

Strategic Development of the Deutsches Zentrum für Astrophysik (DZA)

Overview of the Mission, Vision,
and Strategic Objectives

Christian Stegmann, Michèle Heurs
KAT Community Meeting, Karlsruhe, 16.10.24



22. August 2024 – a growing team





Workshop on administrative structure



Event on the DZA in Crostwitz, Sorbian settlement area

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.

Implementation

2024 DZA in project phase

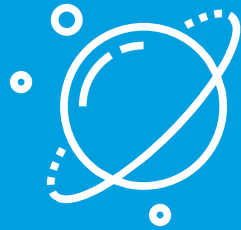
- No legal entity, project funding, interim HQ and technology lab in Görlitz, managed by TUD & DESY, short term positions (through December 2025)
- Launch early gravitational wave and radio astronomy, technology development, and data science projects.

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'

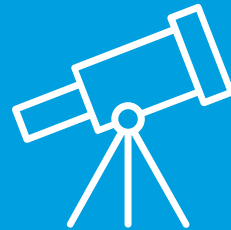
Initial Key Strategic Priorities



Astronomy

Square Kilometre Array
Observatory (SKAO)

Einstein Telescope
(Low Seismic Lab)



Instruments

Developments for future
astronomical experiments

Strong participation of
Saxon industry

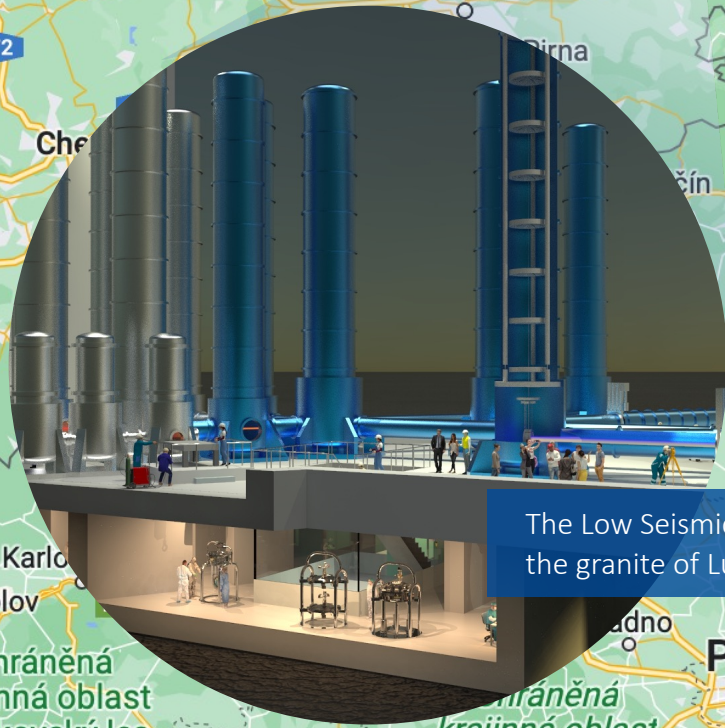


Data Intensive Computing

Processing huge amounts
of astrophysics data from
all over the world

Innovative AI based and
Smart Green Computing

The German Center for Astrophysics in the heart of Europe



The Low Seismic Lab in the granite of Lusatia



The DZA campus on the Kahlbaum site in Görlitz

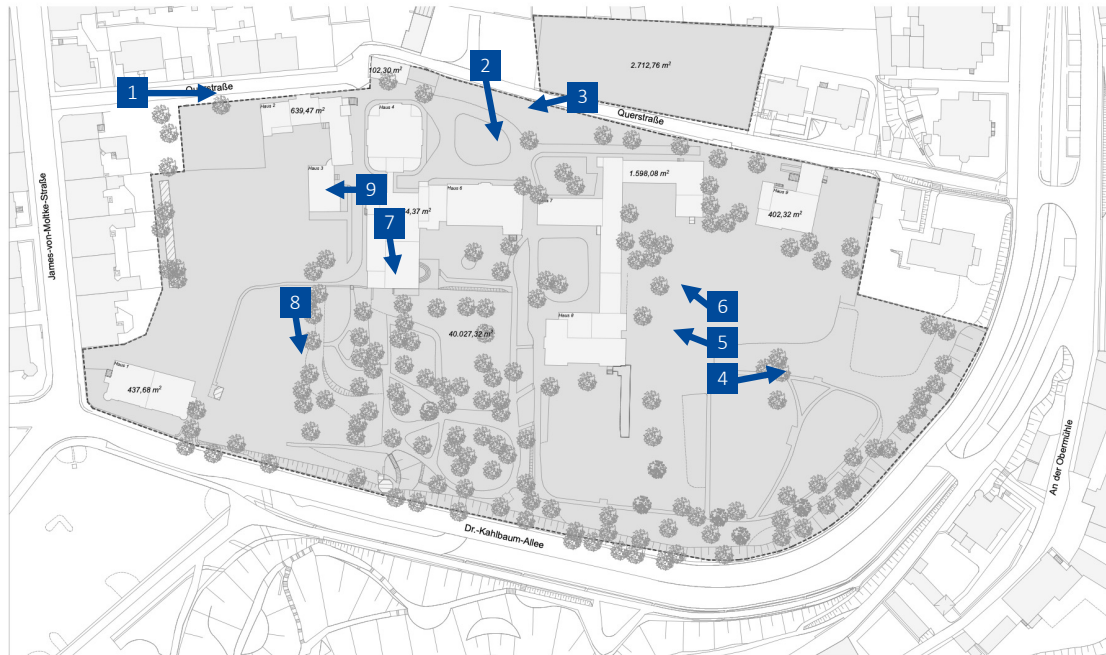
The DZA campus – a landmark in the European City of Görlitz/Zgorzelec

"We welcome the establishment of the German Centre for Astrophysics in Görlitz as an outstanding opportunity for urban and regional development."

Octavian Ursu, Mayor Görlitz

The Kahlbaum-Areal in the centre of Görlitz

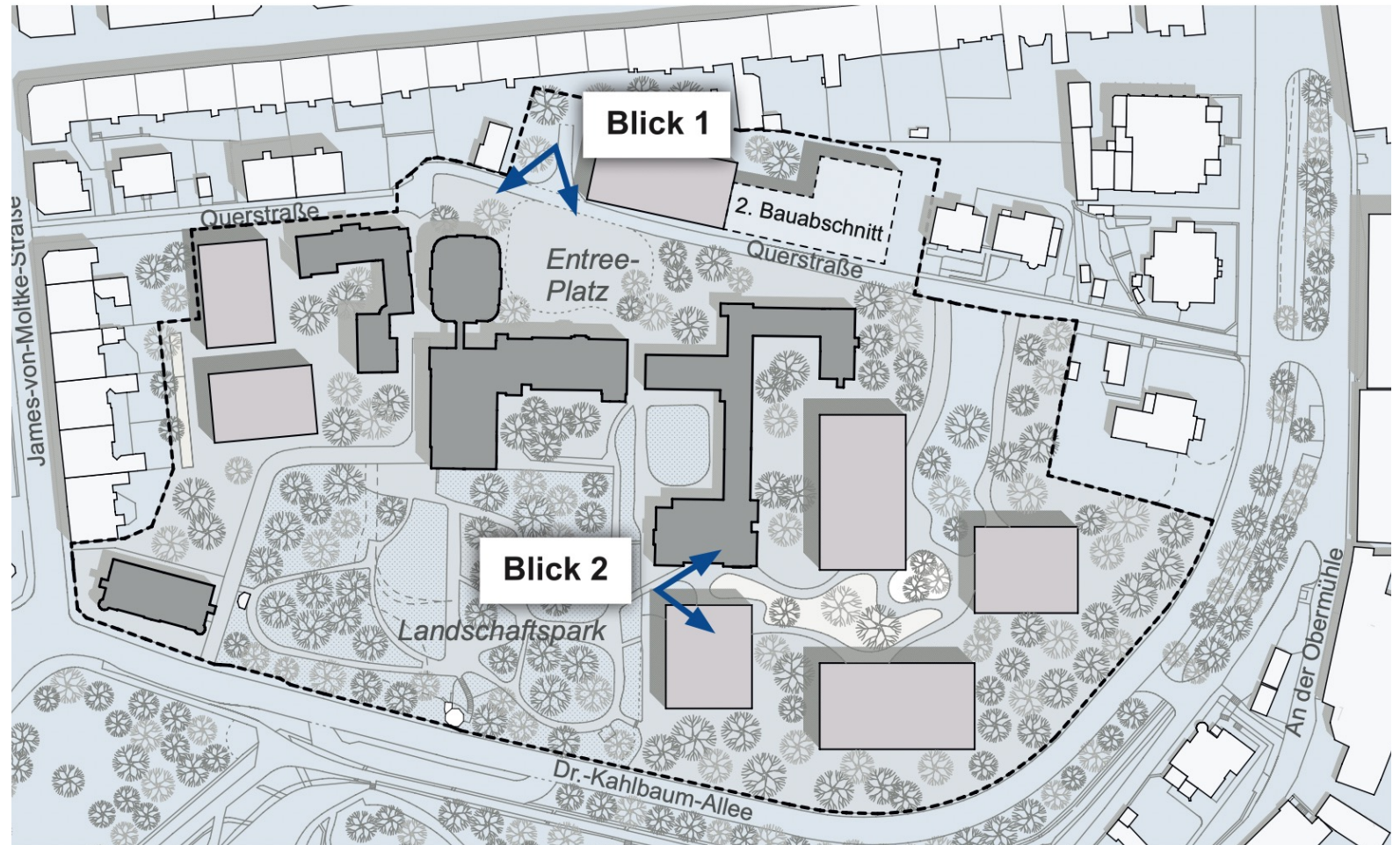
staab
ARCHITEKTEN



Lageplan Bestand Grundstück Görlitz Kahlbaum Areal



Architectural concept



22.9.2024 – The DZA campus will be build on the Kahlbaum-Areal





DZA
Deutsches Zentrum
für Astrophysik

**BESUCHER
ZENTRUM**

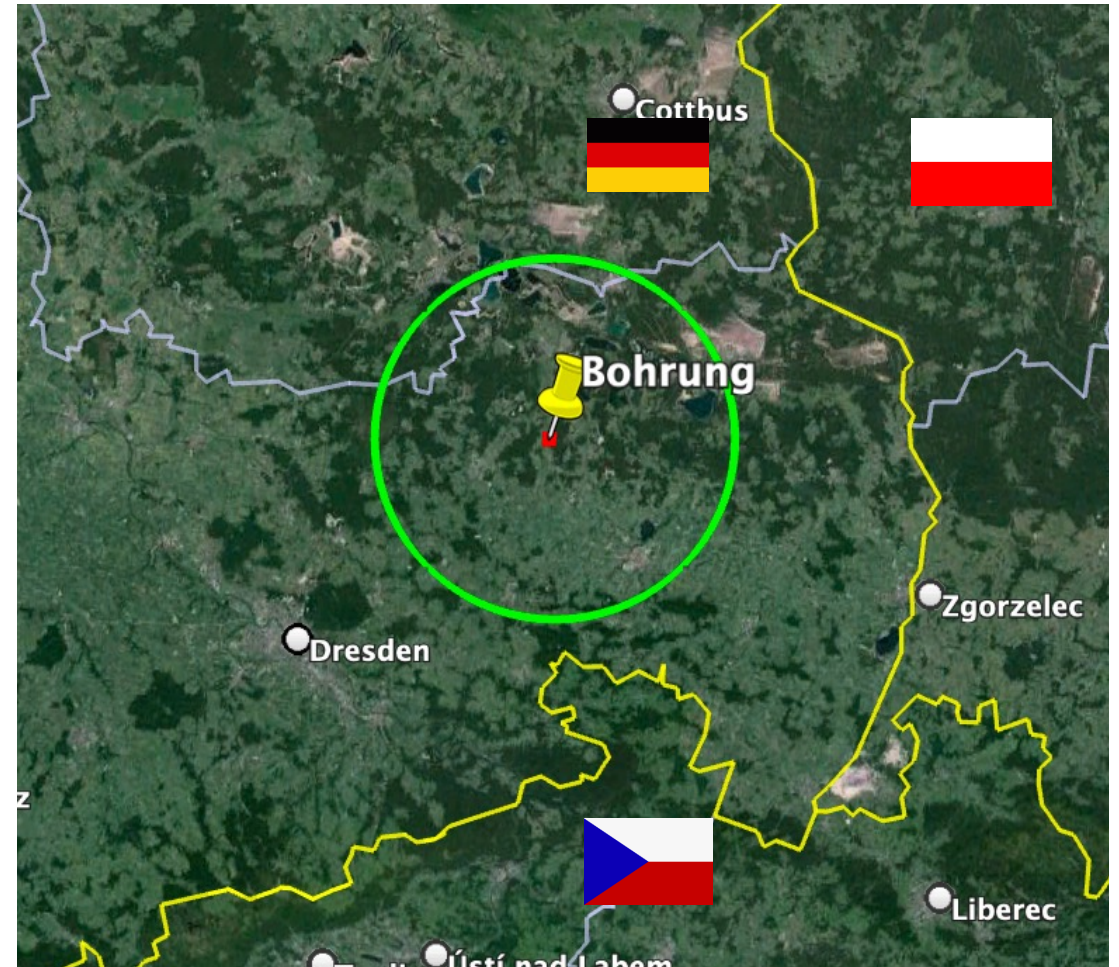
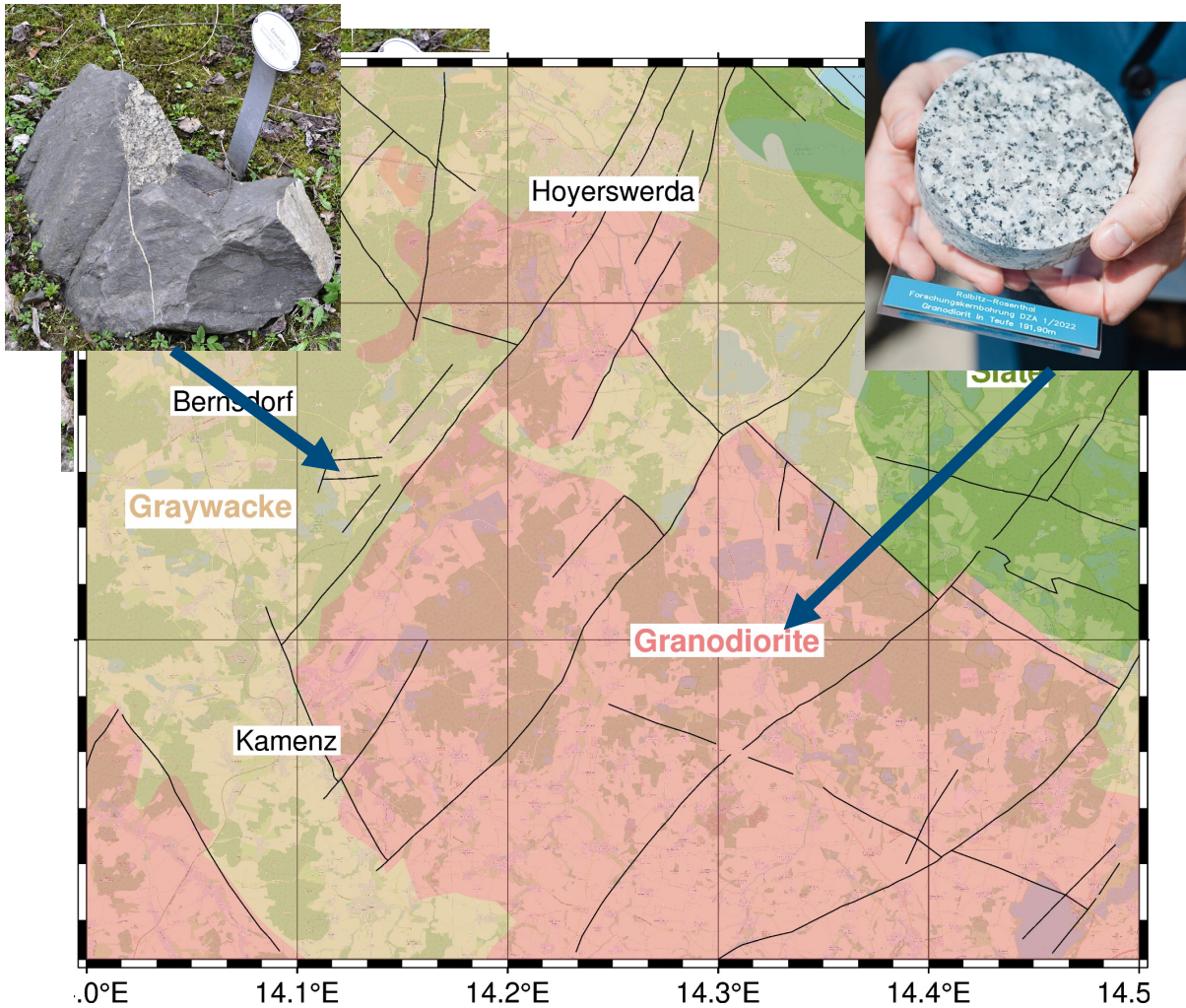
Öffnungszeiten
Montag - Freitag 9:00-16:00

Research in the treasure of Lusatia

"The Lusatians are proud of their granite treasure, and it is a fascinating approach to let this treasure grow into a large number of long-term stable jobs in the whole range from crafts to science."

*Dawid Statnik, Chairman Domowina, Association of Lusatian
Sorbs*

The treasure of Lusatia – a largely monolithic and smooth granodiorite block with extensions of at least 20 km



The Low Seismic Lab

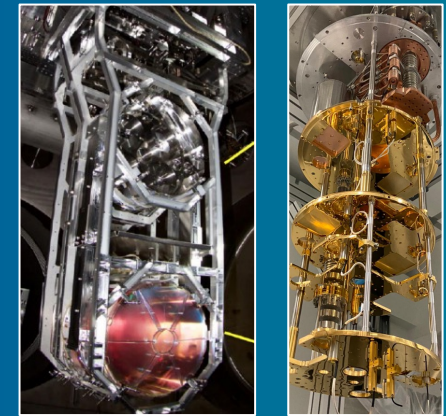
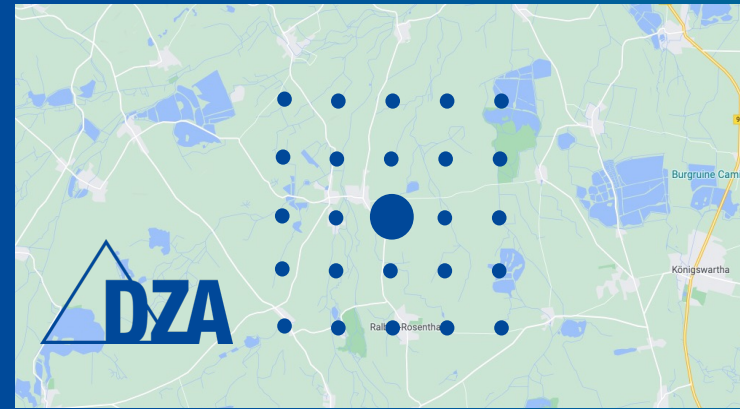
Innovation platform of approx. (40 x 30 x 30) m³ in 200m depth in the Lusatian granite

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":

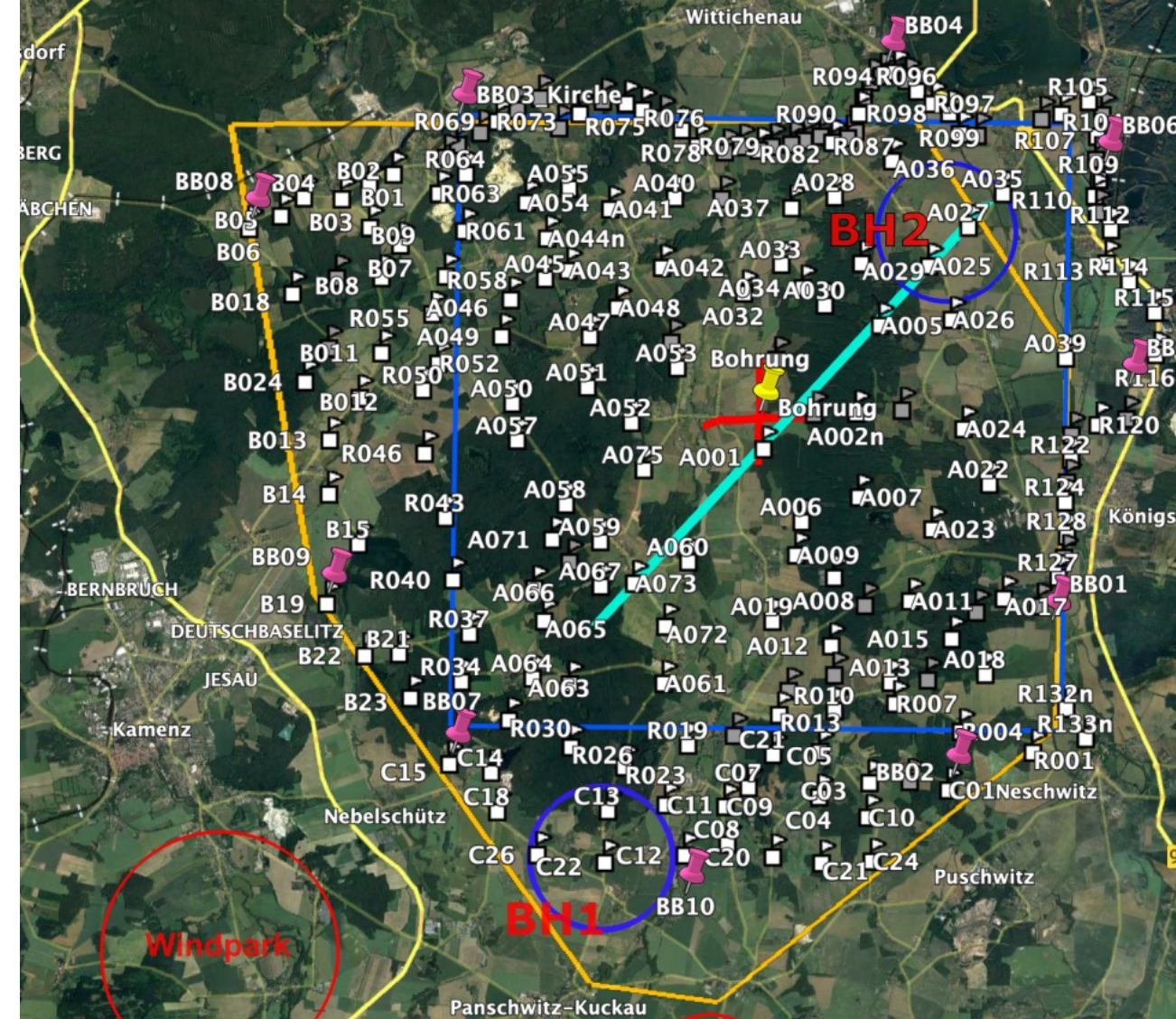
- Technology development for gravitational wave astronomy
- Adaptive seismic noise reduction
- Astrophysics with accelerators
- Low noise detector development
- Subnanometer microscopy and photolithography
- Quantum computing experiments



What is currently happening in Lusetia

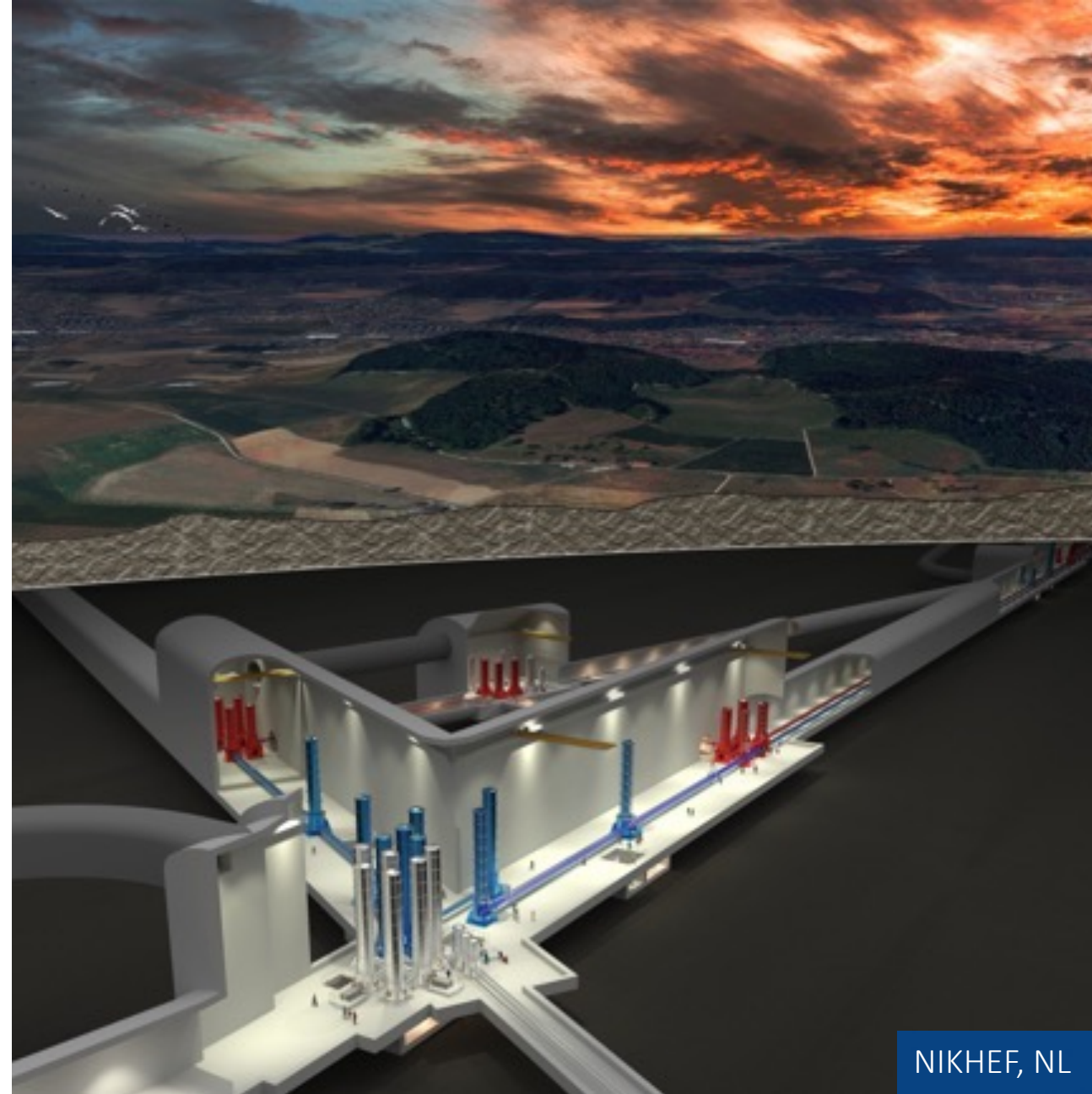
Extensive investigations for the DZA's Low Seismic Lab

- 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



Gravitational Wave Astronomy – the Einstein Telescope

- The DZA will actively contribute to gravitational wave astronomy through its support of ET.
- **Technology development**
 - silicon mirrors, suspensions, control units
 - Low Seismic Lab for detector verification, technology development
- **Early astrophysics:**
 - PTA (using radio astronomy)
 - EM counterpart studies: detection/studies of kilonova and NS/BH binaries
 - Theory



NIKHEF, NL

ET in Saxony?

We have prepared a proposal for a study to assess

- the **geological and geophysical conditions** in Lusatia (already underway),
- the feasibility and **costs of underground and surface structures** and infrastructure,
- the **socio-economic impacts**,
- the expected **operating costs of the infrastructure** and
- the **legal framework**.

The Saxon state government **supports** the proposal.

Medieninformation

Sächsisches Staatsministerium für Wissenschaft, Kultur und Tourismus
Deutsches Zentrum für Astrophysik DZA

SPERRFRIST: 22.08.24, 15:30 Uhr

**DZA-Campus kommt auf Görlitzer Kahlbaum-Areal
Freistaat will Einstein-Teleskop nach Sachsen holen**

Ihr/-e Ansprechpartner/-in
Falk Lange (SMWK)

Durchwahl
Telefon +49 351 564-60200

presse@smwk.sachsen.de*

Dresden,
22.08.2024



Professional Briefings ▾ Über uns ▾ Events Heads Podcast

Bestellen

Astrophysik in Sachsen: DZA erhält Wunschstandort und Aussicht auf Beteiligung am Einstein-Teleskop



Der sächsische Wissenschaftsminister Sebastian Gemkow (li.) und Günther Hasinger, designerter Gründungsdirektor des

Radio Astronomy – the Square Kilometer Array (SKA):

- DZA will enhance the German contribution to SKA to provide access for the entire German community and enhance the SKA capabilities.
- **Technology development and computing**
 - receiver technology and
 - data science (SKA Regional Centre)
- **Early astrophysics:**
 - MeerKat+
 - Theory



SKAO

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.**



Signature of MoU between DZA and Botswana University BIUST

BIUST, SARAO, MPG, DZA SIGN MOU FOR BOTSWANA'S FIRST RADIO TELESCOPE



BIUST PARTNERS WITH INTERNATIONAL BODIES TO ADVANCE RADIO ASTRONOMY



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

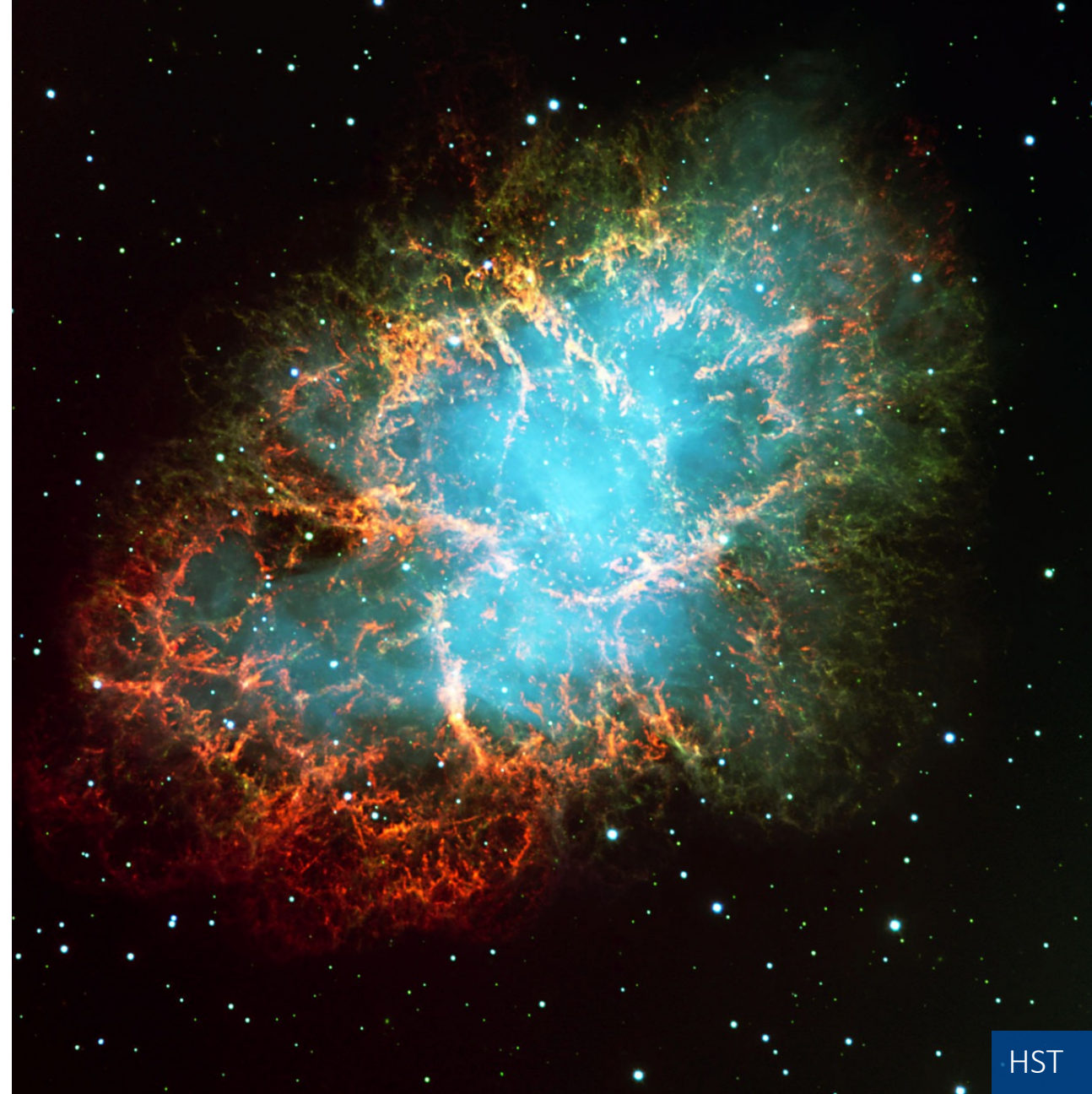
DZA attracts industry to Görlitz



Opening of the intermediate DZA site in Görlitz, 22.2.2024

Optical Astronomy

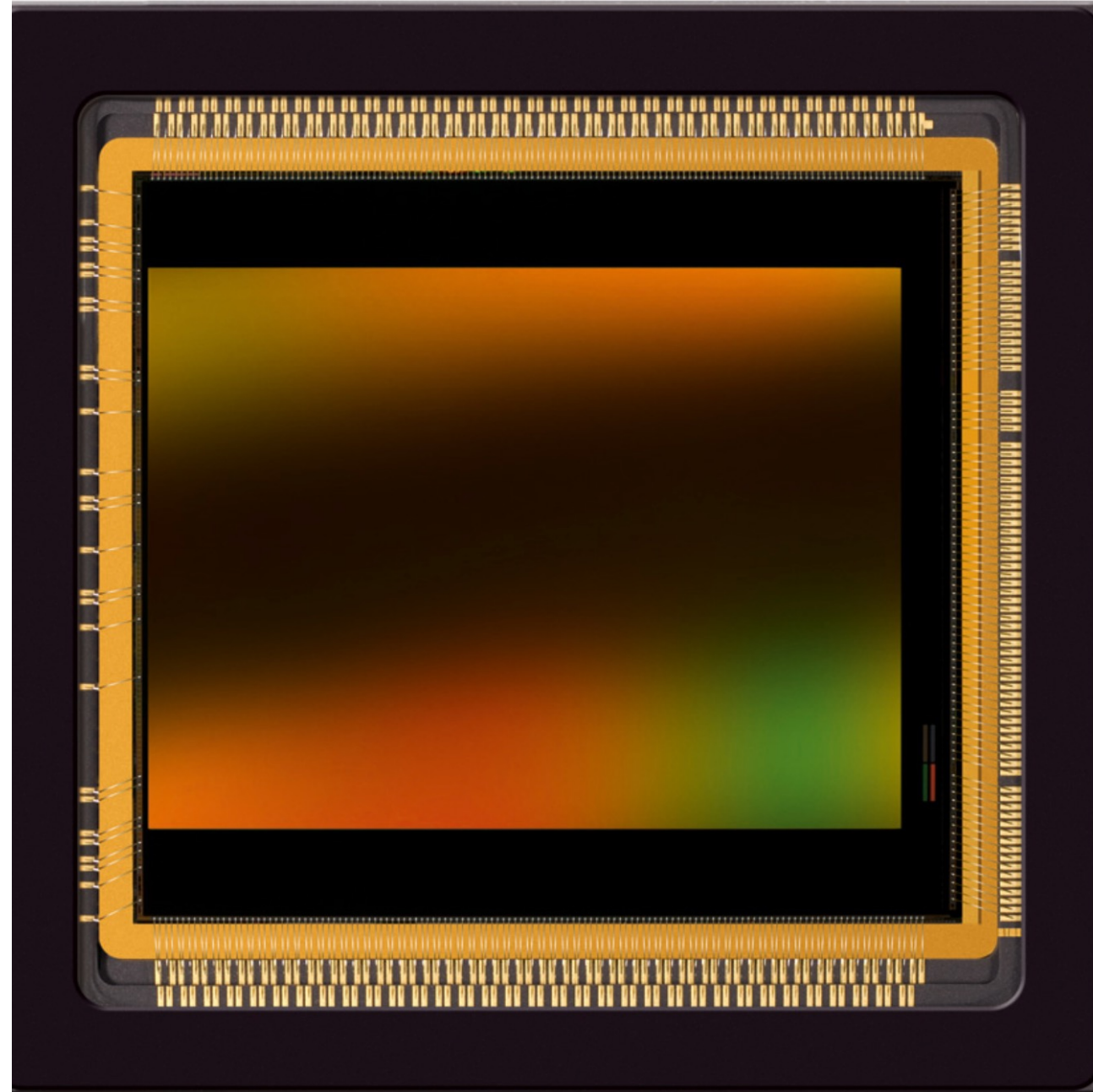
- **beyond the ELT**, a critical role will be played by **Survey and Time-Domain Projects**.
- will provide critical, real-time data on transient events, integrating well into **multi-messenger astronomy**.
- DZA will built up a branch in optical astronomy in forthcoming years.



HST

Technology – the second pillar

- Technology development will partner infrastructure plans in EM and GW projects
- **GW astronomy**
 - Cryogenic silicon mirrors and high reflectivity coatings for ET
- **Radio astronomy**
 - receiver technology
- CCDs are likely to be replaced by **CMOS** detectors
 - many challenges to be met,
 - local partners in technology development

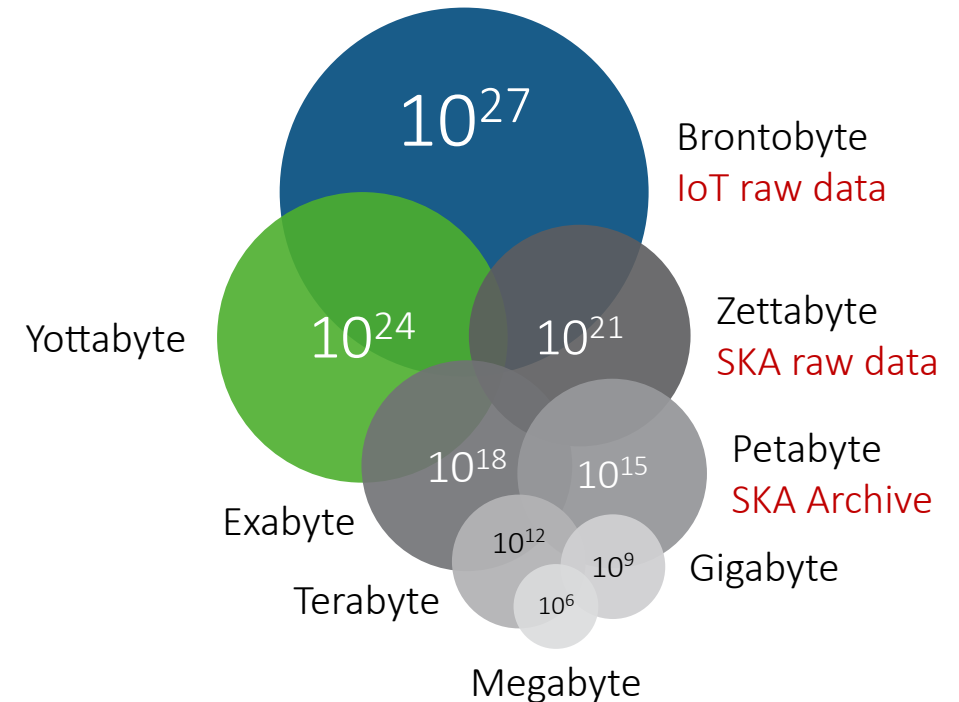




Delivery of equipment for the laboratories in Görlitz, 2.10.2024

Data Science – the third pillar

- SKA will pose unprecedented challenges for **data management**, but other infrastructures will also produce enormous amounts of data.
- DZA aims to contribute to **SKA-Regional Centre** network
 - plans to facilitate the integration of major data sets for multiband studies
 - intends to provide resources for computation and storage
 - will develop ML/AI technology in astrophysics data management



The status as of today

- **Implementation phase:** DZA is actively preparing its foundation, preparing for campus construction and key facilities like the Low Seismic Lab.
- **Scientific focus for the next years:** DZA is launching pilot projects in gravitational wave and radio astronomy.
- **Data science and technology development:** DZA is advancing capabilities in detector development, sensor technology and data science.
- **Regional and international integration:** DZA is establishing strong connections with local stakeholders and national and international research institutions.
- **Strategic role:** DZA is preparing to support the coordination of Germany's contribution to the ET and SKA.

Mission and Vision of the DZA

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.



See job announcements: <https://www.deutscheszentrumastrophysik.de/de/ausschreibungen>

Back up



Sachsen und Nordrhein-Westfalen rücken noch näher zusammen

11.06.2024, 15:27 Uhr — Erstveröffentlichung (aktuell)

Gemeinsame Sitzung der Landesregierungen in Leipzig – Beschlüsse zu den Themen Wandel durch Technologie, zur Krankenhausreform, zur grenzüberschreitenden Zusammenarbeit und zur Einführung einer Elementarschaden-Pflicht

Leipzig (11. Juni 2024) – Die Länder Sachsen und Nordrhein-Westfalen rücken noch näher zusammen. Beide Länder wollen ihre Kooperationen und Erfahrungen vor allem in den Bereichen Staat und Wirtschaft stärken. Darauf verständigten sich Sachsens Staatsministerpräsident Michael Krause und Nordrhein-Westfalens Ministerpräsident Hendrik Emswiler in ihrer gemeinsamen Sitzung der Landesregierungen in Leipzig. Die Leitung der Ministerpräsidenten Michael Krause und Hendrik Emswiler

Kontakt

Sächsische Staatsregierung

Regierungssprecher Ralph Schreiber

Einstein-Teleskop

Sachsen und Nordrhein-Westfalen bekennen sich zum Großprojekt »Einstein-Teleskop«, das als eine Großforschungsinfrastruktur von internationalem Rang für den Forschungs- und Wirtschaftsstandort Europa und Deutschland von großer Bedeutung sein wird. Beide Ländern fordern die Bundesregierung auf, zu den zur Verfügung gestellten Mitteln für Machbarkeitsstudien eine volle und aktive Beteiligung an diesem europäischen Projekt und im Board of Governmental Representatives (BGR) anzustreben. Ebenso muss ein maßgeblicher Teil eines deutschen Beitrags zum Einstein-Teleskop der Bund leisten, da die Finanzierung internationaler Forschungsinfrastruktur in seinen Zuständigkeitsbereich fällt.

Innovative AI and Smart Green Computing

Innovative AI-based methods

- Improved detection techniques (knowledge graphs, ML)
- Filtering and storage (archiving) as central topics
- Data and computer sciences as drivers of success

Smart Green Computing

- Cooling with hot water and remote heating connection
- Energy-efficient hardware
- Reduction of data irreversibility (online + offline) and more
- In 2030, ~ 20% of global electricity consumption by IT [Nature, 2018]

➔ Contributions to reducing the energy consumption of IT

