# On solid ground

## The German Centre for Astrophysics, a centre for research, technology, and digitisation.

**Katharina Henjes-Kunst, Christian Stegmann**

Zeuthen, 7.9.2022

DZA

**Deutsches Zentrum für Astrophysik**

# DESY in the region

## We want to shape

Hamburg

DESY site in Zeuthen, a Brandenburg success story.

Potsdam

Lusatia

Cottbus

Hoyerswerda

Görlitz

**Astrophysik Network Potsdam**
Together with AIP, AEI, UPotsdam a focus for astronomy and astroparticle physics

dahme innovation

**DESY QUANTUM.**

Together with partners we are building "in harmony with nature" a science and technology region at the river Dahme.

**FLASHLab@PITZ.**

**Cottbus Health Region**
We want to work together with the (future) medicine in Cottbus to develop modern methods of **radiotherapy**.

DZA

**Large-scale research centre in Lusatia**
Our proposal is the German Centre for Astrophysics.

# A competition historically unique in Germany

**ANNUAL BUDGET AFTER RAMP-UP PHASE**
**170 M€**

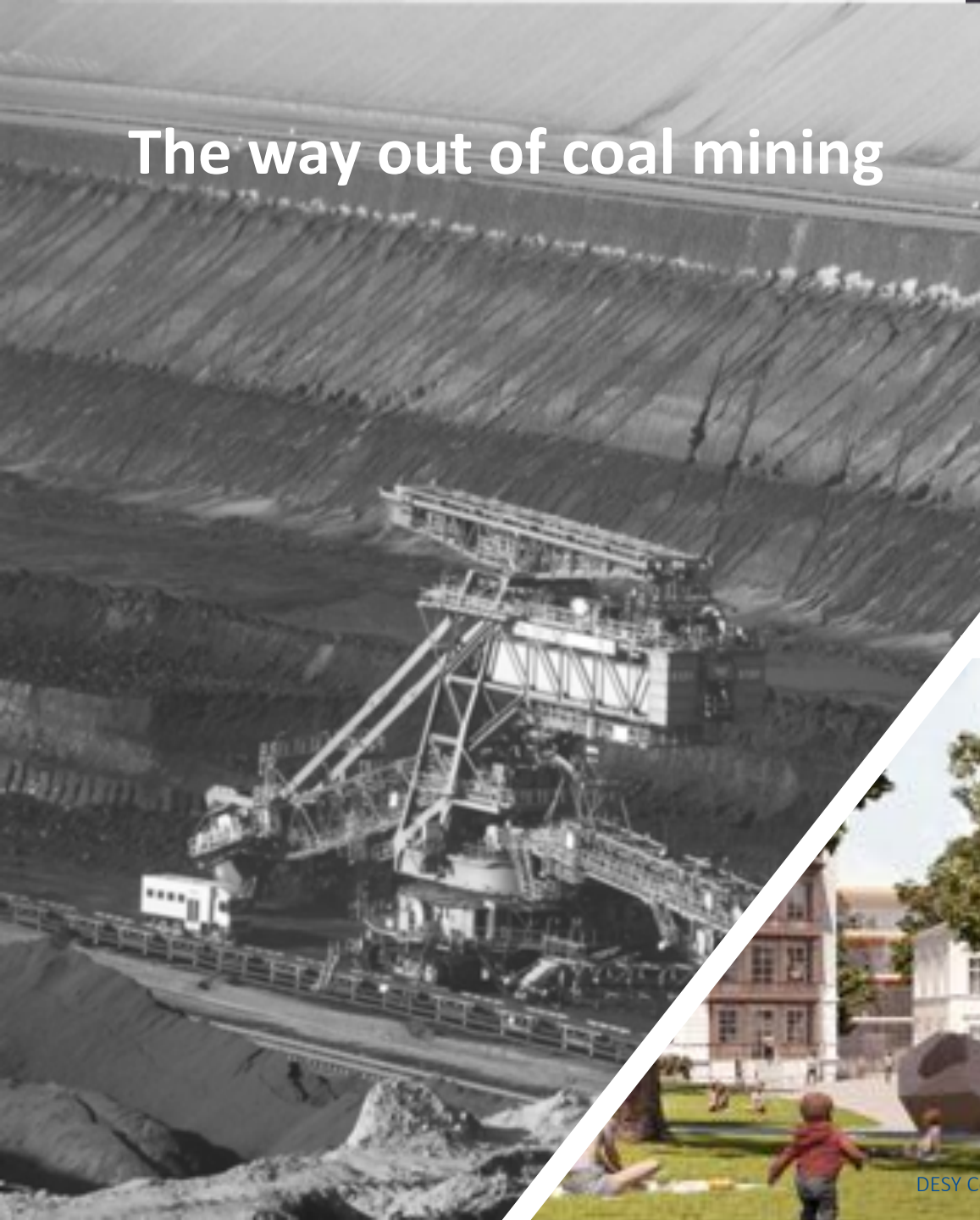
## Structural change

**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

# The way out of coal mining



# The time line of the competition

## July 2021 – The first milestone is reached

The Perspective Commission selected the six most convincing proposals from almost 100 ideas and recommended them to the BMBF for the first funding phase; the competitors are

- CTC (Prof. Peter Seeberger, Potsdam): „Center for the Transformation of Chemistry"
- CLAI_RE (Prof. Georg Teutsch, Leipzig): „Centre for Climate Action and Innovation – Research and Engineering"
- CMI (Prof. Jens Meiler, Leipzig): „CMI – Center for Medicine Innovation"
- DZA (Prof. Günther Hasinger, ESA) "The German Centre for Astrophysics"
- ERIS (Prof. Carsten Drebenstedt, Freiberg): „European Research Institute for Space Resources"
- LAB (Prof. Manfred Curbach, Dresden): „Lab – Lausitz Art of Building"

## May 2022 – concept has been handed in

## July 2022 – scientific evaluation

## August 2022 – evaluation of the transfer and structural impact

## End of September 2022 – final decision (?)

# Who we are

The DZA is a joint initiative of German astronomy and astroparticle physics with the idea of creating a national and also international hub of astrophysics. The idea was born out of the need for cooperation, and it is supported by many research institutions, universities and partners.

# Joint initiative of German astronomy and astroparticle physics


- Germany makes outstanding contributions to astronomical research.
- State treaties with the European Southern Observatory (ESO) and the European Space Agency (ESA) make this leading role possible.
- In order to play this role in new major international projects such as the **Square Kilometre Array** (SKA) radio observatory, **Einstein telescope**, Vera Rubin observatory and European solar telescope, new national structures are needed.
- SKA is asking for regional data centres. The Einstein telescope is looking for partners in Europe to set up large test and development centres for gravitational wave interferometers.
- **Participation of German industry in research and development contracts of international research institutions requires institutional German participation.**

# Competent support for transfer and structural effects

Görlitz OB O. Ursu welcomes the Administrative Advisory Board

There will be a department for transformation research at the DZA, supported by TU Dresden, HS Zittau/Görlitz, Sorbian Institute and Leibniz Institute for Ecological Spatial Development.

## ADMINISTRATIVE ADVISORY BOARD OF THE DZA

Dr. Bettina Böhm, Leibniz

Prof. Dr. Heike Graßmann, MDC

Dr. Andreas Handschuh, eh. Kanzler TUD

Prof. Dr. Alexander Kurz, Fraunhofer

Sigurd Lettow, eh. CERN

Prof. Dr. Josef Puchta, DKFZ

Dr. Catharina Sasse, MPG

Prof. Dr. Ursula Staudinger, Rektorin TUD

Dr. Markus Zirkel, Fraunhofer

# Astronomy was and is a high-tech science

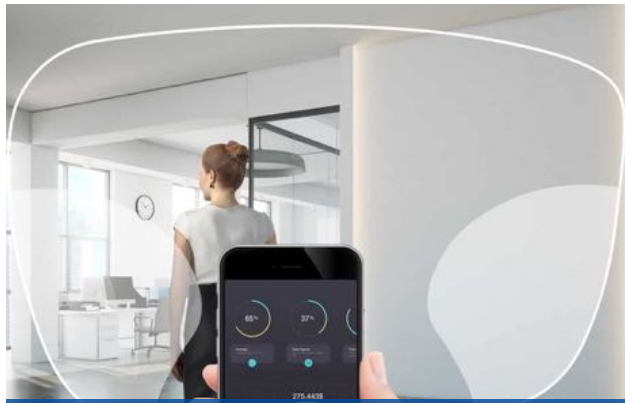
*"More than 40% of the world's gross national product is based on quantum mechanics and relativity."*

*Leon Lederman, Nobel Prize winner*

# Astronomy has always been a driver of progress

The astronomical clock in Görlitz (Scultetus 16th century)

Wifi (Radio astronomy)

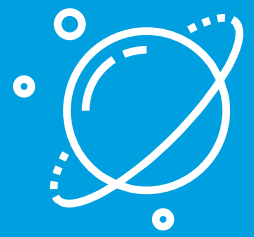


Progressive lenses (X-ray astronomy)

Zerodur (Optical Astronomy)

Adaptive Optics (Optical Astronomy)

# 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

# Shaping structural change

*"We are convinced that the DZA, as a major research centre with international visibility, can provide sustainable impact for successful structural change in Lusatia and contribute to Germany's technological sovereignty through transfer in technology and digitalisation."*

*Prof. Ursula M. Staudinger, Rector of Dresden University of Technology*

# How we understand structural change

**Enable innovation.**
Set the right priorities.

**Have a sustainable impact.**
Have the potential to be relevant in the long term.

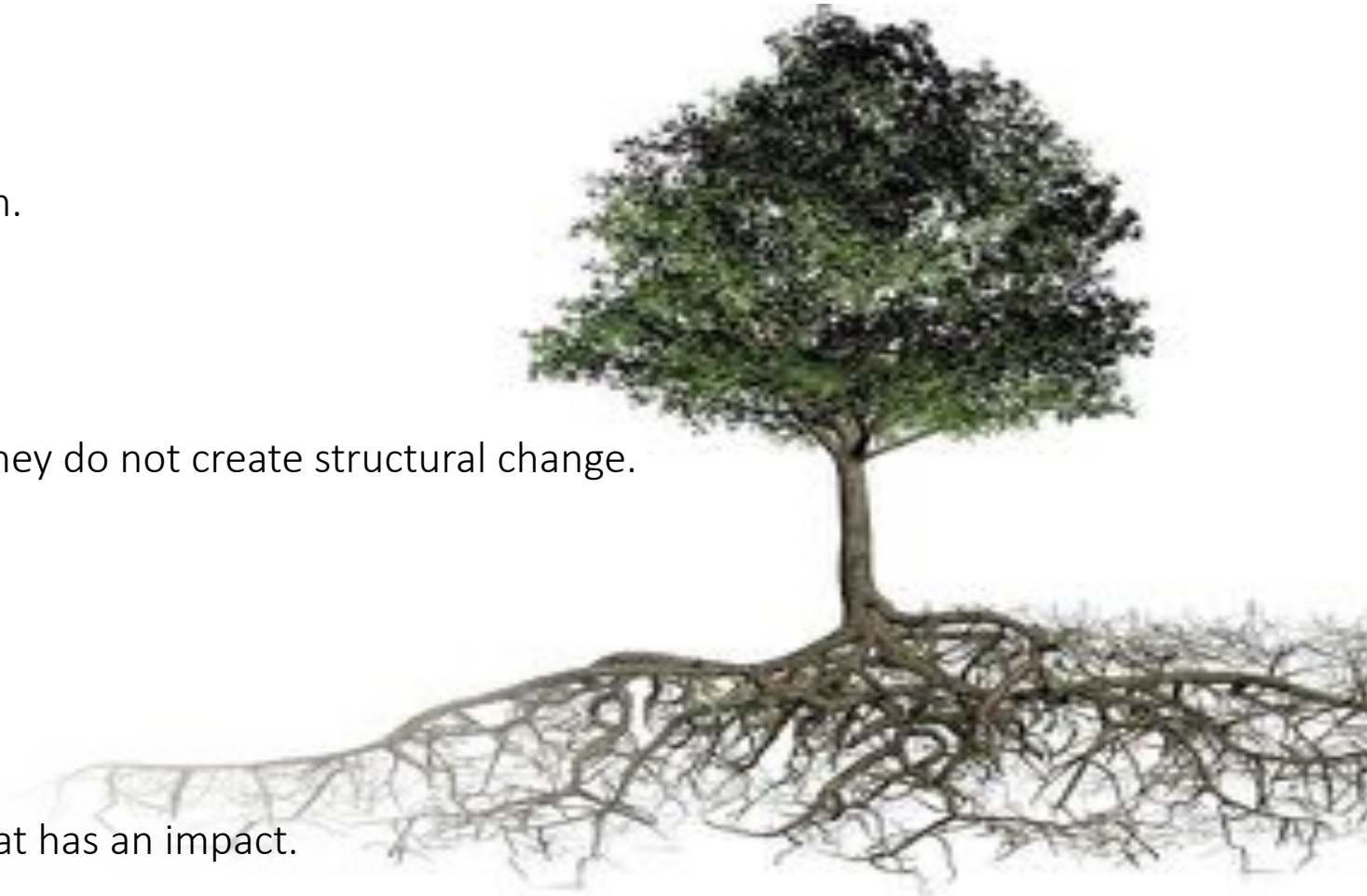
**Be diverse.**
Radiate into diverse areas.

**More than jobs.**
No matter how many open positions there are, they do not create structural change.

**Attracting people.**
Perspectives to stay, come back and settle.

**Shaping together.**
Structural change with local people.

**Creating identity.**
Appreciating what is- creating something new that has an impact.



# Strengthen strengths.

Sustainable structural development must not only focus on challenges, but also on strengths.

## GOOD REASONS FOR LUSATIA:

- Location in the centre of Europe
- Universities and colleges with a focus on natural sciences and technology
- Numerous scientific links, also across borders
- Partners in technology development and digitalisation
- People deeply rooted in the region with great openness and curiosity
- Treasure of Lusatia: outstanding seismographic conditions in granite rock

**All this makes Saxony an ideal location for the DZA.**

# Our mission

**We open new windows to the cosmos.**
We explore the basic structures of the universe, linking the whole spectrum of different cosmic messengers. We participate in major international observatories. In this way, we expand the world's astronomical knowledge and secure Germany's leading position in international astrophysics.

**We make knowledge possible.**
We are building an astrophysical centre for research, technology and digitisation with a forward-looking research and development programme and creating the foundations for tomorrow's society.

**We are drivers of progress.**
We develop new technologies and drive innovation. In this way, we create jobs of the future in the region and secure the technological sovereignty of Germany and Europe.

**We make digitisation green.**
We bring together the data streams of astronomical observatories around the globe and develop new methods for resource-efficient computing. In this way, we are shaping the digital transformation of society in an environmentally friendly way and at the same time securing prosperity and progress.

**We bring knowledge to effect.**
We ensure knowledge and technology transfer and share our know-how. We operate in tightly knit regional, national, international and interdisciplinary networks and thus become a magnet for industry settlements and a nucleus for spin-offs and start-ups.

**We promote young talent.**
We inspire enthusiasm for science and technology and build on education from nursery and school to training and university. In this way, we create sustainable prospects for young people in the region and secure the demand for skilled workers.

**We are a centre in Lusatia.**
We will be a centre with international appeal, closely rooted in the region and contributing to identity formation. Together with partners from business, politics, civil society and the local people, we are driving structural change forward.

# The German Centre for Astrophysics

2 Locations for research, technology, digitalisation



The Low Seismic Lab in the granite of Lusatia

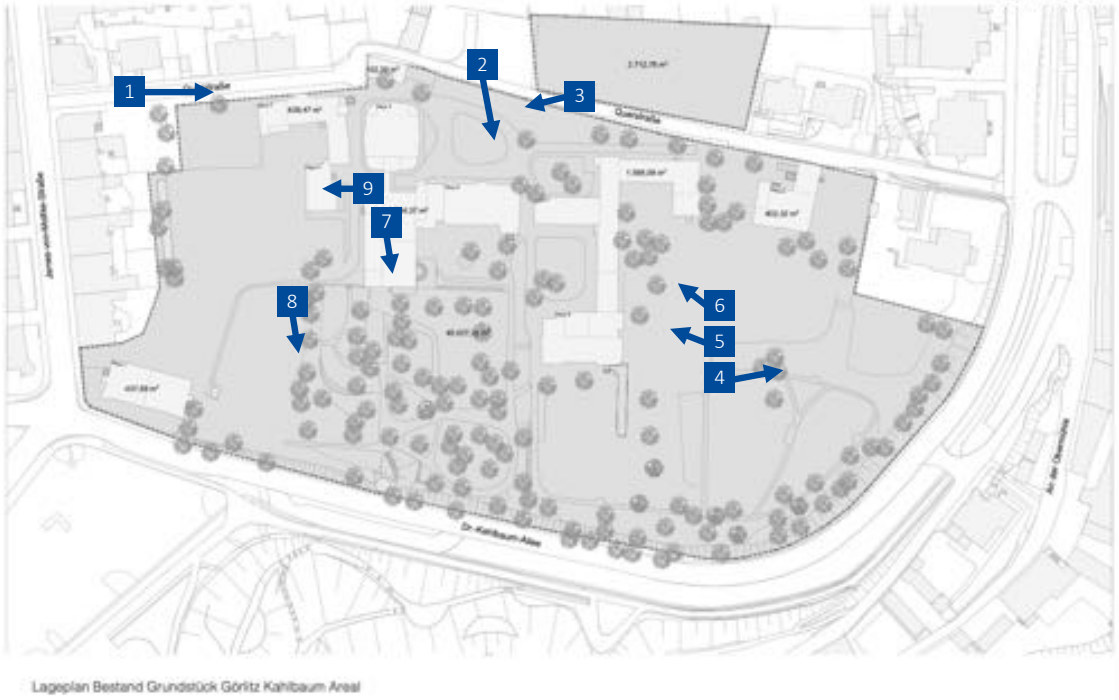




The DZA campus on the Kahlbaum site in Görlitz

# The Campus in Görlitz

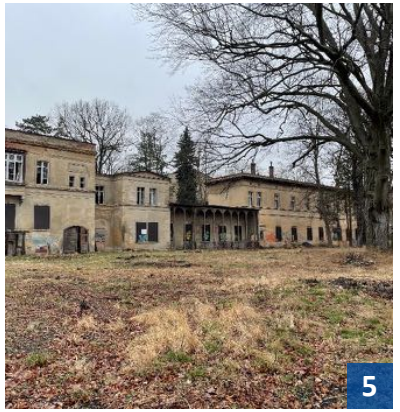
# Das Kahlbaum-Areal in the centre of Görlitz



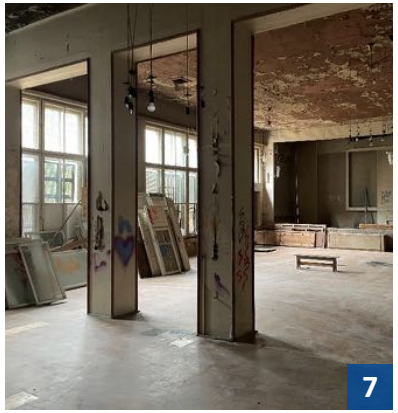

Lageplan Bestand Grundstück Görlitz Kahlbaum Areal









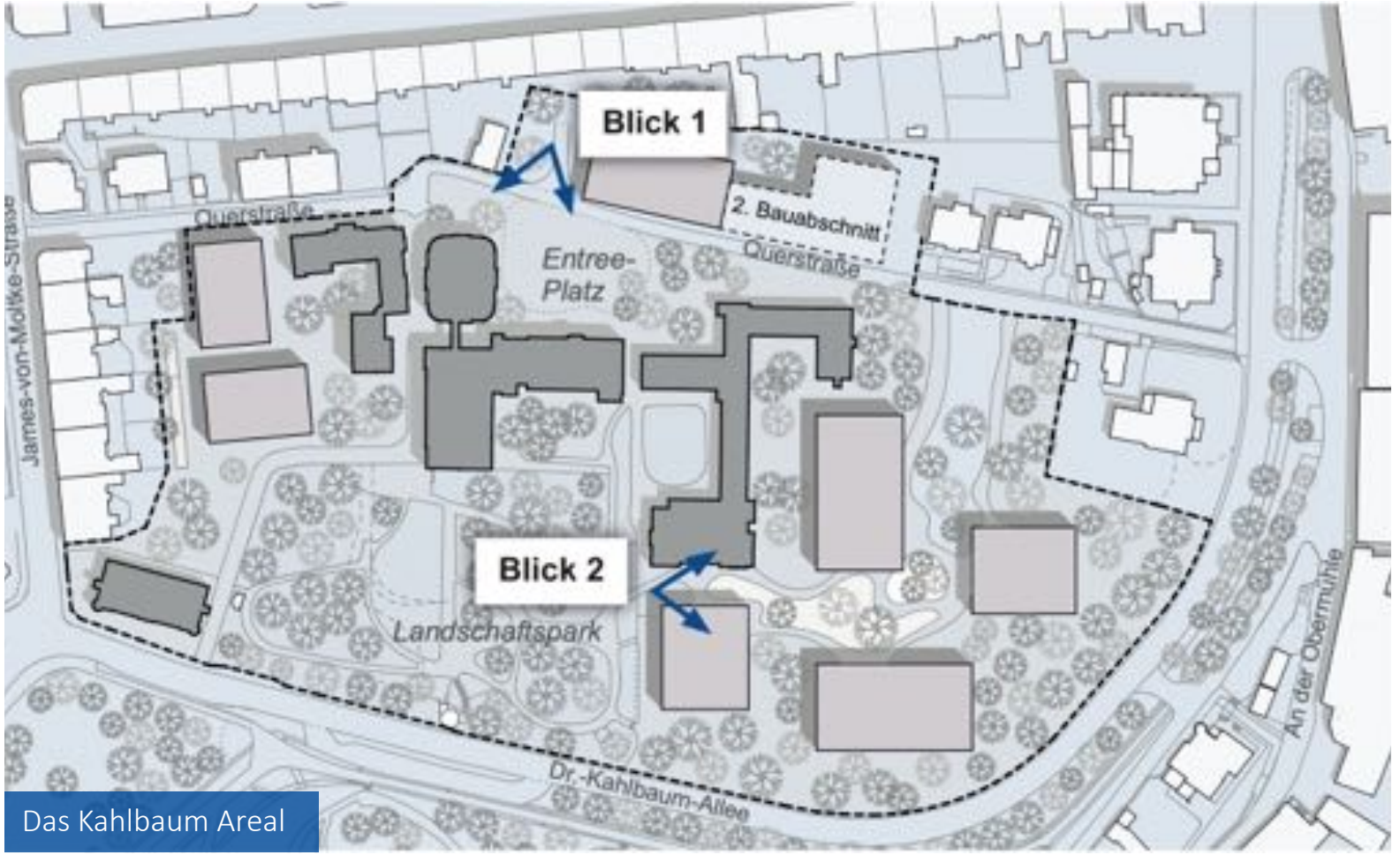




# Architecture concept

Blick 1


Blick 2




Das Kahlbaum Areal

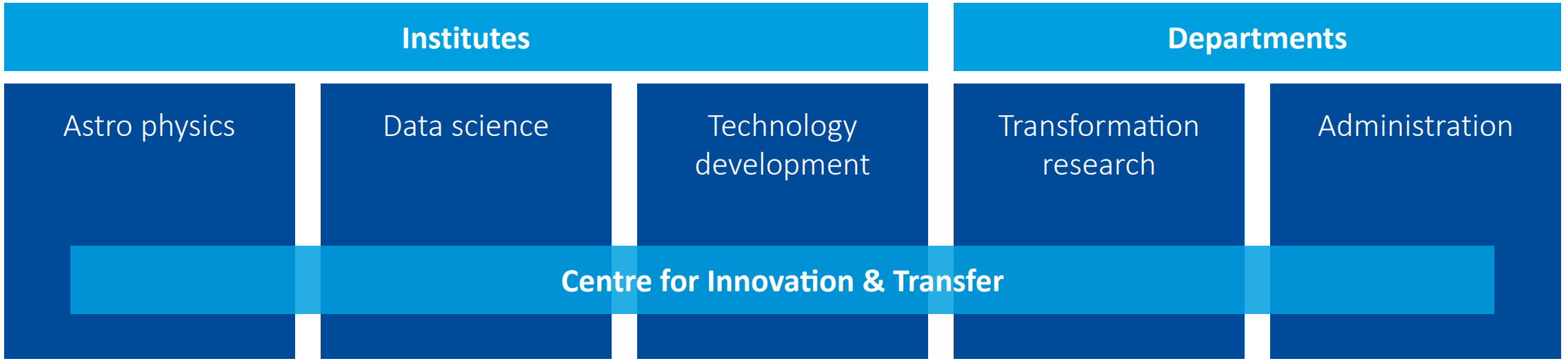

DZA

# Digitisation and technology development

*"The common technological interests in microelectronics and the IT industry offer unique opportunities for cooperation in the interest of Saxony as a business and science location."*

*Stefan Uhlig, Senior Manager - Silicon Saxony e.V.*

# The Structure of the DZA




**Think tanks for key technologies**

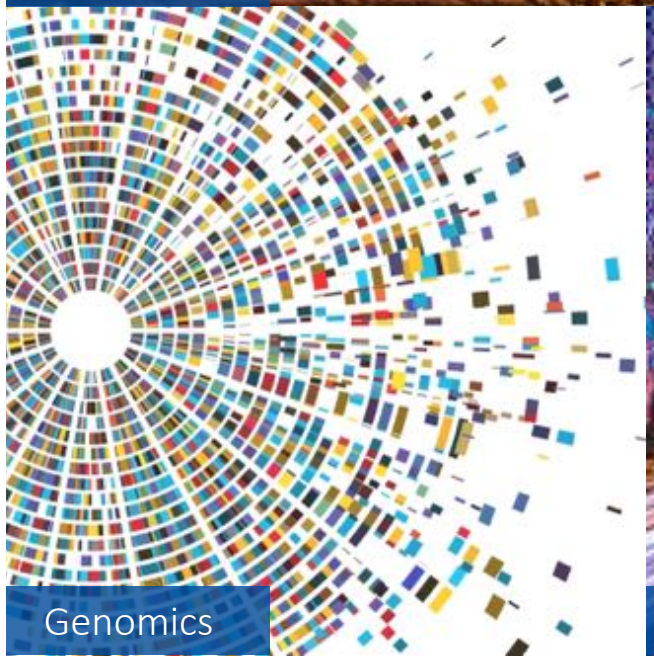
- Advanced materials (silicon and semiconductor optics, photodetectors), photonics, advanced manufacturing technologies, ...
- Digitisation (hardware, algorithms and software)

# Focus on Innovation Potential

- Synergies in science but also in technology: radio and gravitational wave astronomy
- Both fields have exciting new developments and instruments that provide huge opportunities, especially in opening innovation potential and collaboration with industry.
- Especially radio astronomy will produce (among) the largest rate and volume of data in any kind of science, pre-empting future requirements across society and science, feeding into a seemingly endless stream of data to research.

Our research mission has large societal impact!


SKAO


Genomics


Smart City

# Long-term IT challenges ...

## MAIN FOCUS

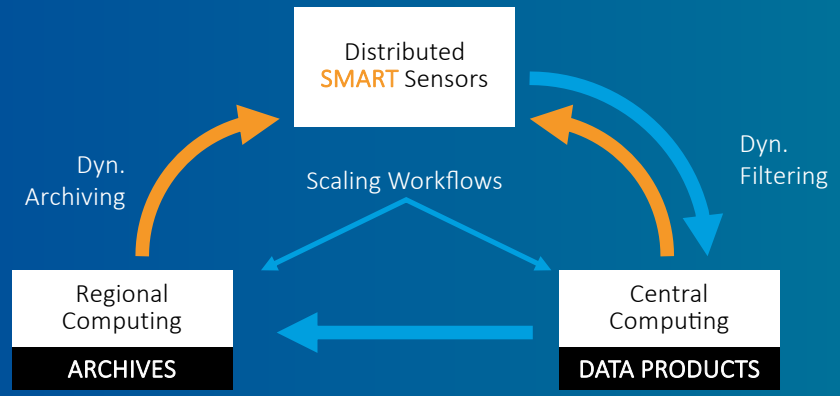
- Strategies for managing big data
- Data from all over the world
- Innovative methods of artificial intelligence
- Green computing

**Cooperation with high-performance institutes and companies regionally and worldwide**

- ZIH at TU Dresden, Computer Science at HS Zittau/Görlitz, CASUS, Fraunhofer IPMS Dresden, IBM Germany, Hewlett Packard Labs, Atos, GlobalFoundries, spin-offs and start-ups in the vicinity of the DZA

**We start computing research immediately at the TU Dresden**

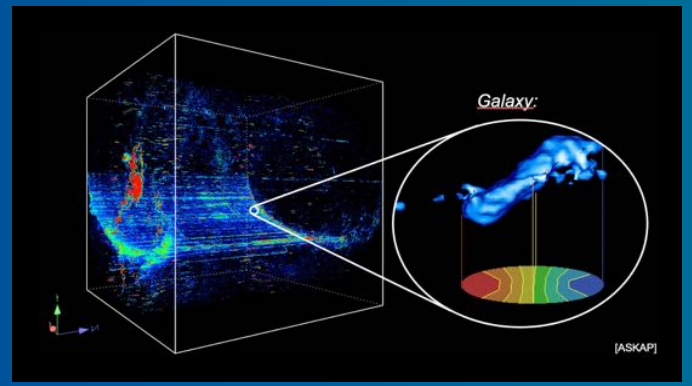
## ... DRIVEN BY ASTRONOMY




## HUGE DATA OBJECTS

SKA: up to ~ 1 petabyte / 3D cube

Genomics/biomedicine: complex long time series



# Partnership with applied research and industry

## ON THE PATH TO INTELLIGENT SENSOR TECHNOLOGY

- Technology development for astronomy and astrophysics
  → unique selling points of the DZA
- Construction and operation of scientific systems for astrophysics

## IN COOPERATION AND WITH DIVERSE INDUSTRIAL APPLICATION

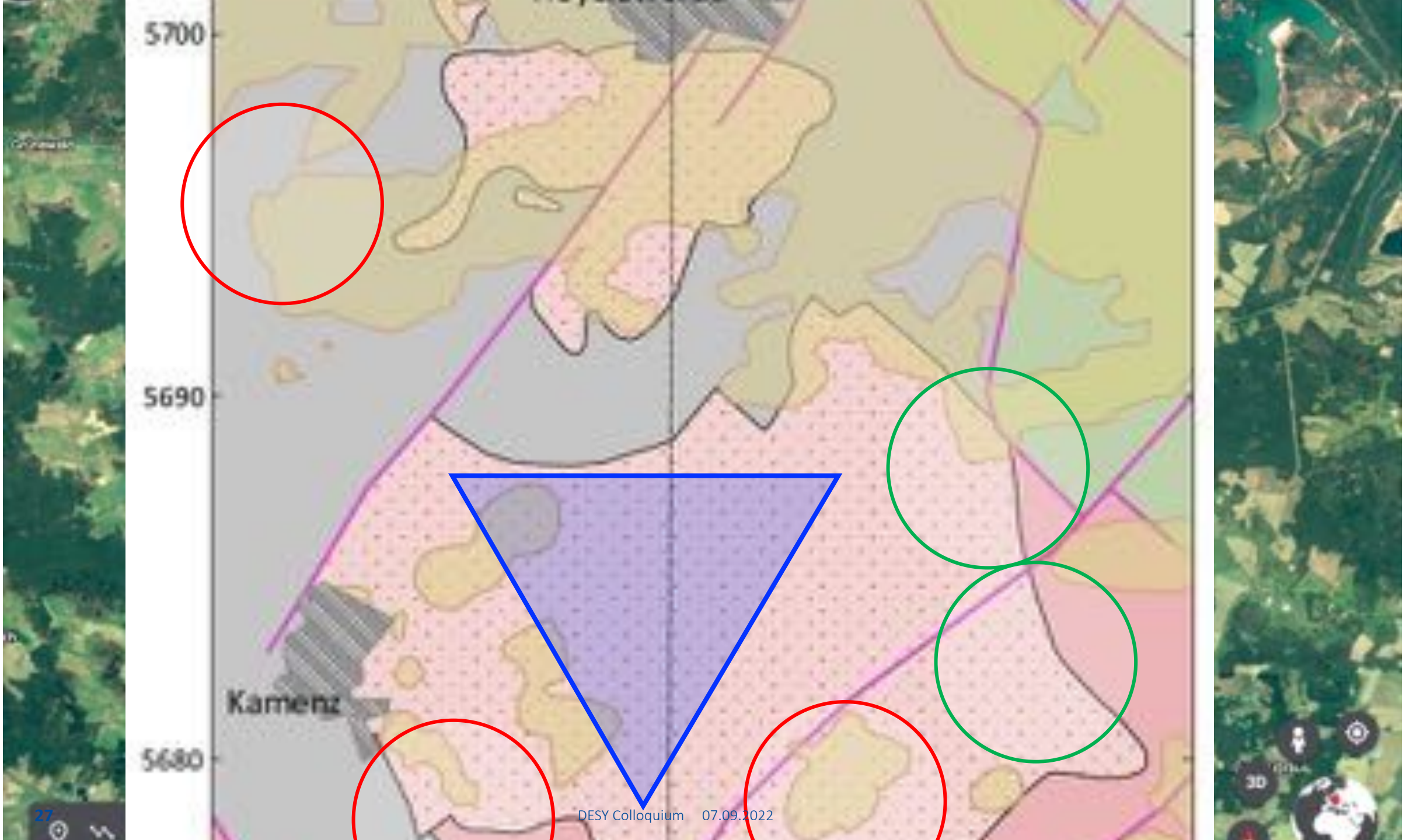
- Technical development and production of prototypes/small series in cooperation with industry
- Further development of technologies for industrial applications
- Provision of DCA technology and know-how for industry


**Technology development at an early stage with partners**

# 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*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Bundesministerium für Bildung und Forschung
Probebohrung
DZA
Probowe

# Research in the treasure of Lusatia



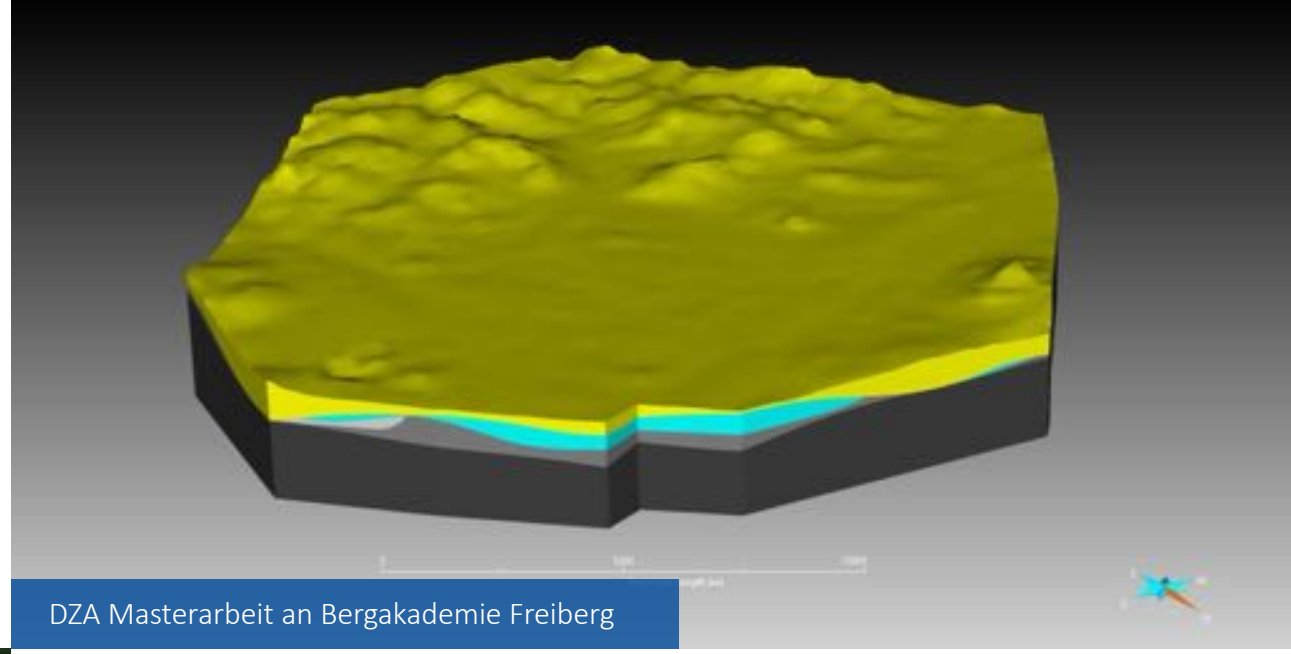





# 250 m depth

Two steps

- Core drilling until the depth of 250m
- Widening of the borehole
- Large interest on results outside physics



DZA Masterarbeit an Bergakademie Freiberg

Drill cores

A unique monolithic and smooth granite block with an extension of at least 20 km with a homogeneous damping and seismic isolation layer!

# Drill cores

Drill cores with a strong quartz content

Drill cores with basalt

# Measurements in the Treasure of Lusatia

Seismometer on the surface

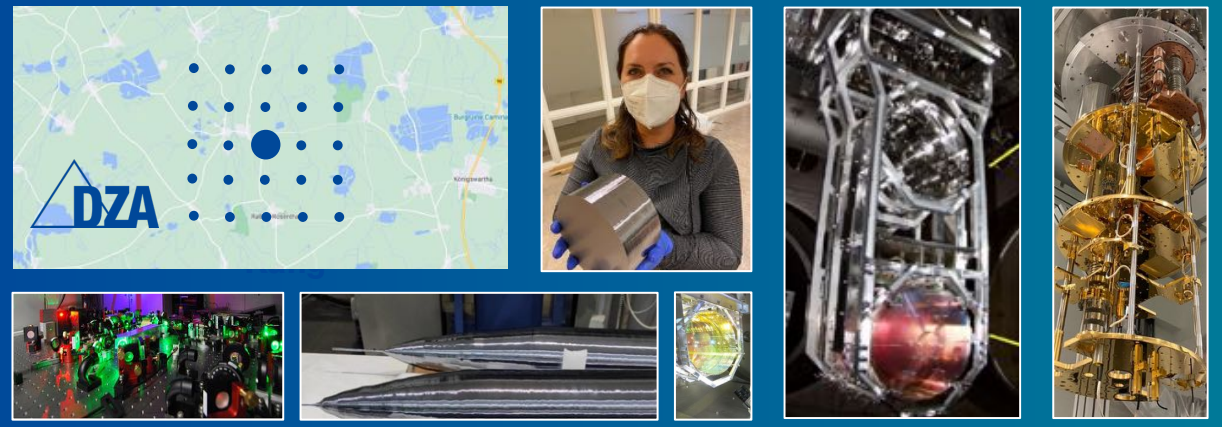
Test drilling in Cunnewitz

# 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


NIKHEF, NL

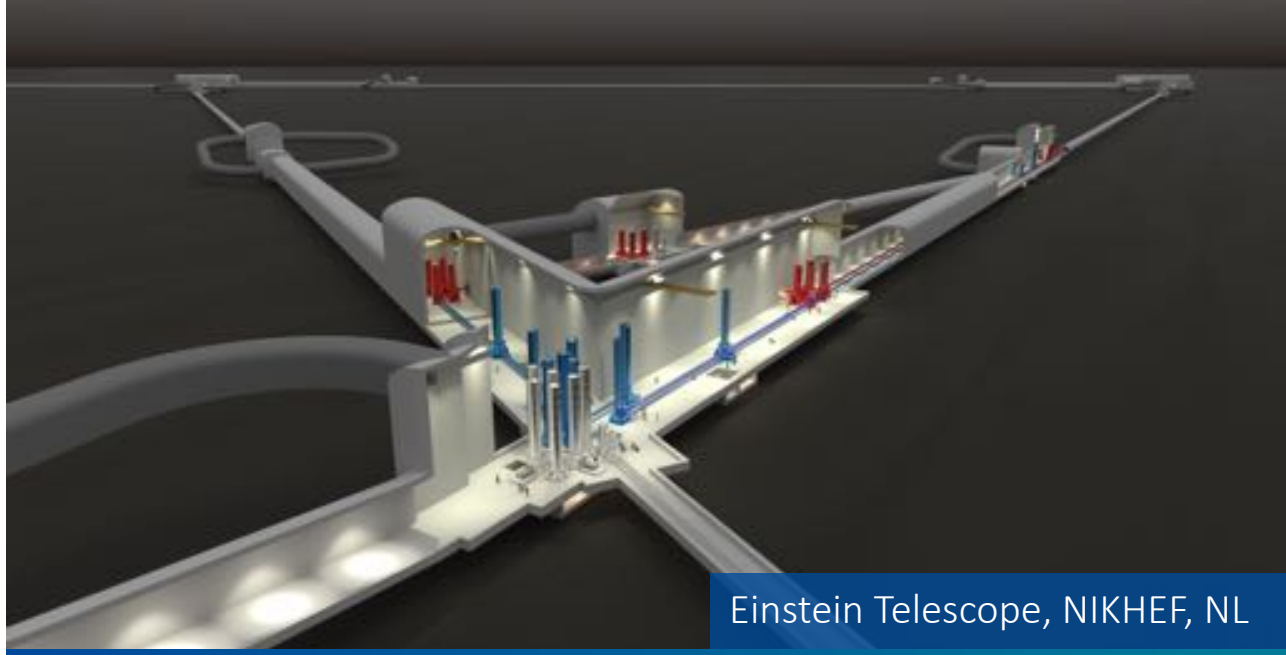
# The role of the DZA in the Einstein Telescope

## THREE POSSIBILITIES:

1. **No ET**
   The DZA will participate in other international projects with the Low Seismic Lab (e.g. Cosmic Explorer, Advanced LIGO etc.).

2. **ET in Sardinia or Holland**
   With the Low Seismic Lab, the DZA will make essential contributions to the reduction of seismic noise, among other things.

3. **ET in Lusatia**
   A potentially excellent scientific solution. Strengthening the lighthouse character for the region. Political support for financing is necessary.



Einstein Telescope, NIKHEF, NL

## A EUROPEAN PROJECT

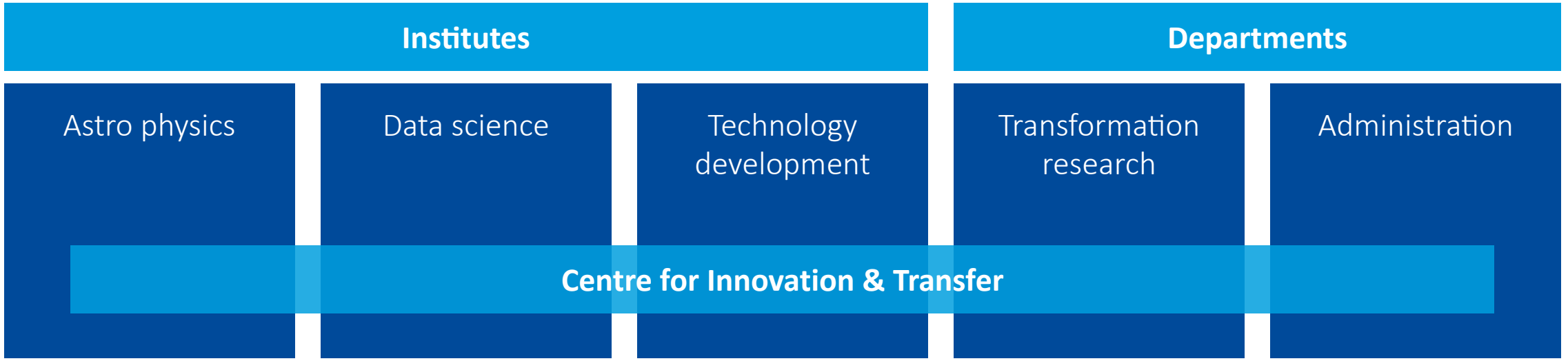
- Construction costs:
  - First phase € 1.2 billion
  - Full scope 1.7 bn €
- Construction time: 8 years
- Lifetime: 50 years
- Location decision: 2025

# Making knowledge work.

*"Our innovation ecosystem thrives on fast and intensive exchange between science, business and society. This requires more excellent networks that connect all relevant partners in a region."*

*Federal Minister Bettina Stark-Watzinger, BMBF*

# The Structure of the DZA




**The Centre for Innovation & Transfer - the innovation engine**

- Technology screening
- Promotion of spin-offs and start-ups
- Open Science & Transfer Policy
- Funding, project, network, IP and knowledge management

# Structural change through networking

- Diversity with a broad spectrum.
- From small engineering firms to the largest chip manufacturer in Dresden.
- More than 80% of the companies are SMEs.


# Knowledge. Creates. Perspectives.

*"It is a fascinating idea for our students to get an attractive perspective for the future with the Low Seismic Lab of the DZA in such close proximity to our school. We wish the DZA every success and look forward to many more visits and projects about astronomy and our role in the world."*

*Milenka Kober, Headmistress, Sorbian Secondary School Ralbitz*

# Jobs at the DZA

**1000** positions at the DZA

**35%** scientific professions

**65%** of posts in the non-scientific area

**3** Job multiplication factor

# From day care to professor: All things education

- Fostering enthusiasm in young people about STEM topics at an early stage.
- Cooperation with day care centers, schools, vocational schools and universities.
- Student laboratories, competitions, lectures, internships, training days in our workshops and labs.
- Training opportunities for educators.
- Vocational training. Dual track education.
- Practical training for industry partners.
- Joint professorships. New master courses.
- Exchange programs for students and professors from all over Germany and worldwide at the DZA.

**We convey enthusiasm from an early age on and increase the attractiveness of the region!**

# Shaping the future together

KulturFabrik Hoyerswerda


Station Weißwasser

Stadthalle Bautzen


Rathaus Görlitz


Synagoge Görlitz

# Shaping the future together

Cunnewitz, Gemeinde Ralbitz-Rosenthal

# We are ready to go

*"Your concept proposal impressively demonstrates that your proposal is a valuable addition to Germany's scientific landscape"*

*Prof. Otmar Wiestler, President of the Helmholtz Association*

# A-Z – vom Antrag zum Zentrum

## FOUNDING PARTNER

TECHNISCHE UNIVERSITÄT DRESDEN

MAX PLANCK GESELLSCHAFT

HELMHOLTZ SPITZENFORSCHUNG FÜR GROSSE HERAUSFORDERUNGEN

Leibniz Gemeinschaft

Uniwersytet Wrocławski

Fraunhofer

ET EINSTEIN TELESCOPE

## SUPPORTER NETWORK

DESY.

HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

KAT. Komitee für Astro. Teilchen. Physik

R D S

VdR

IBM

OHB DIGITAL

b-tu

SKAO

Stadt Görlitz

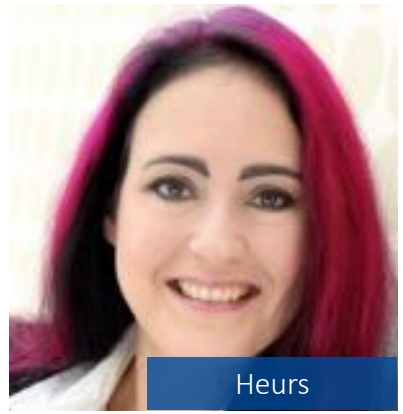
futureSAX Ideen Transfer Innovation

LRT SACHSEN/THÜRINGEN

SILICON SAXONY THE HIGH-TECH NETWORK

DOMOWINA


Hasinger


Heurs


Steinmetz


Nagel


Kramer


Hessling


Henjes-Kunst


Stegmann


Wagner

# Many have participated - thank you

# The DZA and DESY

## A partnership for astroparticle physics and research in eastern Germany

- Astroparticle physics is a growing research field - not only at DESY - with many exciting initiatives.
- The DZA is a unique opportunity to strengthen both astronomy and astroparticle physics in Germany.
- The DZA can organise Germany's institutional participation in the Einstein Telescope (and other large international astronomical projects).
- It is particularly well placed to address the challenges in the development of new detector technologies and especially in the field of digitisation.
- A large astrophysical centre in Saxony is an essential step for the further development of the science region in eastern Germany, in the centre of Europe.
- DESY is a strong partner in the initiative and will also be so in the implementation and operation of the DZA.

- I would like to thank everyone at DESY who has worked so hard over the last few months - especially Katharina for her work as project leader in the DZA concept phase.
- Please keep your fingers crossed. The decision is expected at the end of September.