

High-energy physics

Staff (as of October 2024):

- Program professor (PAP): **Arnaud Ferrari** (collider)
- Faculty members:
 - Elin Bergeås Kuutmann, **Richard Brenner**, Rebeca Gonzalez Suarez (collider)
 - Christian Glaser, Erin O'Sullivan, **Carlos Perez de los Heros** (astroparticle)
 - **Rikard Enberg**, **Stefano Moretti** (theory)
- Ph.D. students: 2 (collider), 4 (astroparticle), 1 (theory) + 3 who graduated in 2024 -- present: Nils Heyer
- Postdocs: 2 (collider), 1 (astroparticle), 4 (theory)
- Researchers (permanent): 2 (collider) -- present: Geoffrey Mullier
- Research engineers: 1



Research focus

The program consists of three research groups with common fundamental research interests revolving around the understanding of the Universe, from the smallest to largest scales, through the use of large infrastructures and by exploiting advanced investigative approaches.

Main Research Areas		% of program	FTE Faculty	Type
1	High-energy collider physics (ATLAS, FCC)	35%	3	Basic
2	Astroparticle physics (IceCube, RNO-G)	35%	3	Basic
3	Theory and phenomenology	25%	1.5	Basic
4	Instrumentation and detector development	5%	0.5	Mixed

KoF24 report, Table 3.1



Key enablers for HEP research

- **Enabler 1: participation in large infrastructure projects**
 - Substantial funding from VR-RFI for hardware development;
 - Additional support needed for engineering and technical staff to build, integrate and test hardware contributions to RNO-G, IceCube-Gen2 and HL-LHC upgrades, once construction starts.
- **Enabler 2: collaborative work**
 - High visibility in large experimental and tool-development collaborations:
 - Leadership positions, workshop and conference organisations, excellent representation in international boards and committees.
 - Synergies between theorists and experimentalists within the program:
 - Aim to capitalize on this broad methodological approach to interpret any new data from collider and astrophysical experiments.
- **Enabler 3: funding**
 - Strong on external grants (individual and consortia) but structural problems of the current funding environment:
 - Infrastructure funding of experiments usually does not cover salaries for academic staff;
 - Most external agencies do not cover the full overhead costs for staff or post-docs;
 - Limited funding streams from other sources than VR, KAW and EU (e.g. industry partnerships).



High-energy physics program priorities

Priority 1 (program): Accelerator development towards future high-energy colliders

- UU actively contributed to developments for CLIC and LHC, and is now focusing on FCC
- Continue and strengthen such activities by including local accelerator physics expertise in the program

Priority 2 (department): Inter-disciplinary postdoc program in high-energy physics

- Novel inter-disciplinary postdoc scheme based on interactions between experimentalists and theorists
- Connecting theorists to data-analyses carried out by experimentalists through joint appointments across the two subfields

Priority 3 (faculty): AI4Physics -- also one of the department priorities

- HEP program members active in research using ML/AI (either via AI4Research or spontaneous collaborations)
- Engaging with AI4Physics, aimed to train staff, postdocs and students on such novel investigative methods

