On solid ground

The German Centre for Astrophysics,

a centre for research, technology, and digitisation.

Christian Stegmann for a growing team

23.4.2024, ET Community Day

DZA

Neutron star merger, AEI Golm

A competition historically unique in Germany

ANNUAL BUDGET AFTER RAMP-UP PHASE 170 M€,

TOTAL VOLUME OF THE APPLICATION 1.2 B€

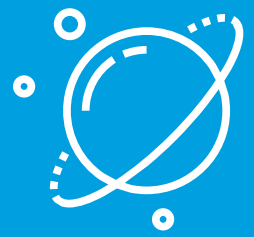
Structural change

KNOWLEDGE CREATES PERSPECTIVES FOR THE REGION!

Two new large-scale research centres will be established in Lusatia in Saxony and in the Central German mining region. With "Knowledge creates perspectives for the region!", the BMBF and the Free State of Saxony are launching a competition for the establishment of the centres.

https://www.bmbf.de/de/wissen-schafft-perspektiven-fuer-die-region-13122.html

DZA concept : the challenges of astrophysics today



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

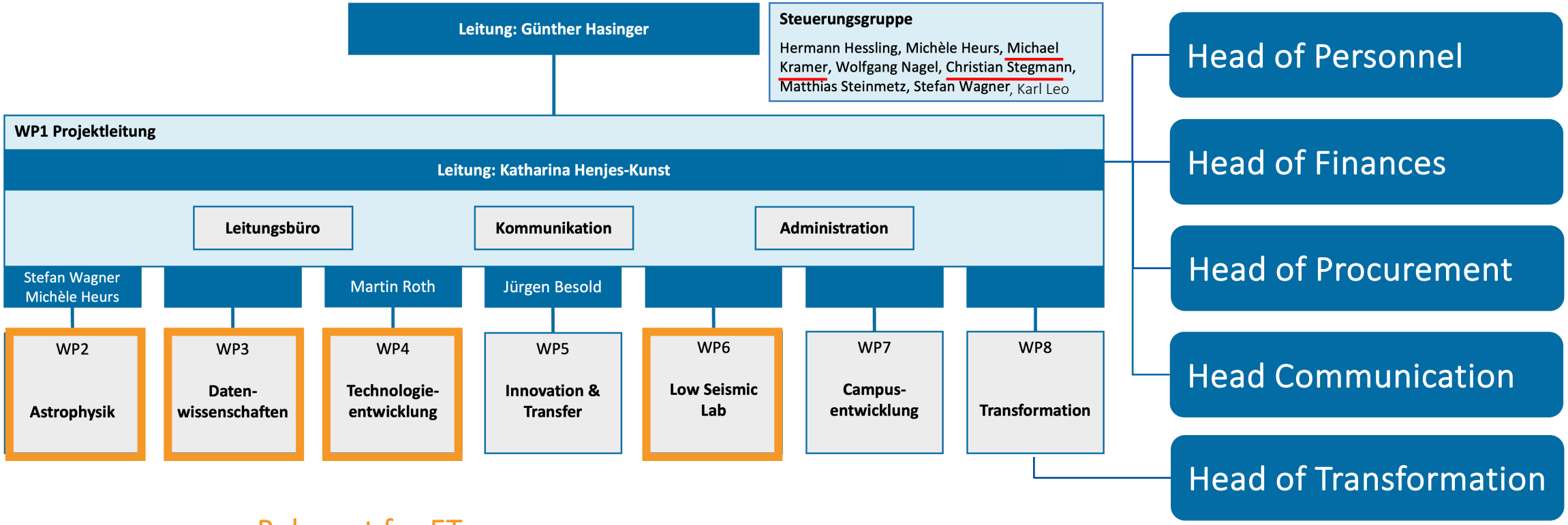
Processing huge amounts of astrophysics data from all over the world

Innovative AI based and Smart Green Computing

Interlocking of pillars → unique synergies

DZA Project Structure until legal Foundation, expected in 2026

The BMBF-funded project to establish the DZA is based at the TU Dresden and DESY



Relevant for ET

https://www.deutscheszentrumastrophysik.de/de/news/aktuelle-stellenausschreibungen-des-dza

First MeerKAT Plus Antenna – Prototype for SKA

- Festive inauguration ceremony of the first MPG antenna in the Karoo region in South Africa on February 21. 2024
- Under the presence of SARAO, MPIfR, DZA and OHB.
- This is the first working antenna of the SKA Mid design!
- **DZA will receive two antennas of the same kind.**

DZA is creating impact – Signature of MoU between DZA and Botswana University BIUST, February 27, 2024

For the first leg of an African VLBI Network (AVN) in Botswana, on February 27, 2024

DZA is creating impact – Signature of the cooperation agreement between DZA and NIKHEF, October 4, 2024

- Collaboration between the German Centre for Astrophysics (DZA) and Nikhef (Netherlands) for the Einstein Telescope
- Goal: Establish leading positions in scientific instrument development for the Einstein Telescope
- Intention to develop joint project proposals and coordinate scientific efforts

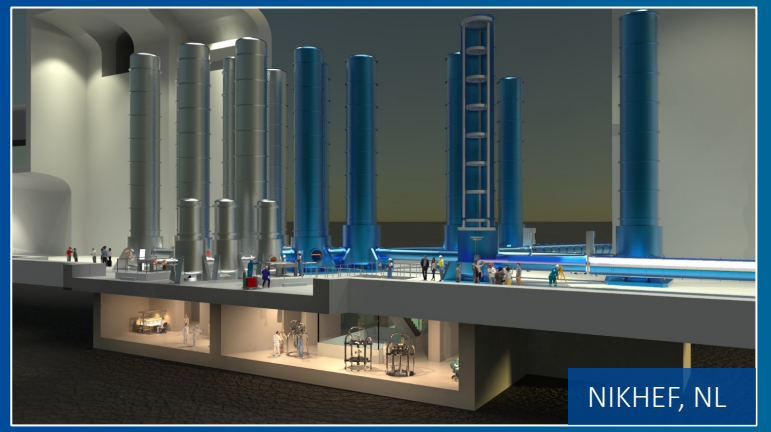
- Further cooperation agreements (INFN, Academy of Science Czech Republic, ….) are in preparation

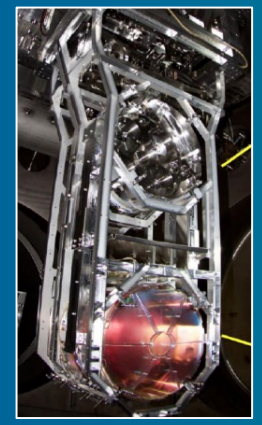
The Low Seismic Lab

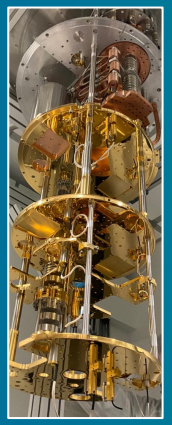
Innovation platform of approx. (40 x 30 x 30) m^3 in 200m depth in the Lusatian granite

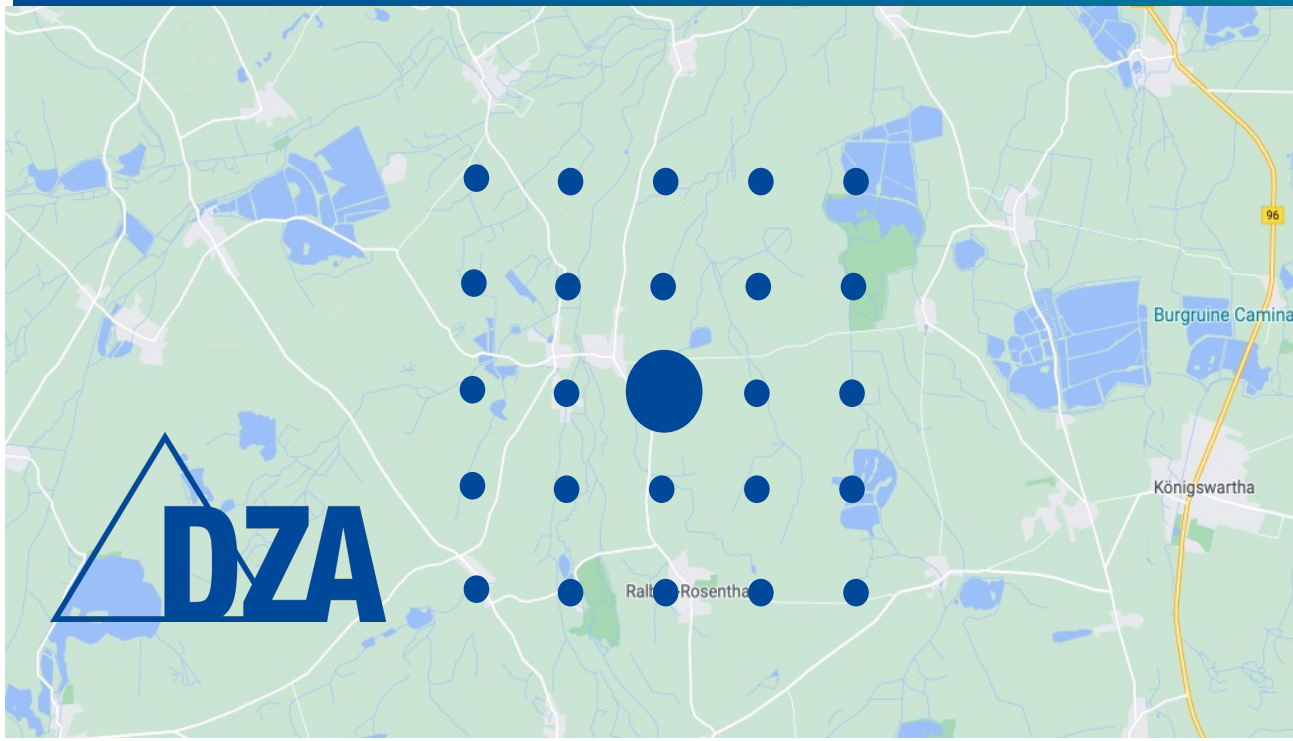
With a square kilometre 3D seismometer sensor array.

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







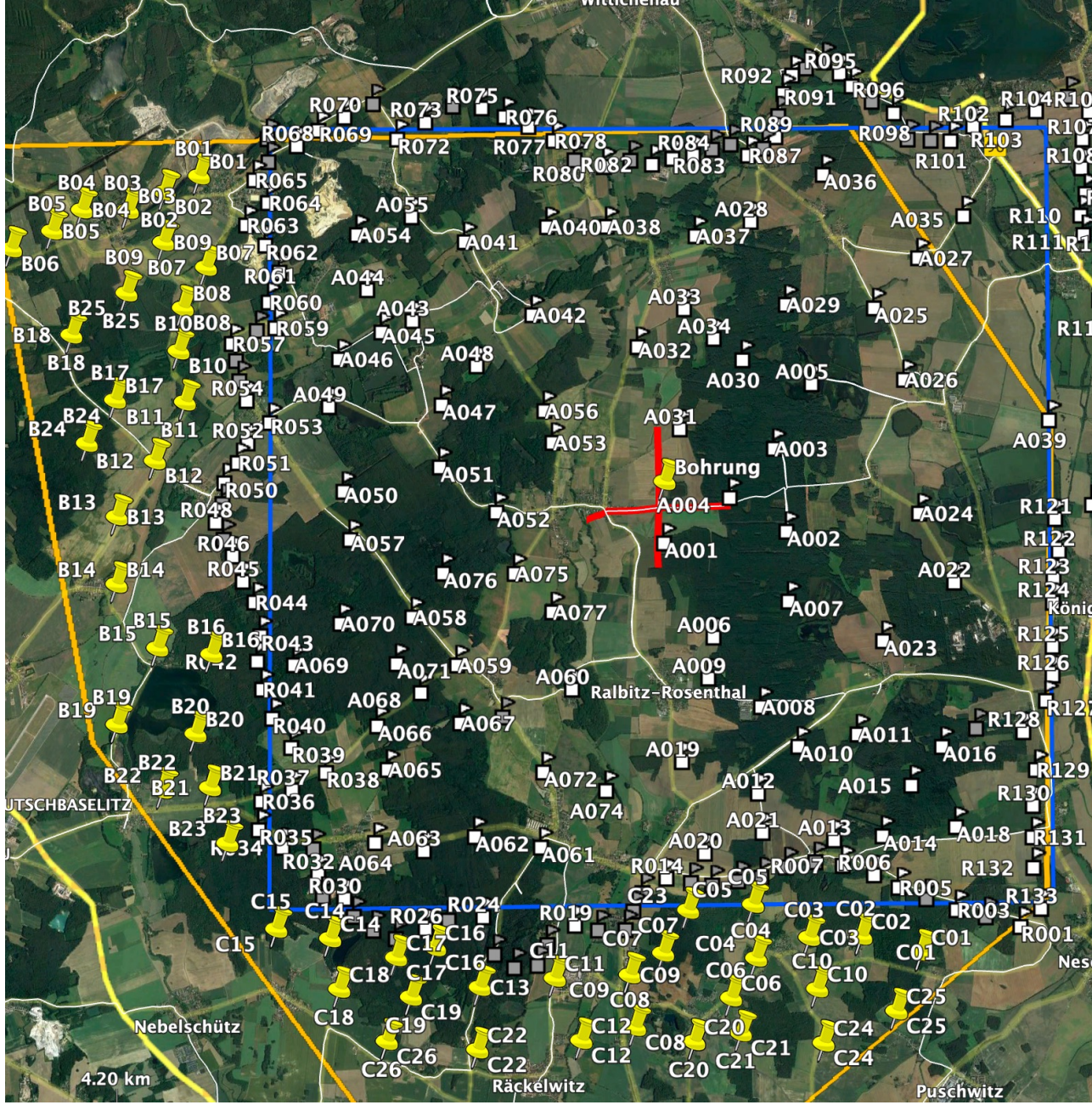


THE PLACE FOR FUTURE "DEEP TECH":

- Technology development for gravitational wave astronomy
- Adaptive seismic noise reduction
- Subnanometer microscopy and photolithography
- Quantum computing experiments
- Astrophysics with accelerators

What is currently happening?

- **Passive seismological experiment for the determination of the 3D shear wave model**
  - Deploy 100 seismic stations to measure the temporal variation of seismic noise and operated for at least 1 year.
- **Conduct high-resolution 2D reflection seismic surveys of geological structures**
  - Acquire 2 km long reflection seismic profiles and intersecting near the drilling location DZA-01 for calibration. Perform detailed studies at future drilling locations.
- **Analysis of the physical parameters of the drill cores**
  - focusing on the Lusatian granodiorite and tectonic structures.
- **Update the geological/hydrological map of the granite stock**
  - Develop a geological/tectonic model using data from the archive from the Lusatian Geological Survey.
- **Measurement of seismic noise at three additional boreholes**
  - to qualify the spatial and temporal noise level in Lusatia.
- **Integrated Lusatian subsurface model and characterization of seismic noise**



Further planned GWD research activities at DZA

Lab space @ Alstom in Görlitz is being prepared for ***optical materials research and characterisation for 3G GWD***

Examples

- Large diameter silicon optics metrology and characterisation
- Bulk silicon characterisation and handling of large (ET-scale) optics

Planning of the ***Low Seismic Lab***,

- First drafts of floor plans and access
- Down selection of experiments for 3G GWD (incl. suspensions, cryogenics, controls) and for nuclear astrophysics
- Underground lab space for quantum computing research, sub-nm microscopy and lithography,…
- Scoping the “seismic cage” for real-time 3D seismic measurements and control

Preparations are underway to implement a group in GW Astronomy.

Statement by the DZA on the Einstein Telescope

The Einstein Telescope (ET) is one of Europe's key scientific projects for the coming decades. In Germany, the ET is receiving a great deal of attention at various levels, from a growing number of scientific groups to political support at state and federal level.

The role of the DZA

- The DZA is prepared to assume a coordinating role in ET and to make significant in-kind contributions to ET.
- Investigating the Lusatia site for ET was part of the application.

The site decision

Several criteria are relevant for this decision and can be roughly divided into four categories:

1. can the scientific programme be carried out by ET at this location?
2. can ET be built at this site cost-efficiently and with calculable risks?
3. can ET be operated at this location for decades?
4. is there political support and financial commitment for the site?

The site decision should only be made after a thorough examination of the first three categories, as these are decisive for the duration and costs of ET.