Dr. Lydia Beresford
My research and career journey



Our Future in Research:
Physics, Collaboration and Careers Across Europe
29th October 2026

DESY.
HELMHOLTZ
ATLAS EXPERIMENT

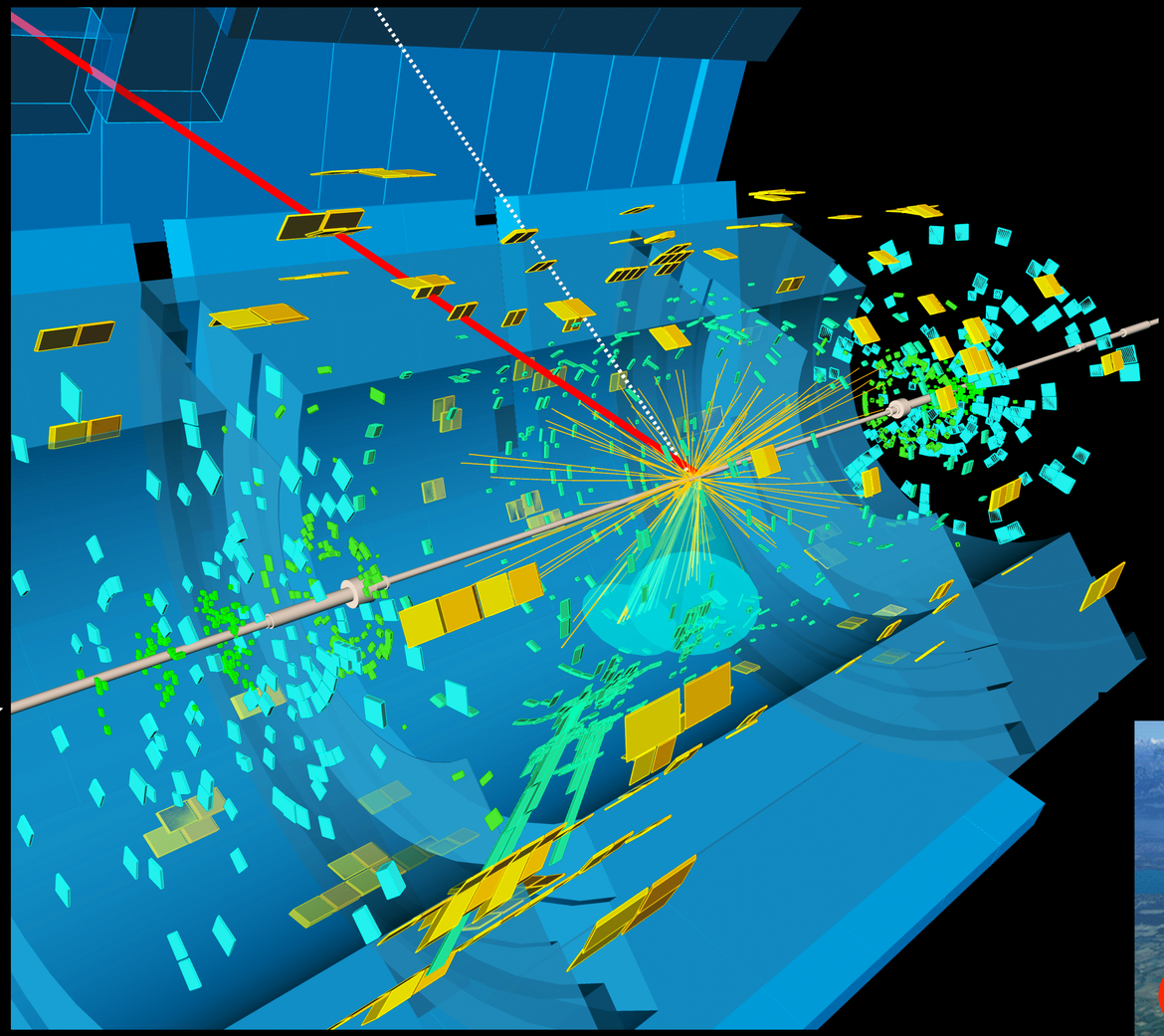
About me



- Experimental particle physicist
- Member of the ATLAS collaboration at CERN
- Originally from the UK
- Tenured staff scientist at DESY in Hamburg

My research, career path, introduction to DESY & potential opportunities

From the LHC to the cosmos



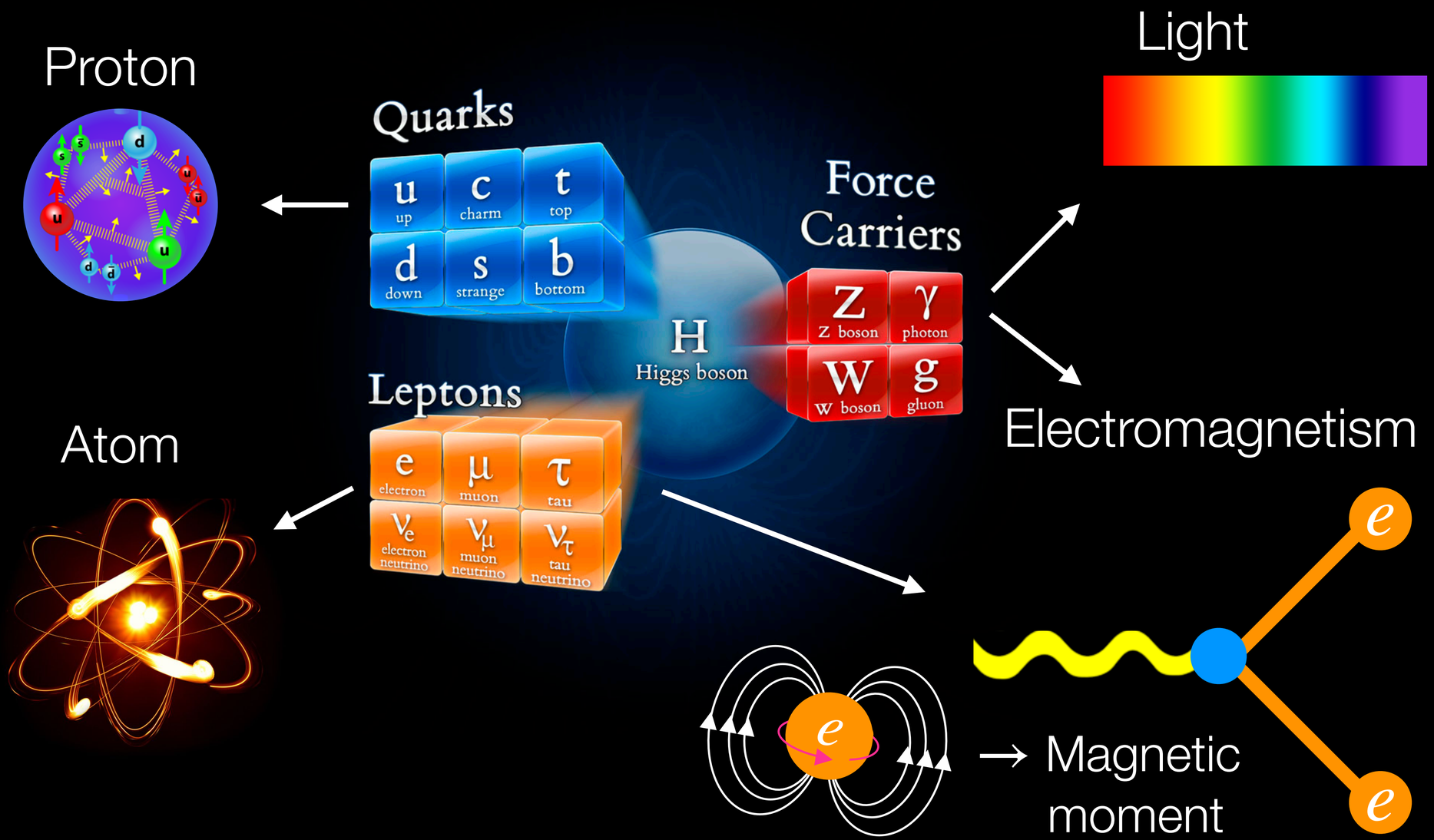
ATLAS EXPERIMENT

Candidate Event:
pp → H(→bb) + W(→μν)
Run: 338712 Event: 335908183
2017-10-19 23:31:18 CEST



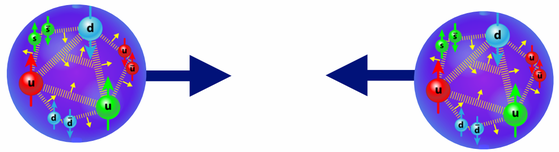
World's highest energy hadron collider

Standard Model of Particle Physics (SM)

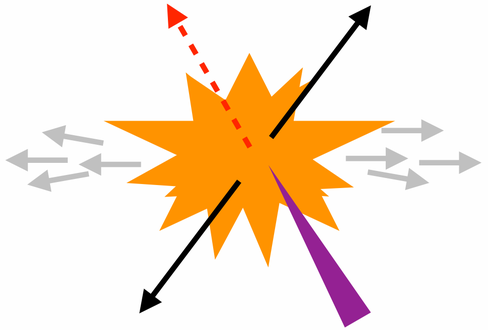


The LHC as a photon collider

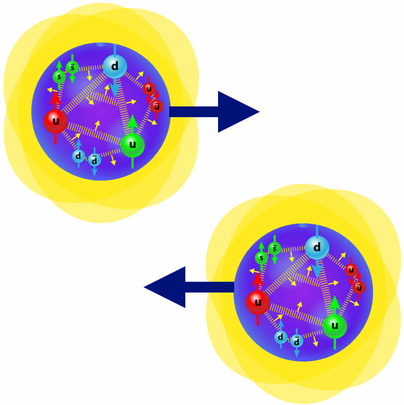
Head-on collision



Partons collide
to produce new particles



Protons ‘miss’



Photons collide
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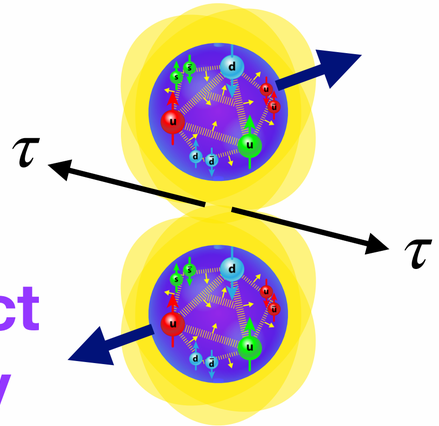
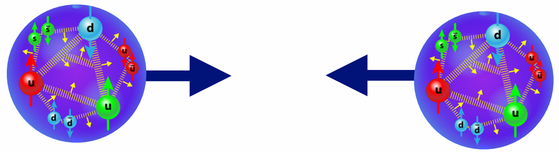


Protons intact
Lose energy

World’s highest energy photon collider

The LHC as a photon collider

Head-on collision



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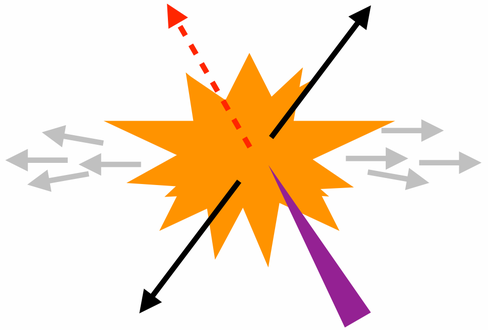

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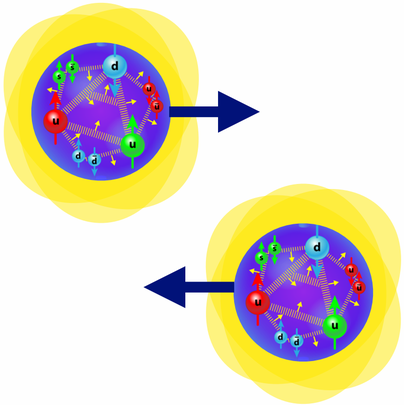

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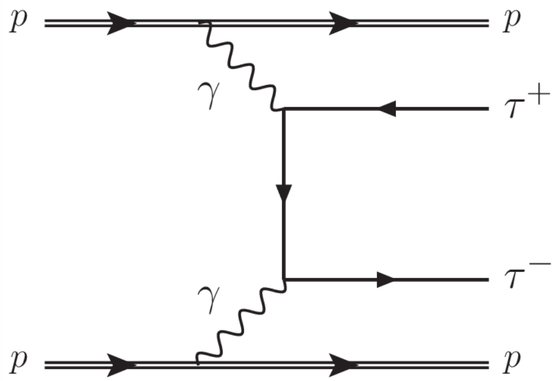


World’s highest energy photon collider

Lepton magnetic moments

Electron $a_e = 0.00115965218059\ (13)$

Muon $a_\mu = 0.001165920705\ (148)$

→ **Measured extremely precisely for e and μ**

What about the tau?

Do photons interact equally with all lepton generations?

New phenomena more strongly affecting taus?

Electron: Fan et al PRL 130 (2023) 071801 Hanneke, Fogwell and Gabrielse PRL 100 (2008) 120801 Van Dyck PRL 59 (1987) 26
Muon: BNL PRD 73 (2006) 072003 Fermilab muon g-2 experiment PRL 135 (2025) 101802

Lepton magnetic moments

Electron $a_e = 0.00115965218059\ (13)$

Muon $a_\mu = 0.001165920705\ (148)$

→ **Measured extremely precisely for e and μ**

What about the tau?

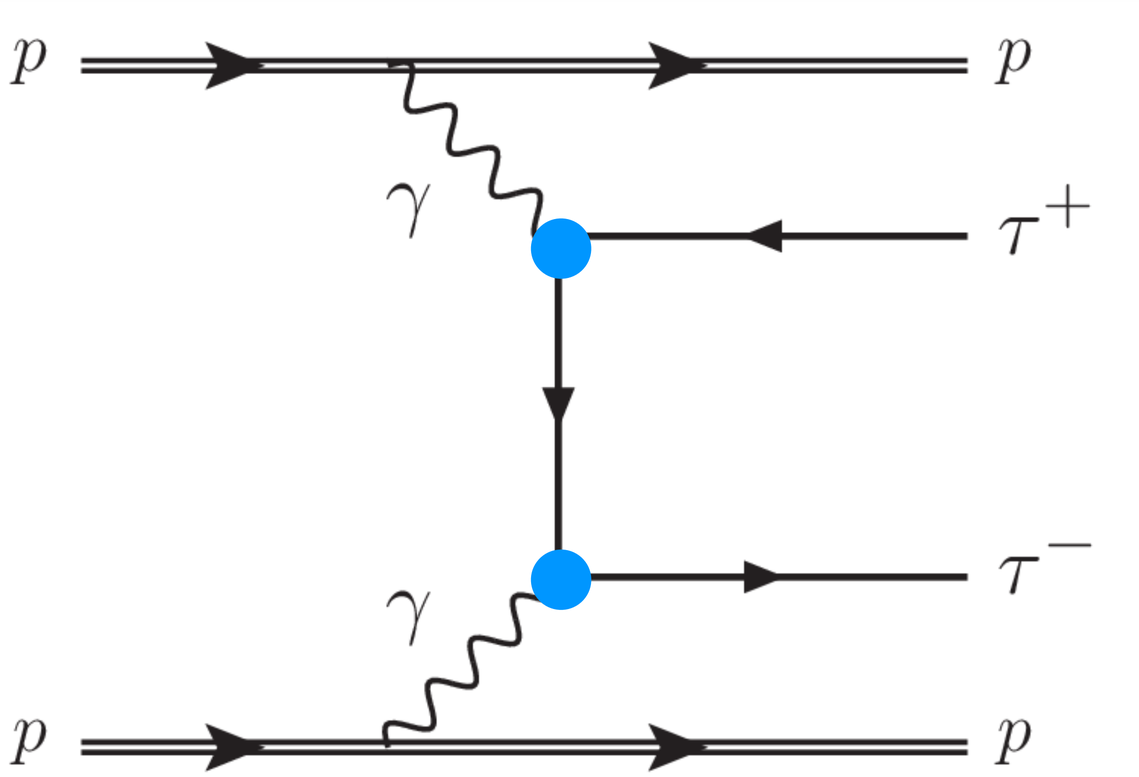
→ Short tau lifetime 10^{-13}s

→ Extremely challenging experimentally!

Electron: Fan et al PRL 130 (2023) 071801 Hanneke, Fogwell and Gabrielse PRL 100 (2008) 120801 Van Dyck PRL 59 (1987) 26
Muon: BNL PRD 73 (2006) 072003 Fermilab muon g-2 experiment PRL 135 (2025) 101802

How magnetic is the tau?

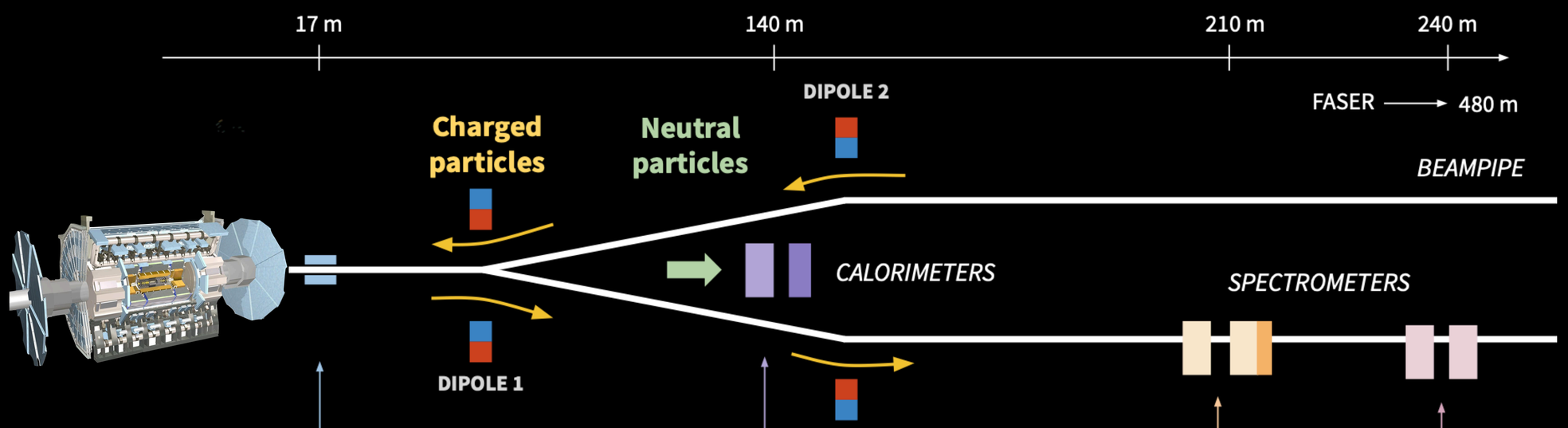
$\gamma\gamma \to \tau\tau$ **has two** $\gamma\tau\tau$ **vertices**



Production rate of $\gamma\gamma \to \tau\tau$ **sensitive to the tau magnetic moment**

→ We can measure it!

ATLAS forward detectors & LHCf



LUCID
Luminosity Cherenkov Integrating Detector
$5.6 < |\eta| < 5.9$
Luminosity measurement

LHCf
LHC Forward

ZDC
Zero Degree Calorimeter
Low-μ, $|\eta| > 8.0$
Forward neutrons & photons

AFP
ATLAS Forward Proton
Low & high μ, $0.02 < \xi < 0.12$
Diffraction & photon collisions

ALFA
Absolute Luminosity For ATLAS
Low-μ, $0 < \xi < 0.2$
Total elastic cross-section

ARP (ATLAS Roman Pot)

My career path



2009-2013

MPhys

& CERN summer student

2013-2017

PhD

2017-2021

Junior Research Fellow

Since 2021

Senior Research Fellow

Since 2022

Helmholtz Young Investigator Group Leader

↑

Tenure-track position to build my own research group

About DESY

DESY short for Deutsches Elektronen-Synchrotron

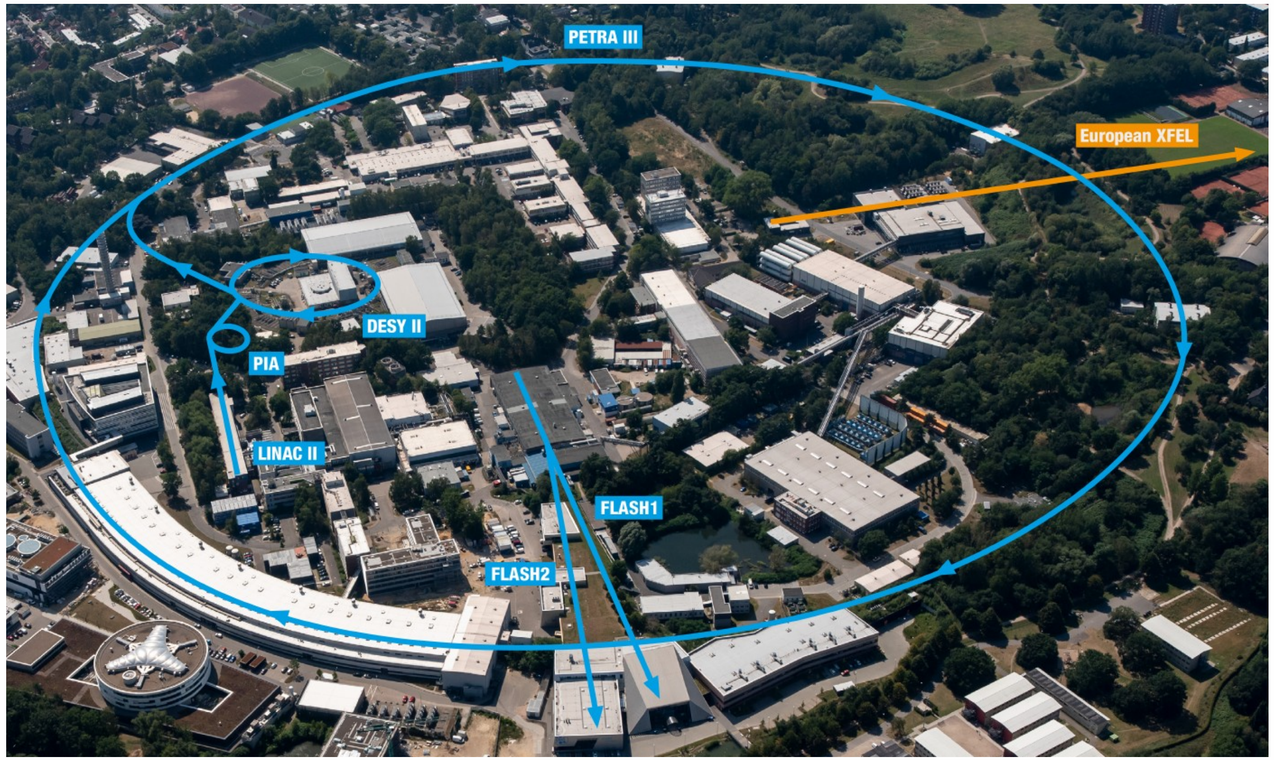
Leading research centre for fundamental & applied science

Motto: *“The Decoding of Matter”*

Located in Hamburg & Zeuthen

Key research areas:

- Particle & astroparticle physics
- Accelerators
- Photon science



DESY website

Post-doctoral opportunities at DESY (a selection)

more info

DESY Fellowships
DESY Post-doc positions

Humboldt Research Fellowship

MSCA Postdoctoral Fellowships

Emmy Noether Programme

Investigator Group

ERC grants

Always check eligibility criteria, some programs require host to support application, for some there is a DESY internal selection first → Discuss with host first

Summary

Exciting physics at LHC & DESY to advance our understanding of the universe

Quick impression of one career path, every path is unique

Happy to discuss science, careers, collaboration & potential opportunities!

