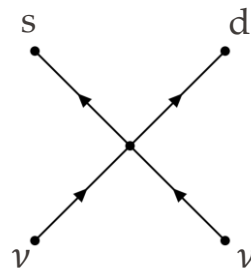
- explore the mysteries of the flavour structure in the Standard Model of particle physics
- CP violation and its connection to matter-antimatter asymmetry observed in the Universe
- differences between the flavour interactions of strange, charm, beauty quarks
- study of rare or forbidden by the SM processes and understand why they can have discovery potential far beyond the energy frontier

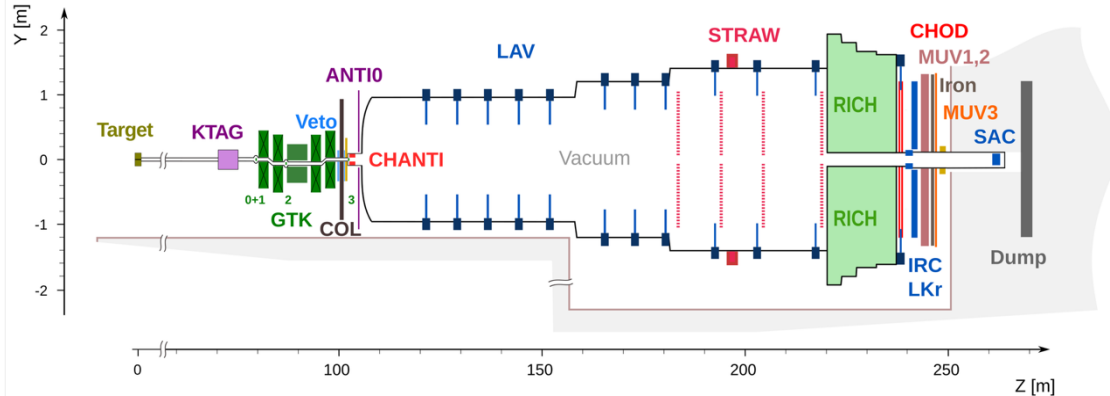
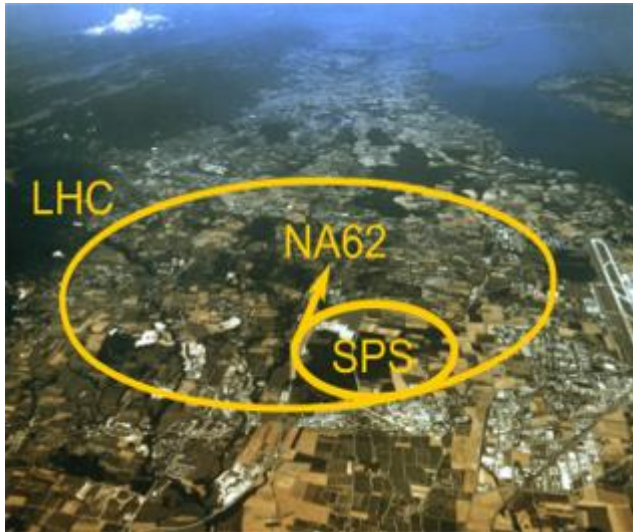


Loop processes

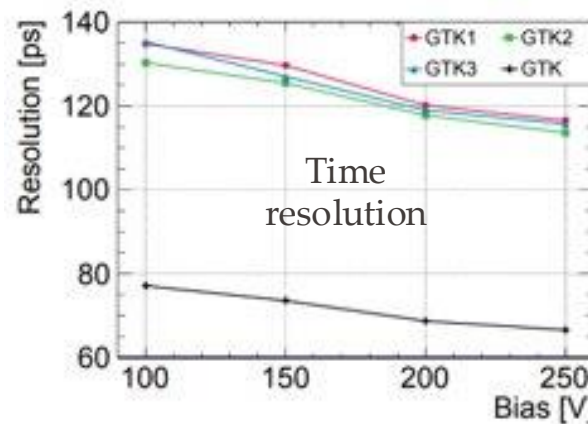
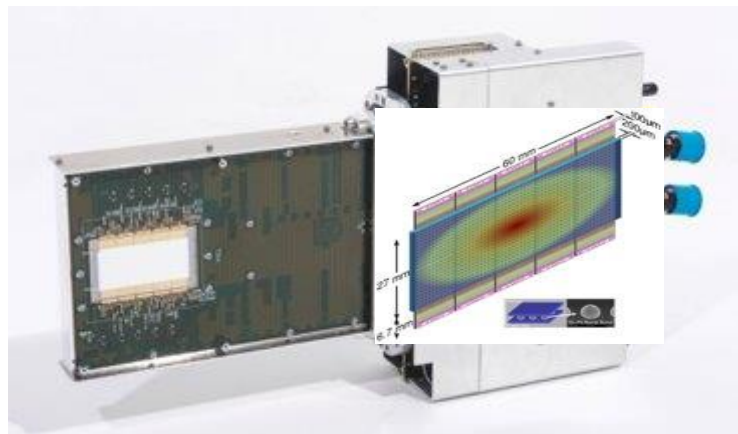


New Physics?

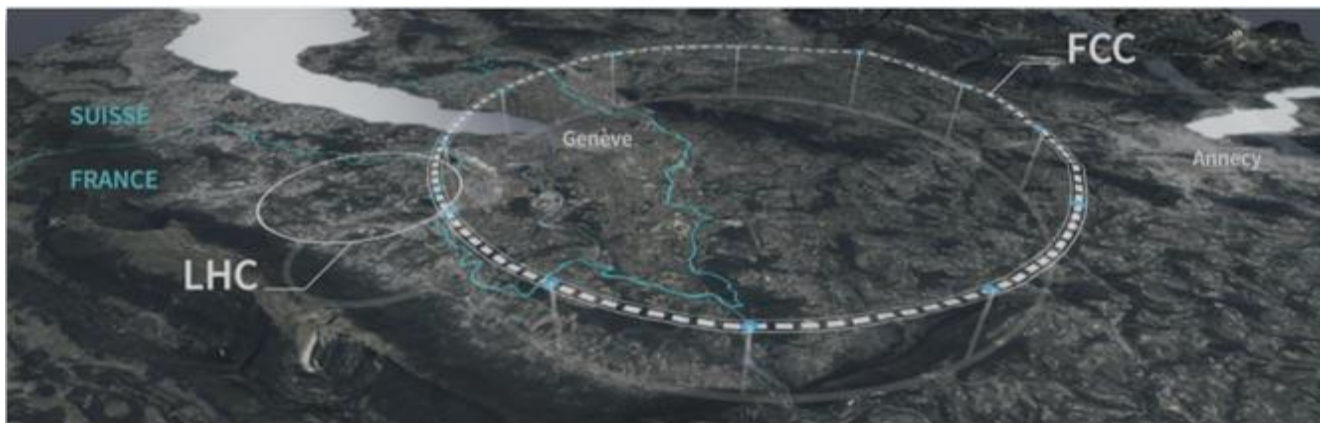




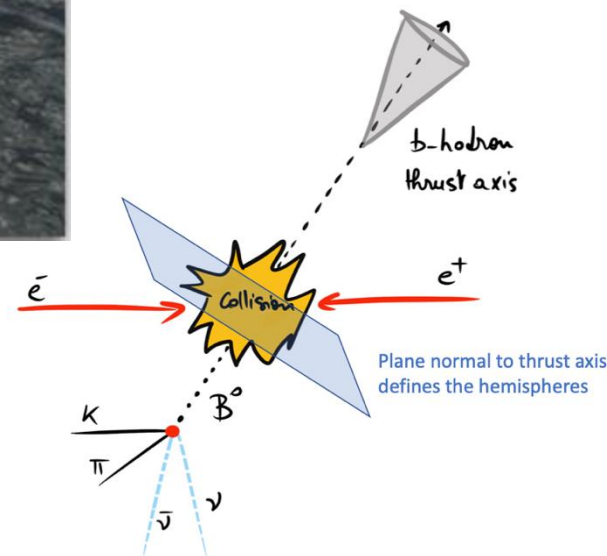
- Fixed-target flavour physics experiment at the CERN SPS studying kaon decays
- Main goal: measurement of one of the golden modes of flavour physics $K^+ \rightarrow \pi^+ \bar{\nu} \nu$
 - $BR(K^+ \rightarrow \pi^+ \bar{\nu} \nu) = (8.4 \pm 1.0) \times 10^{-11}$
- Broader physics program: rare/forbidden kaon decays and searches for exotic particles
- LPHE has a strong involvement in NA62: operation, tracking, physics analysis



- LPHE is responsible for the GigaTrack (GTK) detector
 - silicon pixel tracker providing 4D track reconstruction
 - operating at very large particle rates (~750 MHz of particles)
 - one of the most crucial detectors in NA62 used for tracking and background suppression
- Performance studies and operational aspects using data collected after 2021
 - effects of intensity on the detector (time resolution, sensor irradiation, track reconstruction efficiency, etc.)
 - calibration of the detector (pixel-by-pixel time calibration, alignment, etc.)



- Dedicated research effort towards FCC-ee
 - brand new research program starting now at LPHE
 - effort towards the future flagship facility collider at CERN
- Plenty of new projects will become available in the following years
 - involvement in physics feasibility studies
 - assessing the potential of FCC-ee to perform flavour physics measurements and searches for long-lived particles





SHiP
Search for Hidden Particles



**FUTURE
CIRCULAR
COLLIDER**

