Komitee für Astroteilchenphysik (KAT):

Report from KAT

KHuK Annual Meeting

Bad Honnef, 06.12.2024

Daniel Bemmerer

Helmholtz-Zentrum Dresden-Rossendorf

KAT composition

Constituency	Elected member	Deputy
Dark Matter	Manfred Lindner	Federica Petricca
Neutrino properties	**Kathrin Valerius (Deputy Chair)**	Stefan Schönert
Low-energy ν astrophysics	Achim Stahl	Michael Wurm
Cosmic rays	Markus Roth	Michael Schmelling
Gamma-ray astronomy	Stefan Funk	David Berge
High-energy ν astrophysics	**Uli Katz (Chair)**	Marek Kowalski
Nuclear astrophysics	Uwe Oberlack	Daniel Bemmerer
Gravitational waves	Michèle Heurs	Harald Lück
Theory	Walter Winter	Michael Klasen

Plus *ex-officio* members from other committees, in particular:
J. Haller (DPG FV Teilchenphysik), J. Wilms (RdS), W. Nörtershäuser (KHuK)

Multi-messenger Workshop in Görlitz

26+27 March 2024

Co-organised by DZA, KAT, RDS

Objectives:

→ Current status and plans of multi-messenger studies
→ Mid- and longer-term planning
→ Explore option of DFG Schwerpunktprogramm

Conclusions:

→ Very good program triggering lots of „interdisciplinary discussion“
→ Clearly a good step towards increased KAT/RDS cooperation
→ A bit unclear how to transform this into a sustainable process
→ Rather diverse ideas of „multi-messenger“

Four big KAT projects

1) DARWIN/XLZD: Liquid xenon - Dark Matter and more

→ Sensitivity down to neutrino fog

→ Invest: 45 M€ detector + 135 M€ Xenon

→ Expected German contribution 45 M€

2) IceCube-Gen2: Cosmic neutrinos and more

→ Unique discovery potential

→ 500 M$ (US accounting), ~150 M$ invest

→ Project strongly depends on NSF funding

→ Expected German contribution 40 M€ in-kind

3) LEGEND-1000: 0νββ in ^{76}Ge

→ Prioritised over other 0νββ projects by DOE

→ Likely hosted by Gran Sasso

→ Expected German contribution: 25 M€

4) Einstein Telescope: Gravitational waves

→ Overall invest 1.7 B€

→ Site as yet undecided

→ German contribution site-dependent, ~450 M€ ?

BMBF FIS process

- Prioritisation of research infrastructures (FIS)
- Only projects above 50 M€ German contribution to construction cost
- Result will be a „short list“, not implying funding commitments
- Final funding decisions expected from next federal government
  (this already was the plan before the recent developments)
- Formally demanding application process, substantial commitments expected from lead institutions („Trägereinrichtungen“)
- Deadline for full proposals 25 Oct 2024, review process until June 2025
  Results announced in summer 2025

<u>Applications from astroparticle physics:</u>
Einstein Telescope (gravitational waves)
IceCube-Gen2 (neutrino telescope)
LEGEND-1000 (neutrinoless double-beta-decay)
XLZD (direct dark matter search and more)

KET workshops towards ESPPU

- European process, main objective is CERN strategy for next 5+ years
- Currently, national input is collected and consolidated
- 3 KET-organised workshops:
  - → Non-collider particle physics (22-24 Nov 2024, Bad Honnef)
  - → Collider particle physics (27-29 Nov 2024, DESY)
  - → Concluding workshop (19-22 Jan 2025, Bad Honnef)

KAT (and KfB, KHuK) participating in preparation;
Communities invited to participate

A few impressions from non-collider workshop:

→ Very visible KAT participation
→ Very open and mostly constructive discussions
→ Summary document edited, contains most of APP projects
→ Repeated questions what the KAT views are and whether a KAT statement will be prepared

KAT has heralded such a statement and announced that we wish to avoid any contradiction or tension with the KET statement.

→ Final/advanced version required mid-January

KAT Strategy paper

Decided at KAT meeting in March 2023

RDS produced new Denkschrift

KAT should come up with equivalent document at a similar (equal?) time line

Also motivated by need to incorporate DZA in strategy

A paper covering the field and its perspectives over a longer period (10 years); English and German

Involving a bottom-up approach to address full community

To be finalised early 2025

Final product: PDF + glossy brochure defining astroparticle physics in Gemany, not targeted at 3-year ErUM-Pro cycle

To be coordinated with astronomy/RDS

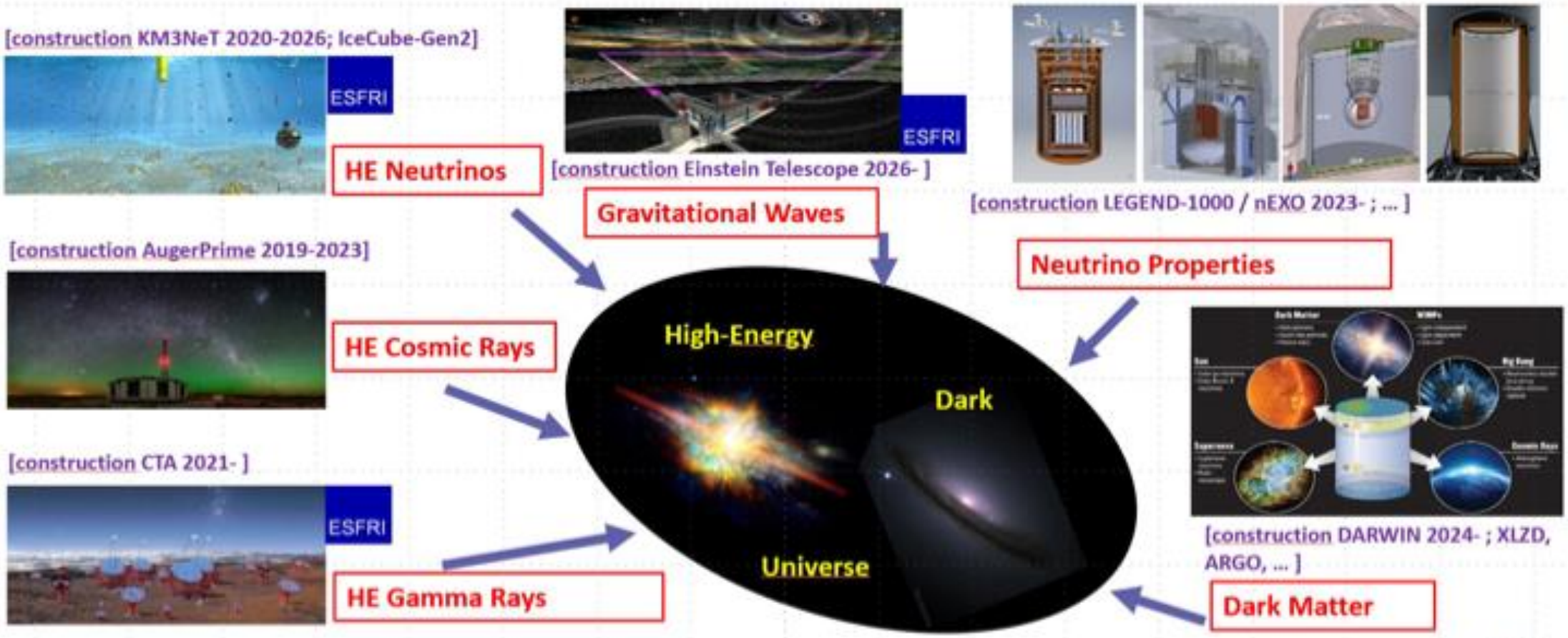
Karlsruhe KAT Community Meeting, 16-18 Oct 2024

- Meeting open to full community
- Presentation of current status of strategy paper
- Open, constructive discussion clarifying many open questions
- In particular: Consensus on structure of strategy document

APPEC Flagship Research Infrastructures

This is not a closed, but dynamic list…

ESFRI=European Strategy Forum on Research Infrastructures



8 29/11/2024

KAT. Komitee für Astro.Teilchen.Physik

APPEC

Courtesy A. Haungs, KIT

TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept SCIENCE AND INNOVATION CAMPUS

HZDR

ACME

HORIZON-INFRA-2023-SERV-01-02 (domain: Astronomy & Astroparticle physics)

- Topic: **better access of users to RI services to advance frontier knowledge**
- Consortium: 41 partners, 15 countries, >30 research infrastructures
- Kick-off Meeting in Paris 16-17/9/2024 https://indico.in2p3.fr/event/33636/

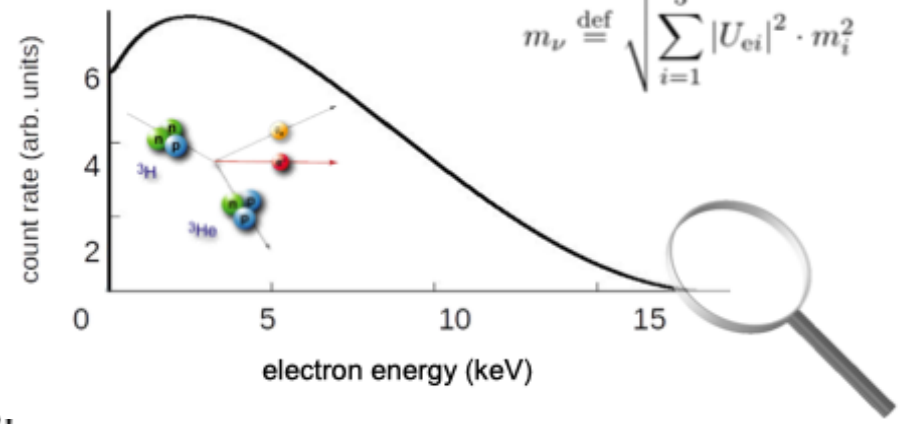
15 29/11/2024

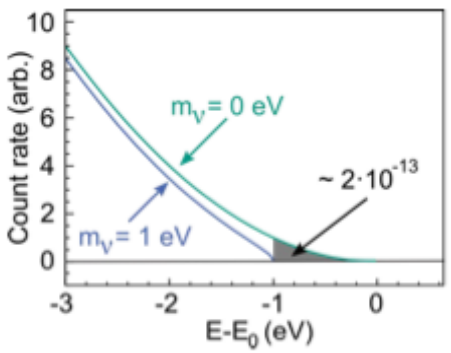
Courtesy A. Haungs, KIT

KATRIN study of ^{3}H decay

$$R_\beta(E) \propto (E_0 - E)\sqrt{(E_0 - E)^2 - m_\nu^2}$$

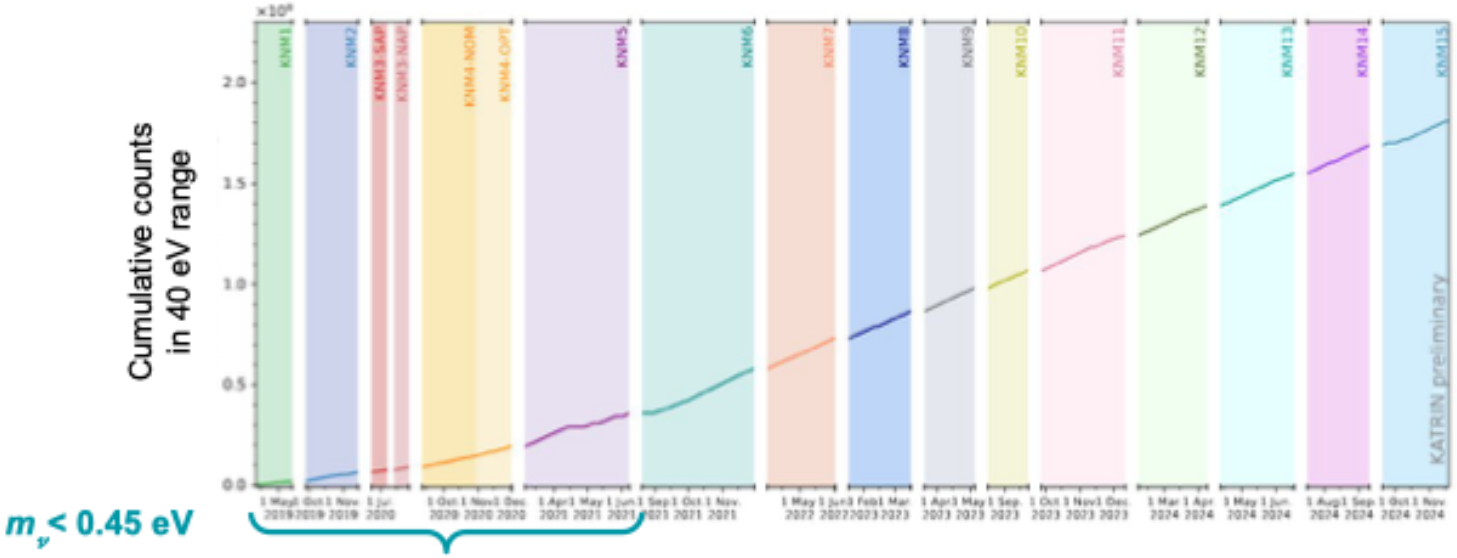
$$m_\nu \stackrel{\text{def}}{=} \sqrt{\sum_{i=1}^{3} |U_{ei}|^2 \cdot m_i^2}$$





KATRIN data taking continues

- **15th** measurement campaign will be completed
- **~ 170 Mio** counts recorded – **x4.5** the statistics!
- Another **50 Mio** to come in **2025** + calibration/systematics improvements



Courtesy A. Lokhov, KIT

Mission and Vision of the DZA

- The DZA stems from the long-term goal of the RDS community to create a national center and the KAT community's aim to strengthen this emerging research field.
- The center was established by winning a competition to transform Saxony's coal mining region.
- DZA activities are not only science-driven but also consider regional development, with a focus on data science and technology innovation.

Mission:

To establish a national center for astronomy, astrophysics, and astroparticle physics, supporting the German scientific community.

Vision:

To become a global hub for cutting-edge research in multi-messenger astrophysics, data science, and technological innovation while contributing to regional economic transformation in Saxony.

DZA Strategy Development, KAT Meeting | 16.10.2023

Courtesy C. Stegmann, DESY

Implementation

2024 DZA in project phase

- No legal entity, project funding, interim HQ and technology lab in Görlitz, managed by TUD & DESY, short term positions (through December 2025)
- Launch early gravitational wave and radio astronomy, technology development, and data science projects.

2025/2026 Evaluation of project phase

- independent legal entity
- start of initial 10 year period, launching projects, building an own campus.

2026-2035: Implementation of a 'Großforschungszentrum für Astrophysik'

DZA Strategy Development, KAT Meeting | 16.10.2023

Courtesy C. Stegmann, DESY

Initial Key Strategic Priorities

Astronomy

Square Kilometre Array Observatory (SKAO)

Einstein Telescope (Low Seismic Lab)

Instruments

Developments for future astronomical experiments

Strong participation of Saxon industry

Data Intensive Computing

Processing huge amounts of astrophysics data from all over the world

Innovative AI based and Smart Green Computing

DZA Strategy Development, KAT Meeting | 16.10.2023

DZA

Courtesy C. Stegmann, DESY

TECHNISCHE UNIVERSITÄT DRESDEN

DRESDEN concept SCIENCE AND INNOVATION CAMPUS

HZDR

The Low Seismic Lab

Innovation platform of approx. (40 x 30 x 30) m^3 in 200m depth in the Lusatian granite

With a square kilometre 3D seismometer sensor array.

→ Metrological validation of advanced seismic isolation concepts on a large scale

THE PLACE FOR FUTURE "DEEP TECH":

- Technology development for gravitational wave astronomy
- Adaptive seismic noise reduction
- Astrophysics with accelerators
- Low noise detector development

- Subnanometer microscopy and photolithography
- Quantum computing experiments

DZA Strategy Development, KAT Meeting | 16.10.2023

Courtesy C. Stegmann, DESY