

## ASTROPARTICLE PHYSICS IN THE HELMHOLTZ ASSOCIATION

“Zeuthen Meeting 2018”  
in Mainz September 17-19

Johannes Blümer, KIT

# SUMMARY

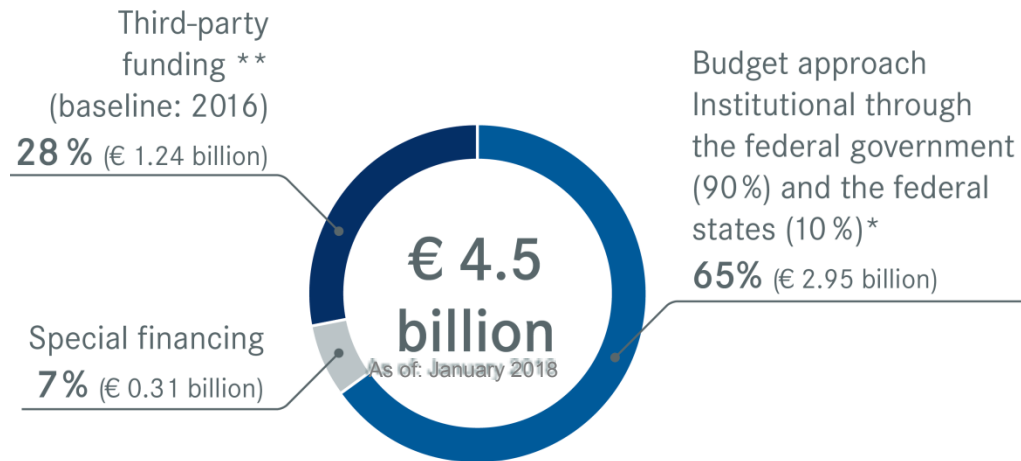
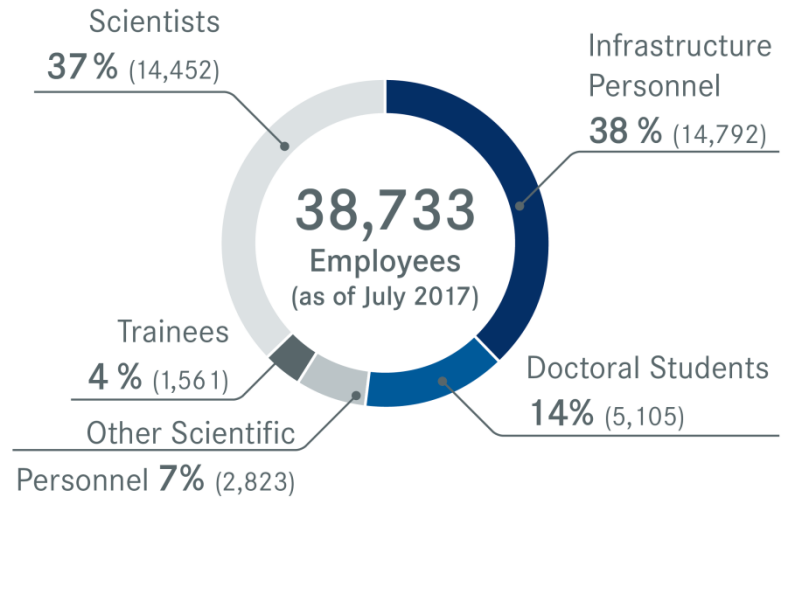
Helmholtz is one of the largest players in astroparticle physics

Program Matter and the Universe | Topic3: Matter and Radiation from the Universe

Helmholtz at large	30''
Program structure and scope	3'
Evaluation	1'
POF4 2021 - 2027	1'
Strategy	3'
What to hope for...	3'

# Facts and Figures

## Personnel & Budget 2018



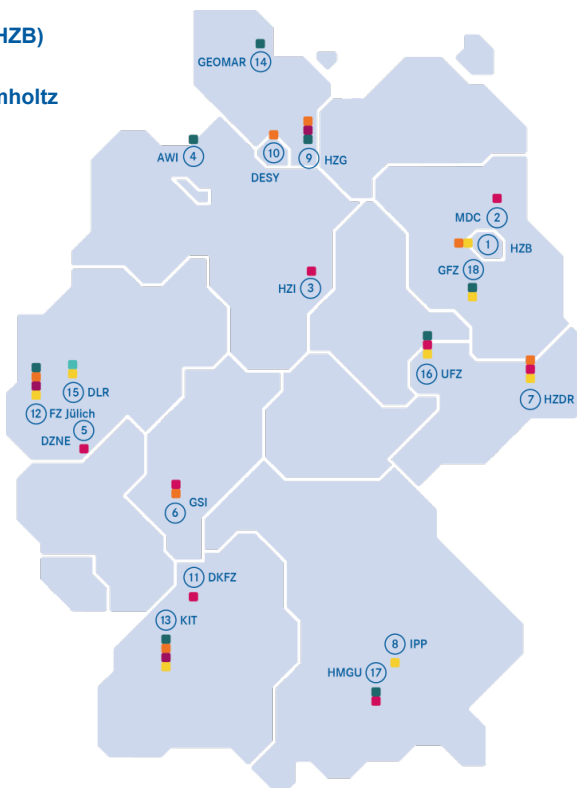
\* As of 2016, the German federal government alone is financing the pact increase so that the federal government's share is over 90%.

\*\* Including project sponsorships

# Helmholtz Research Centers

WIESTLER

1. Berlin  
**Helmholtz-Zentrum Berlin für Materialien und Energie (HZB)**
2. Berlin-Buch  
**Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC)**
3. Brunswick  
**Helmholtz Center for Infection Research (HZI)**
4. Bremerhaven  
**Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung (AWI)**
5. Bonn  
**German Center for Neurodegenerative Diseases (DZNE)**
6. Darmstadt  
**GSI Helmholtz Center for Heavy Ion Research**
7. Dresden  
**Helmholtz Center Dresden Rossendorf (HZDR)**
8. Garching  
**Max Planck Institute for Plasma Physics (IPP) (Associate Member)**
9. Geesthacht  
**Helmholtz Center Geesthacht Center for Material and Coastal Research (HZG)**
10. Hamburg  
**Deutsches Elektronen-Synchrotron DESY**



11. Heidelberg  
**German Cancer Research Center (DKFZ)**
12. Jülich  
**Forschungszentrum Jülich**
13. Karlsruhe  
**Karlsruhe Institute of Technology (KIT)**
14. Kiel  
**GEOMAR Helmholtz Center for Ocean Research Kiel**
15. Cologne  
**German Aerospace Center (DLR)**
16. Leipzig  
**Helmholtz Center for Environmental Research (UFZ)**
17. Munich  
**Helmholtz Center Munich – German Research Center for Health and the Environment**
18. Potsdam  
**Helmholtz Center Potsdam German Research Center for Geosciences GFZ**

## Research Areas:

Energy

Earth and Environment

Health

Aeronautics, Space and Transport

Matter

Key Technologies



# 8 Matter Research Centers

Berlin  
**HZB Helmholtz Center Berlin**

Darmstadt  
**GSI Helmholtz Center for Heavy Ion Research**

Dresden  
**Helmholtz Center Dresden Rossendorf (HZDR)**

Garching  
**Max Planck Institute for Plasma Physics (IPP)**  
(Associate Member)

Geesthacht  
**Helmholtz Center Geesthacht**  
**Center for Material and Coastal Research (HZG)**

Hamburg  
**Deutsches Elektronen-Synchrotron DESY**

Jülich  
**Forschungszentrum Jülich**

Karlsruhe  
**Karlsruhe Institute of Technology (KIT)**



# MATTER PROGRAM STRUCTURE

~HEUER

## Matter and the Universe (MU)

Fundamental Particles and Forces

Cosmic Matter in the Laboratory

Matter and Radiation from the Universe

Facility Topic:  
Data Centers

DESY, FZJ, GSI, KIT  
(300 FTEs plus 99 FTEs associated)

## From Matter to Materials and Life (MML)

Research on the Structure, Dynamics and  
Function of Matter at Large Scale Facilities

Facility Topic:  
Research on Matter with Brilliant Light  
Sources

Facility Topic:  
Research on Matter with Neutrons

Facility Topic:  
Physics and Materials Science with  
Ion Beams

Facility Topic:  
Research at Highest Electromagnetic Fields

DESY, FZJ, GSI, HZB, HZDR,  
HZG, KIT (723 FTEs plus 33 FTEs associated)

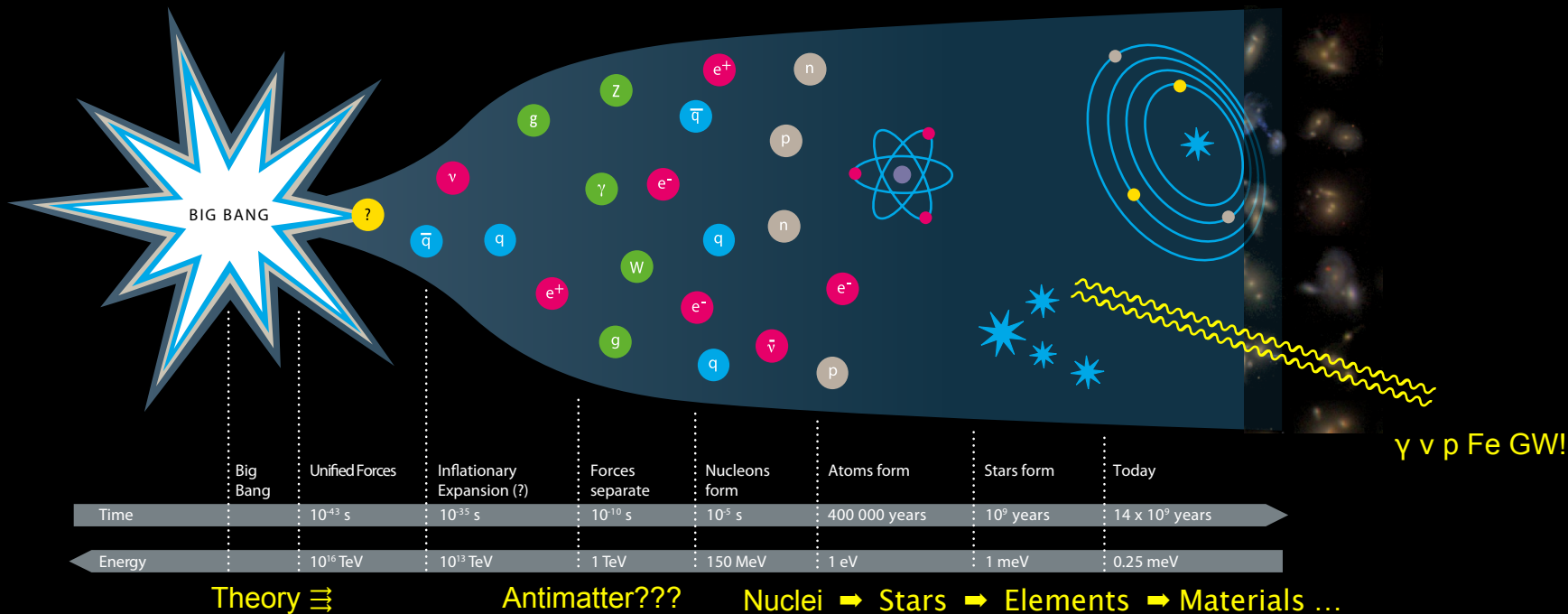
## Matter and Technologies (MT)

Accelerator Research and Development

Detector Technologies and Systems

DESY, FZJ, GSI, HZB, HZDR, KIT  
(134 FTEs plus 12 FTEs associated)

Matter<sub>2016</sub>  $\approx$  1300 FTE<sub>core</sub> 610 M€/a

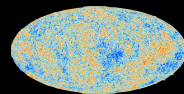


## Matter and the Universe (MU)

Fundamental Particles and Forces

Cosmic Matter in the Laboratory

Matter and Radiation from the Universe



*reaching back to the Early Universe*

neutrinos  
cosmic radiations  
Dark Matter  
LHC...  
 $e^+e^-$  precision tests

# PROGRAM TOPICS

We address common science questions across topics

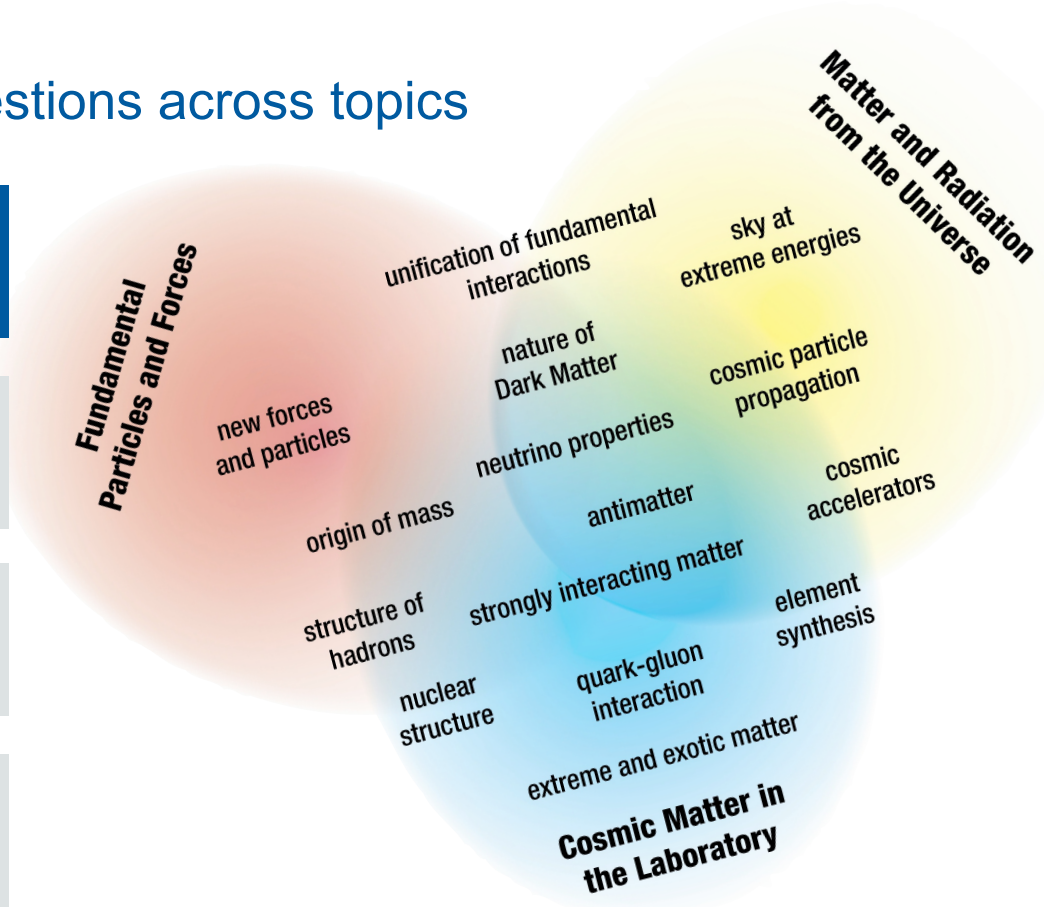
## Matter and the Universe

### full cost proportions

Fundamental Particles and Forces	46%	DESY KIT	98% 2%
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Cosmic Matter in the Laboratory	18%	FZJ GSI	40% 60%
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Matter and Radiation from the Universe	36%	DESY KIT	36% 64%
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# EVALUATION (1)

“... excellent and outstanding work, often world-leading ...”

~HEUER

98 reviewers

17 program reviewers

8 cross-reviewers

1/5 female reviewers

*scientific details, past 4 years, center-based, ... plans*

Date	Research Center	Chair of the review panel
06. 11. 2017	HZG	George Pharr, A&M Univ, Texas, USA
21. 11. 2017	GSI	Enyo Hideto, RIKEN, Japan
13. 12. 2017	FZJ	Meigan Aronson, A&M Univ, Texas, USA
09. 01. 2018	HZB	Andrew Harrison, Diamond LS, UK
16. 01. 2018	HZDR	Manfred Fiebig, ETH, Schweiz
05. 02. 2018	DESY	Hugh Montgomery, Jlab, USA
13. 02. 2018	KIT	Andrew Taylor, STFC, UK

# EVALUATION (2) AND POF4 2021 - 2027

Second phase:

evaluation of the strategy => financial recommendations for POF4  
on the topic level

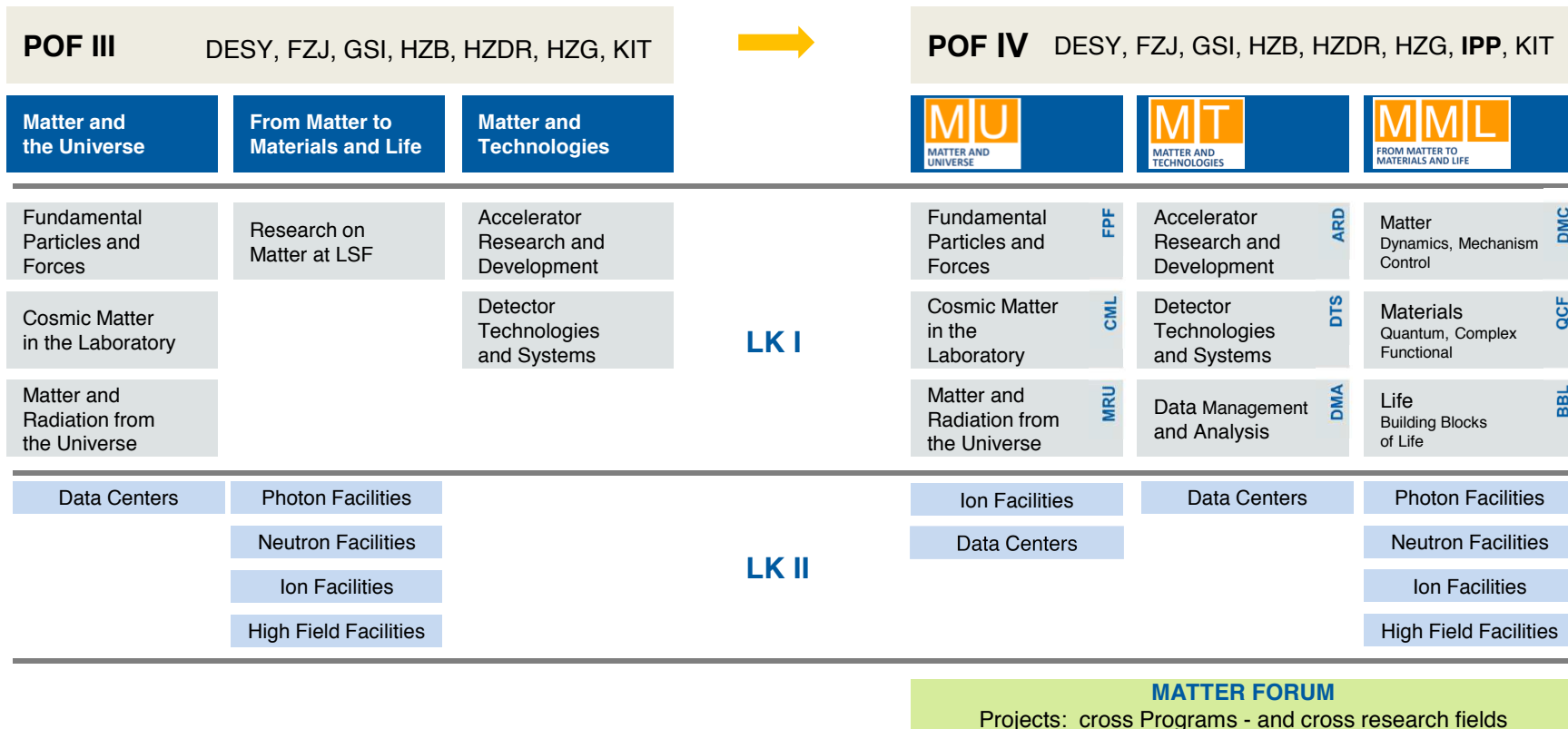
Program proposal due September 2019  
Examination during calendar week 5, 2020

Our interactions with all of you do play an important role

POF4 shall be 'financially neutral' wrt POF3

# PROGRAM DEVELOPMENT

DOSCH



# STRATEGY PAPER (1)

*not a public document,  
not really secret either...*

- How has the universe developed from the big bang to our days – what are the building blocks of matter and what is the origin of the elements in the universe?
- How can we understand and control electronic, atomic and molecular processes to be able to design new functional materials and active agents?
- How can we devise novel high-gradient particle accelerators?



	LK II (User facilities)	International Research Infrastructures	National Research Infrastructures
DESY	FLASH PETRA III TIER-2	LHC BELLE II CTA (under construction) Icecube XFEL	CFEL CSSB NanoLab DESY Testbeams DAF HIB@XFEL PITZ
FZJ	JCNS (in MLZ)	ESS (under construction) ILL SNS	(FRM-II)
GSI	UNILAC SIS18 ESR	FAIR (under construction) ALICE	HI Jena HI Mainz EMMI HICforFAIR
HZB	BESSY VSR		bERLinPro SupraLab EMIL
HZDR	ELBE HLD IBC	XFEL EMFL ESRF	HIB@XFEL DRESDYN
HZG	GEMS-p GEMS-n	ESS (under construction)	EMSC
IPP		PAX/APEX	
KIT	GridKa	KATRIN Auger IceCube	ATP FLUTE TLK SR Beamlines

Figure 1: Map of the Helmholtz Centers contributing to the Research Field Matter and table of their research infrastructure portfolio in Program-oriented Funding period IV (2021-2027).



# Astroparticle Physics @ DESY

STEGMANN

HELMHOLTZ SPITZENFORSCHUNG FÜR  
GROSSE HERAUSFORDERUNGEN



# DESY Astroparticle Physics Programm

Understanding the high-energy Universe

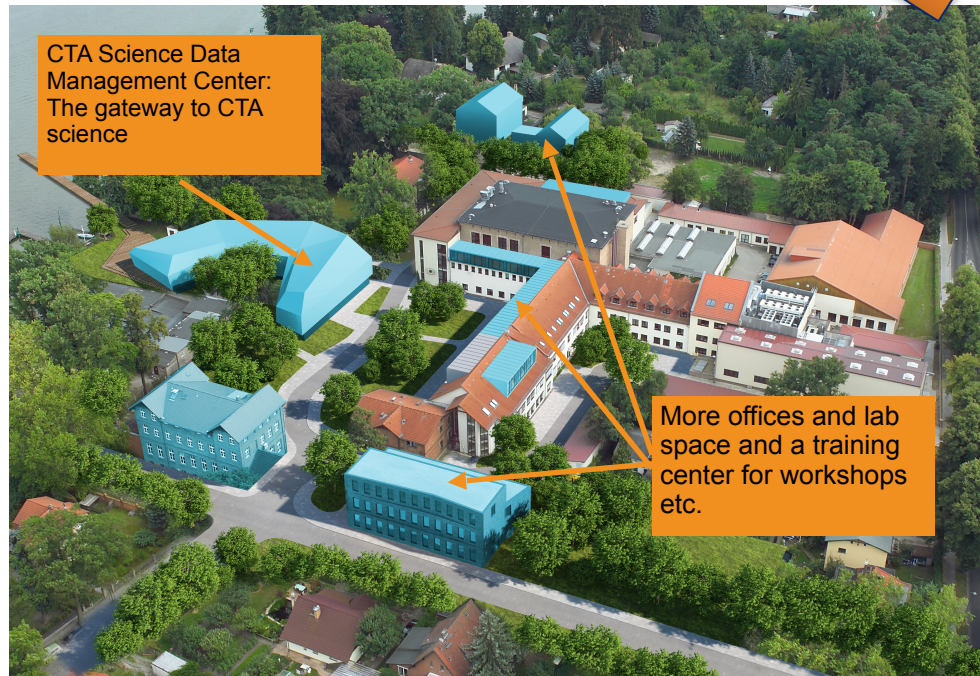
STEGMANN

**Focused research program at DESY based on four pillars:**

- Gamma-ray astronomy with H.E.S.S., MAGIC, VERITAS towards CTA
- Neutrino astronomy with IceCube towards IceCube-Gen2
- Multi-messenger astronomy with gamma-rays, neutrinos and optical follow up
- Theoretical astroparticle physics

**Building on existing activities while strategically expanding the portfolio**

- Radio detection of neutrinos
- MeV gamma-ray satellite
- ...

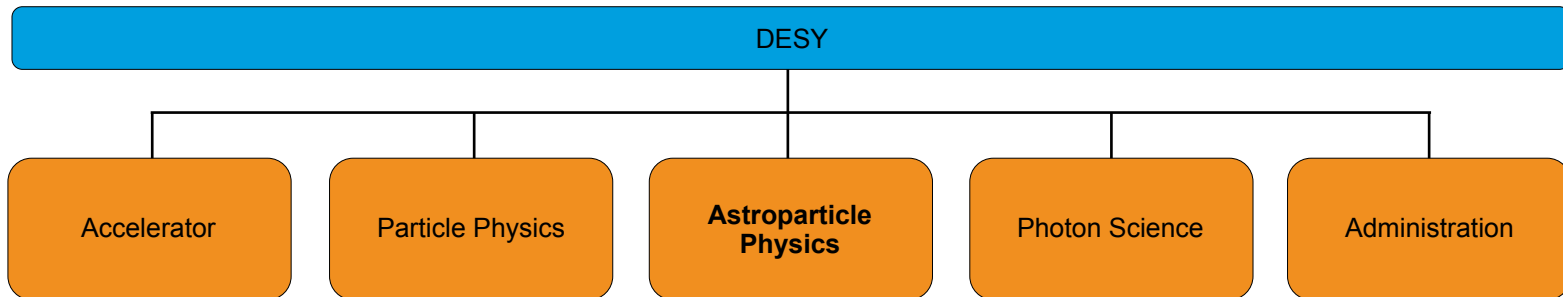


# Research Division Astroparticle Physics

As part of the DESY 2030 strategy

STEGMANN

- So far astroparticle physics is part of the particle and astroparticle physics division
- DESY will established in 2019 a new research division astroparticle physics
  - Strengthening astroparticle physics
  - Further expansion of the Zeuthen site into a centre for astroparticle physics



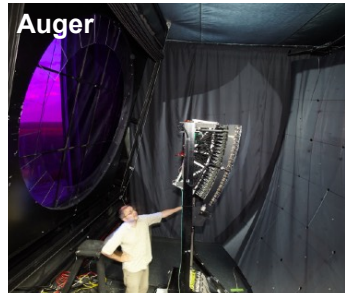
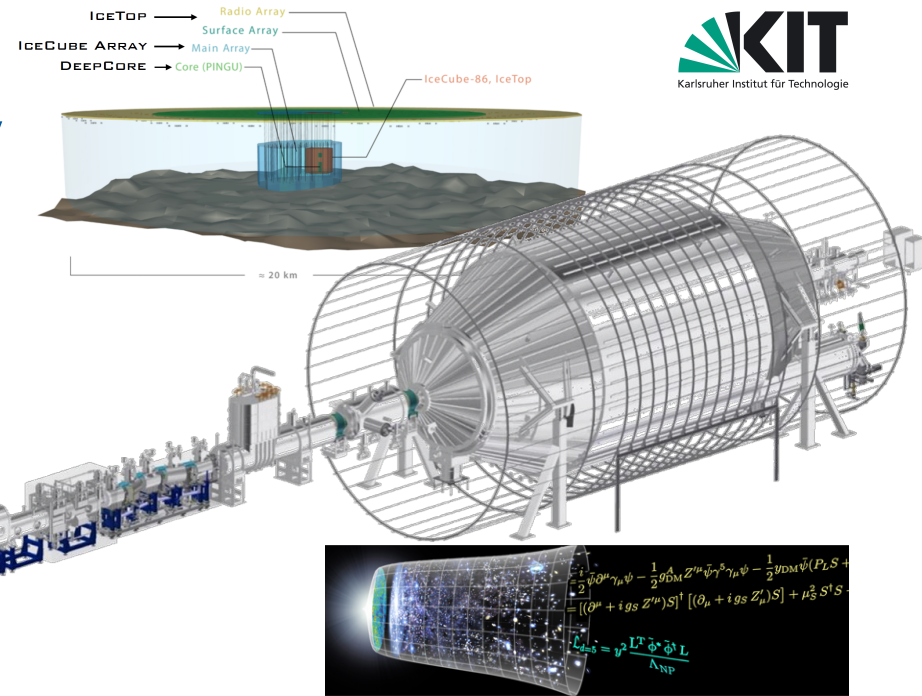


# MATTER AND THE UNIVERSE

## at the Karlsruhe Institute of Technology

KIT is the Research University in the Helmholtz Association.  
Strengthening contributions to *Matter and the Universe*:

- **++Theory** for particle and astroparticle physics
- Multi-messenger astroparticle physics  
**Auger Observatory, IceCube-Gen2**
- Neutrino and DM physics, with **KATRIN**  
and plans beyond (TRISTAN, MATRIX, **DARWIN**)
- **GridKa**, facing the data challenges from the HL-LHC & APP ...
- **++ research data center?**



# SUMMARY, QUESTIONS

MU continues to be your primary Helmholtz partner

MT with /DTS and /DMA offer new opportunities

The links between theory & experiment will become (even?) stronger

Multi-messenger astroparticle physics delivers

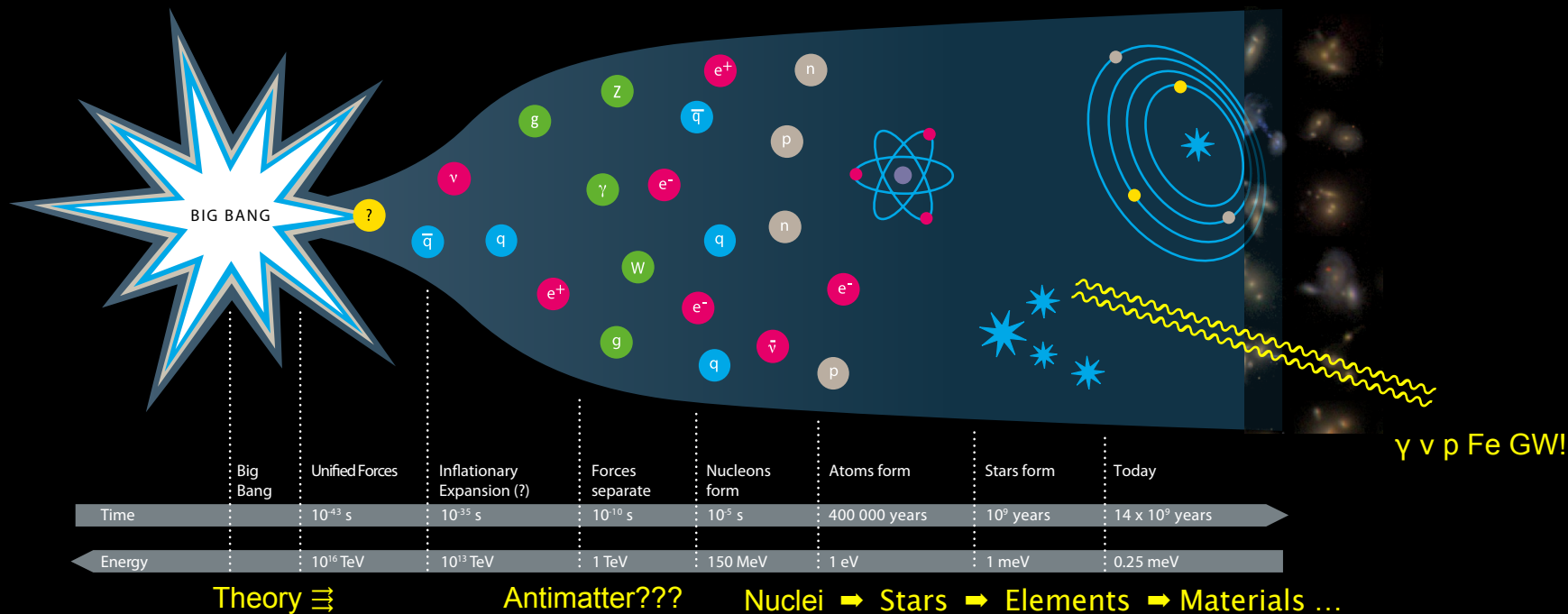
Auger, IceCube, H.E.S.S. *et al.*

Important “observatories and instruments” are coming up

KATRIN, CTA; many plans for the future

Do you remember the Helmholtz Alliance(s)?

What shall we do about gravitational waves?

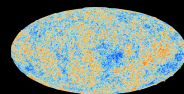


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