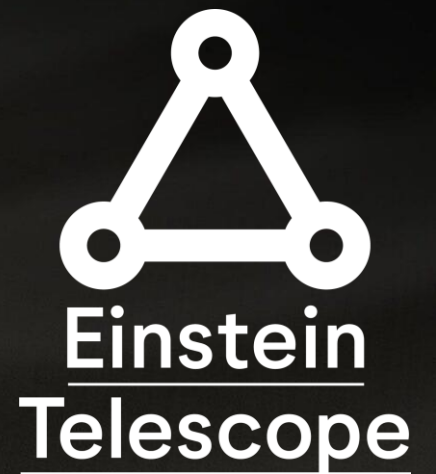




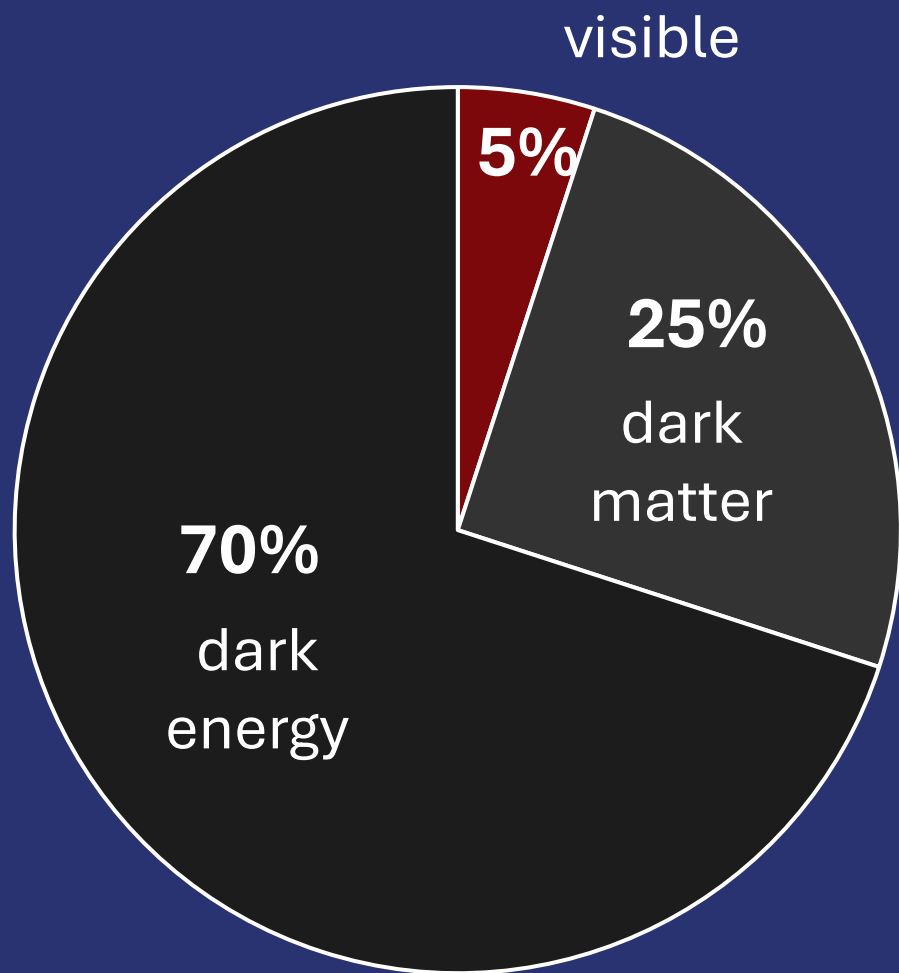
The Einstein Telescope

Europe's 3rd generation gravitational wave detector

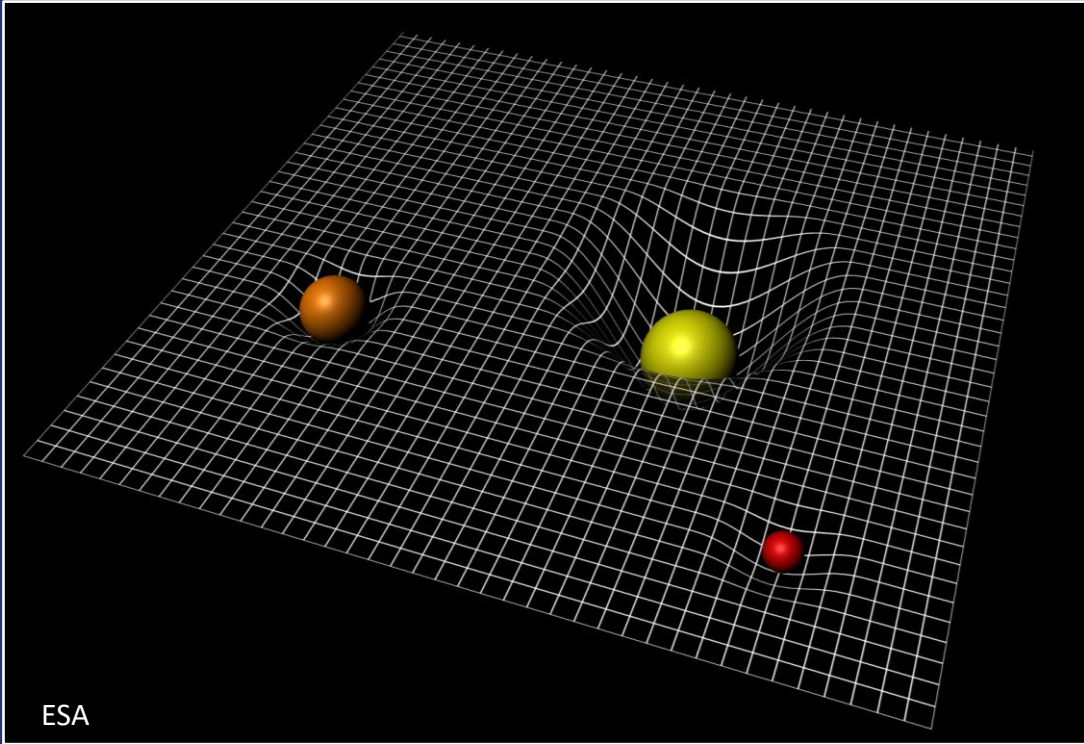
Gerjan van de Walle
ET-Flanders



Discovering the universe

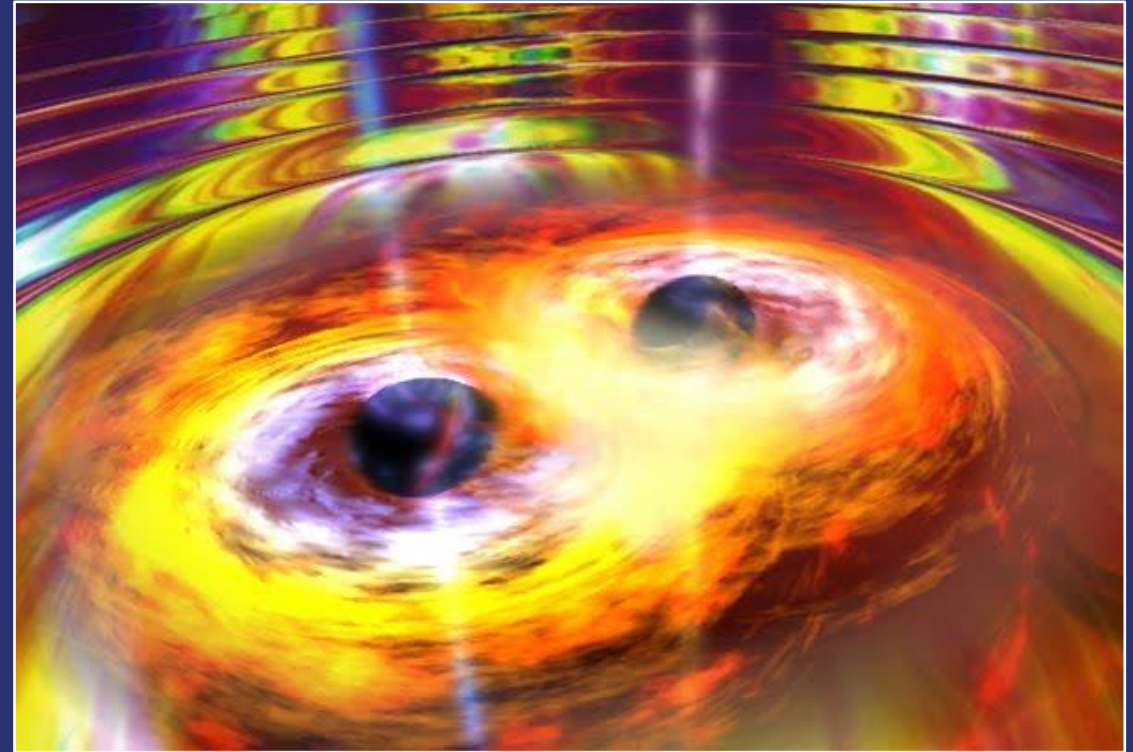


Einstein: space and time are 'flexible'



Mass deforms the spacetime fabric and
spacetime dictates the movement of mass

➤ **gravity**

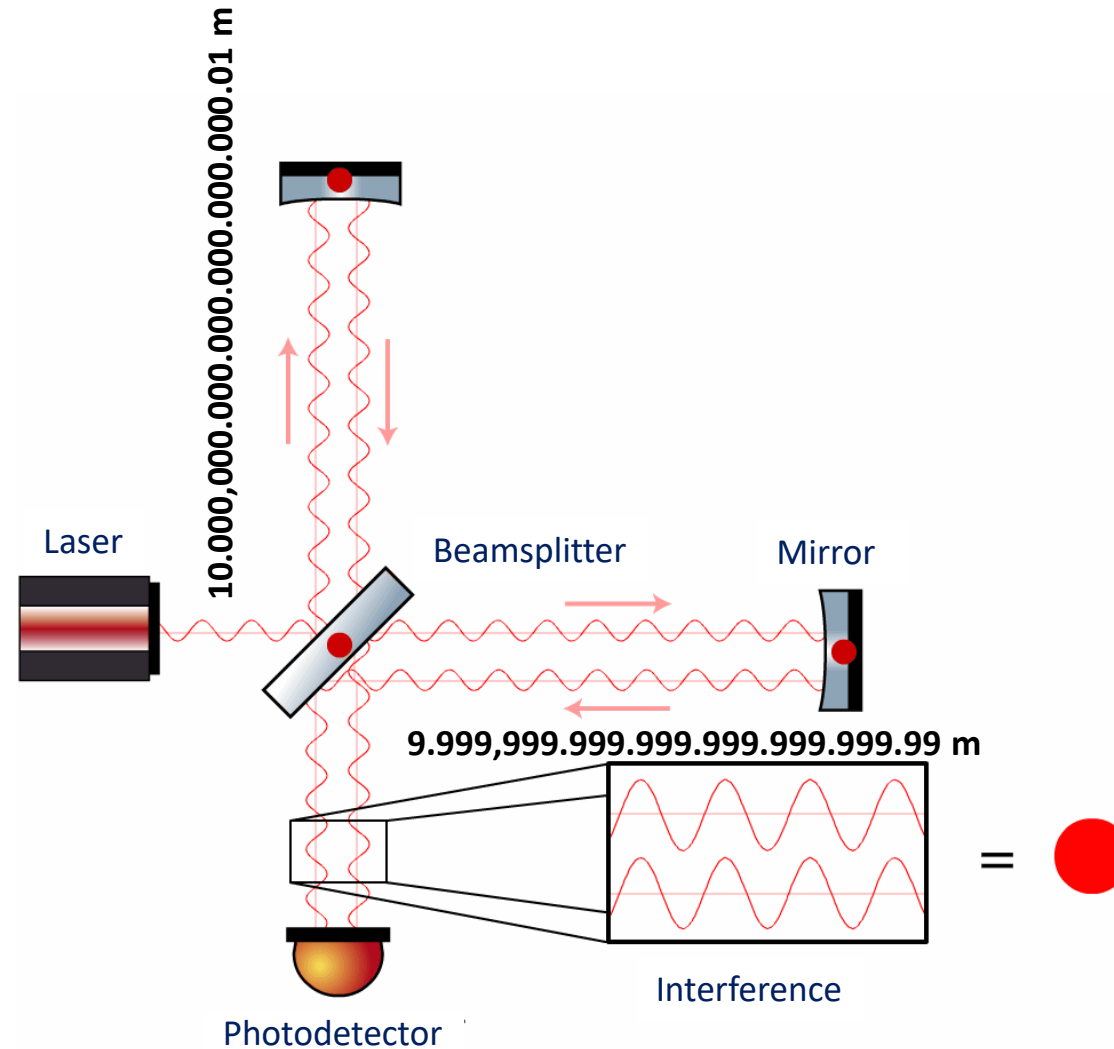


Accelerating masses generate ripples in
spacetime which travel through space

➤ **gravitational waves**

Detecting gravitational waves

laser
interferometer



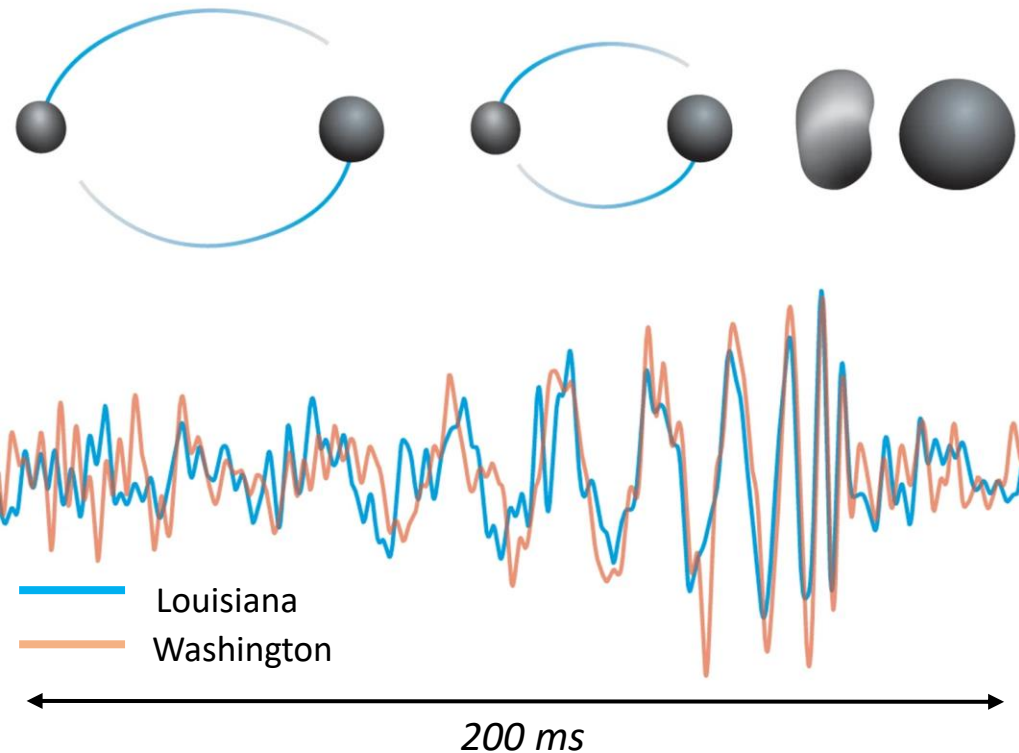
required sensitivity
 10^{-21} m/m



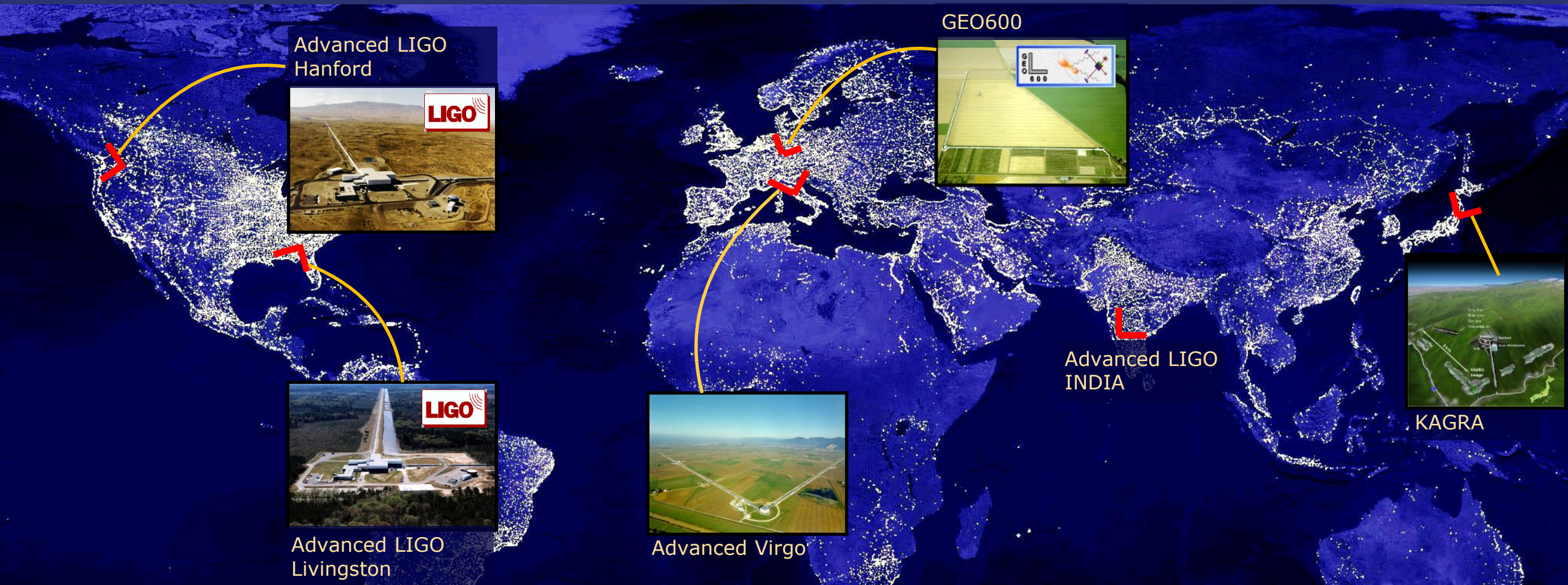
First evidence of gravitational waves

14 September 2015

Merger of two black holes



Today: multiple detectors



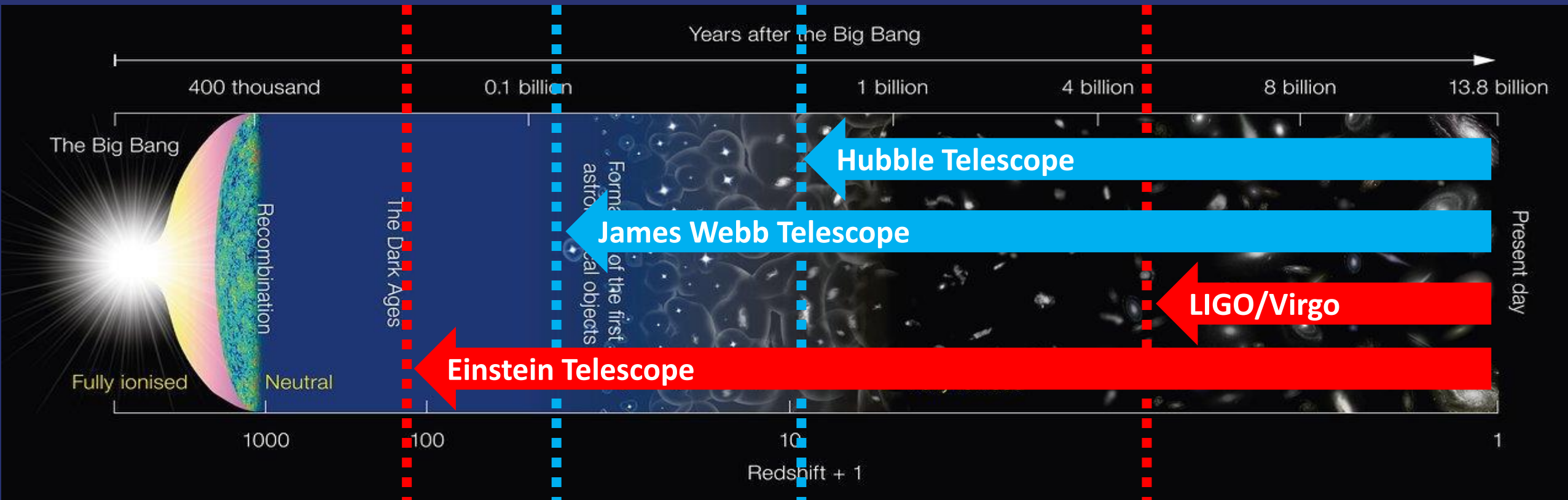
Appr. 3 events/week

Appr. 300 events YTD

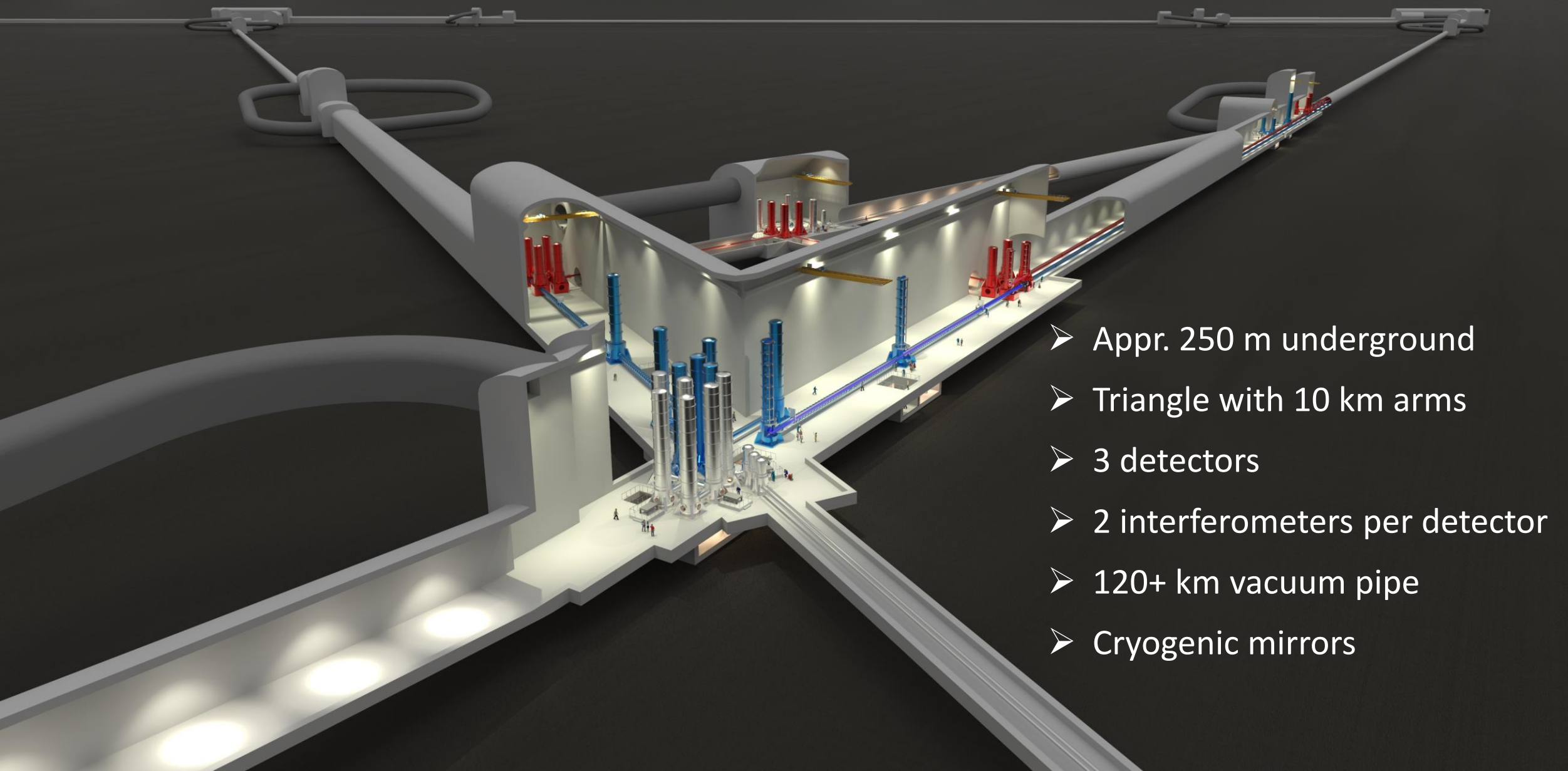


European Research Infrastructure roadmap: Einstein Telescope: 3rd generation detector

- 10x more sensitive
- 1000x more observations



From 2nd to 3rd generation detector



- Appr. 250 m underground
- Triangle with 10 km arms
- 3 detectors
- 2 interferometers per detector
- 120+ km vacuum pipe
- Cryogenic mirrors

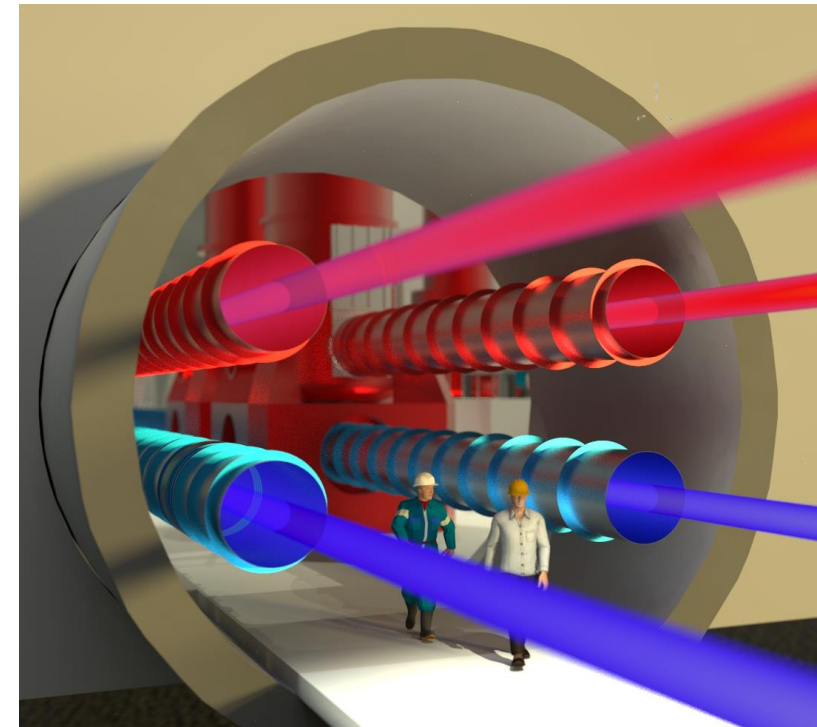
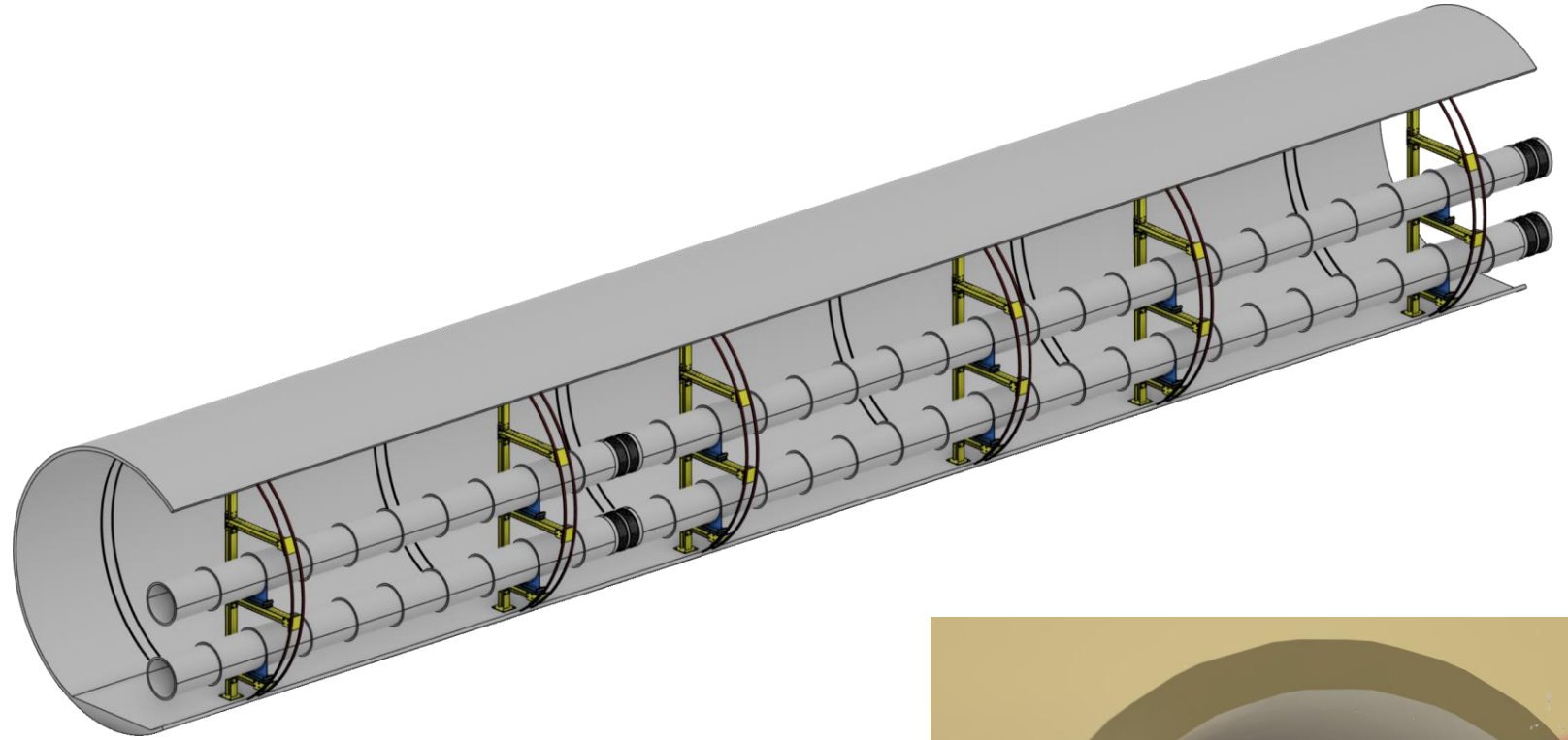
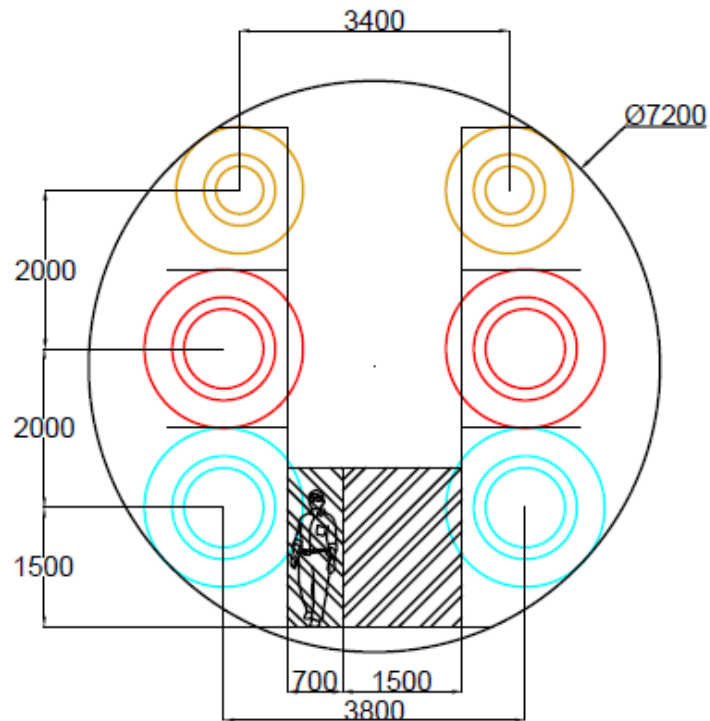
Caverns

- 11 caverns per corner point
- Height up to 30 m
- Width typically 20 m
- Largest cavern 200 m
- 129 suspension towers
- ~26.000 m² cleanroom



Tunnels

- 30 km tunnel
- 120 km vacuum pipe



Innovation challenges

Instrumental Technologies

Precision
mechatronics

Vacuum
technology

Cryogenics

Optics &
lasers

Sensors &
actuators

Data analysis

Engineering Technologies

Tunneling
techniques

HVAC &
clean rooms

Robotic
assembly

Digital twins

Noise
reduction

Safety &
remote monitoring

Sustainability

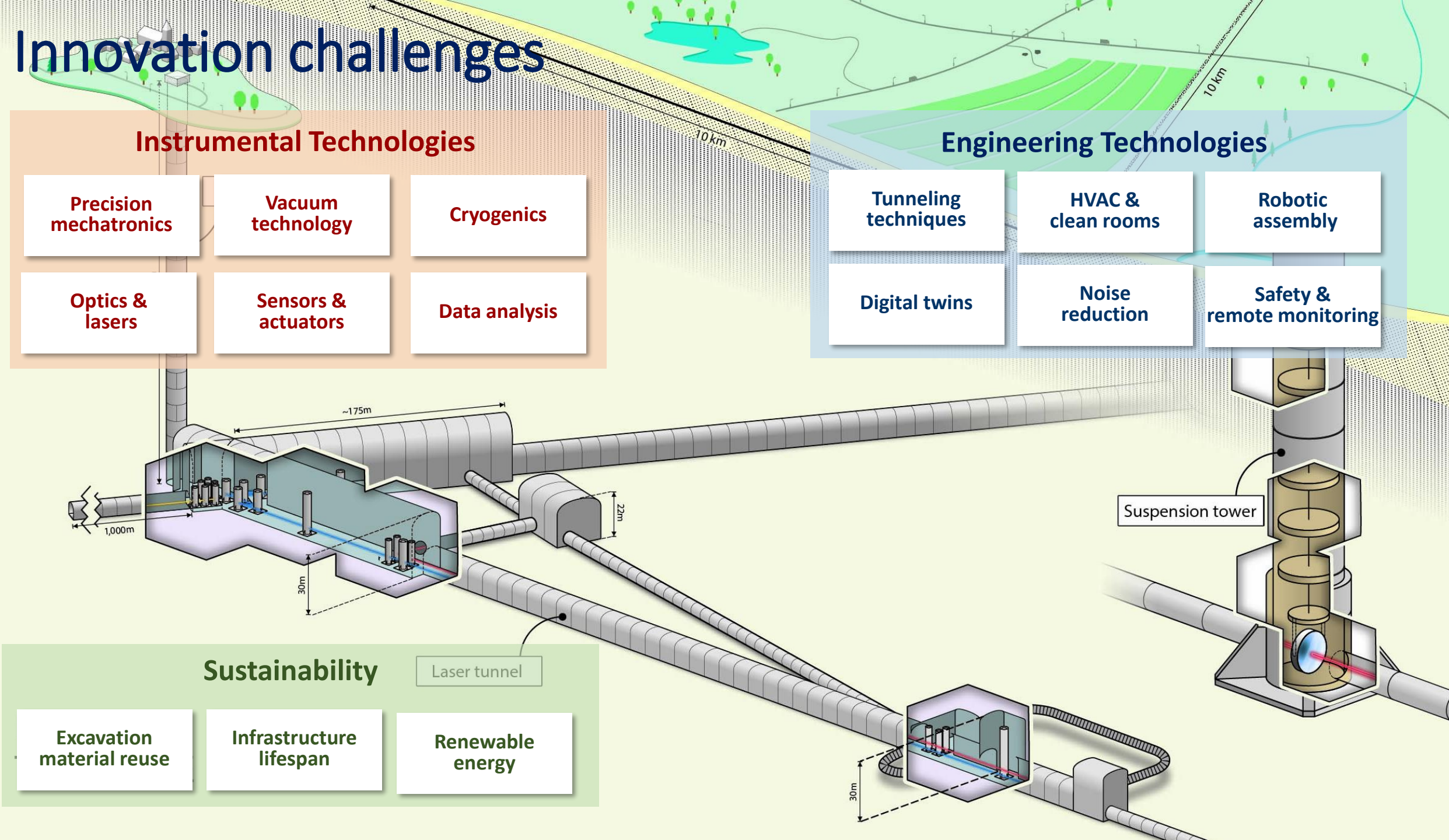
Excavation
material reuse

Infrastructure
lifespan

Renewable
energy

Laser tunnel

Suspension tower



NL/B/D candidacy Euregion Meuse – Rhein (EMR)

- **Favourable underground**
 - Geology & civil engineering study
- **Rural and attractive living area**
 - Education, culture and employment
- **Suitable logistic infrastructure**
 - Extensive railway network
- **High tech ecosystem**
 - Academia and universities
 - R&D projects with industry



Feasibility studies

- Drilling and seismic campaigns
- Geology
- Geomechanics
- Geohydrology



Einstein Telescope ecosystem Euregio Meuse Rhein

400+

Companies and
knowledge
institutes in
ecosystem

80+

Companies and
knowledge
institutes involved
in R&D

27

R&D projects

30M€

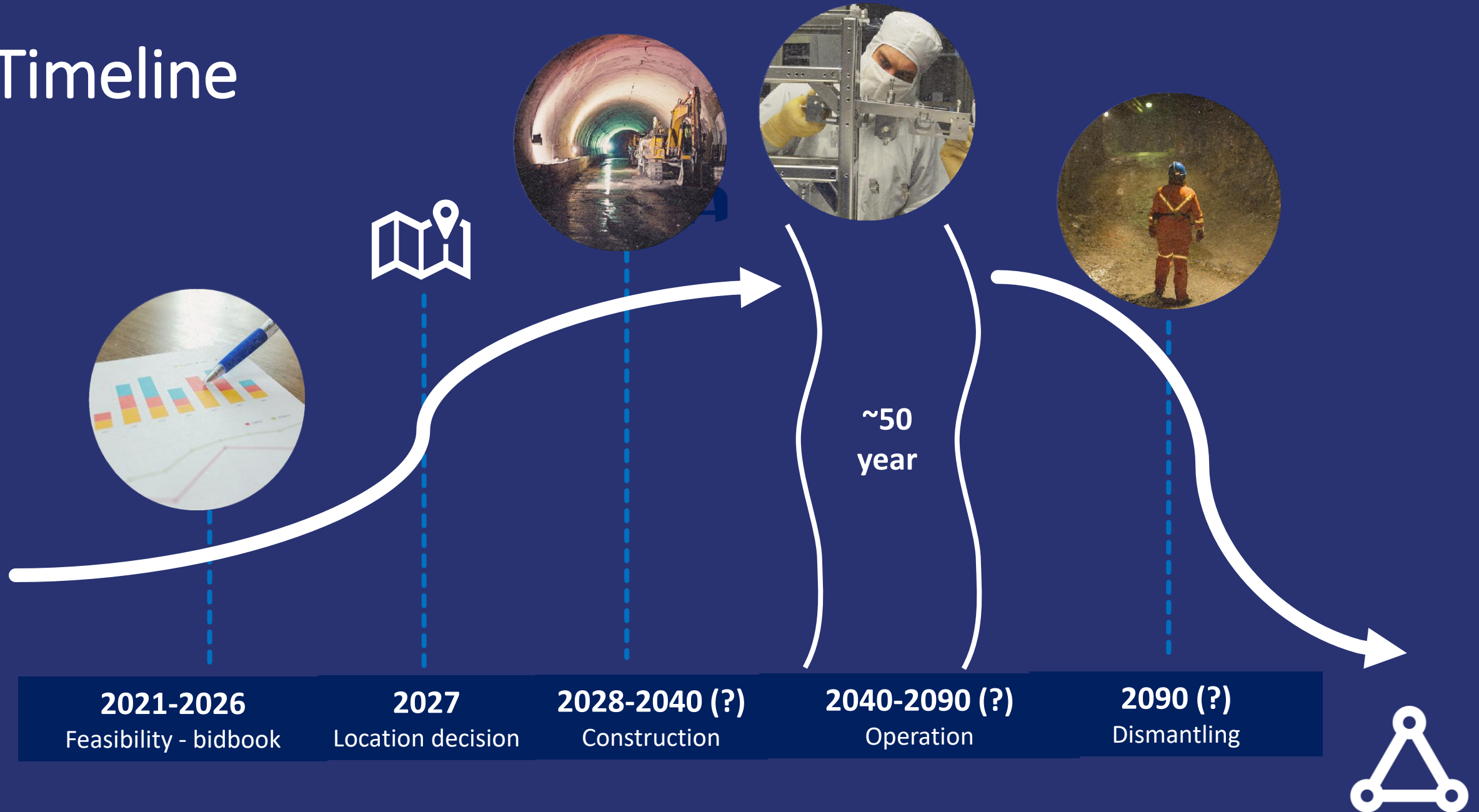
Investment

20M€

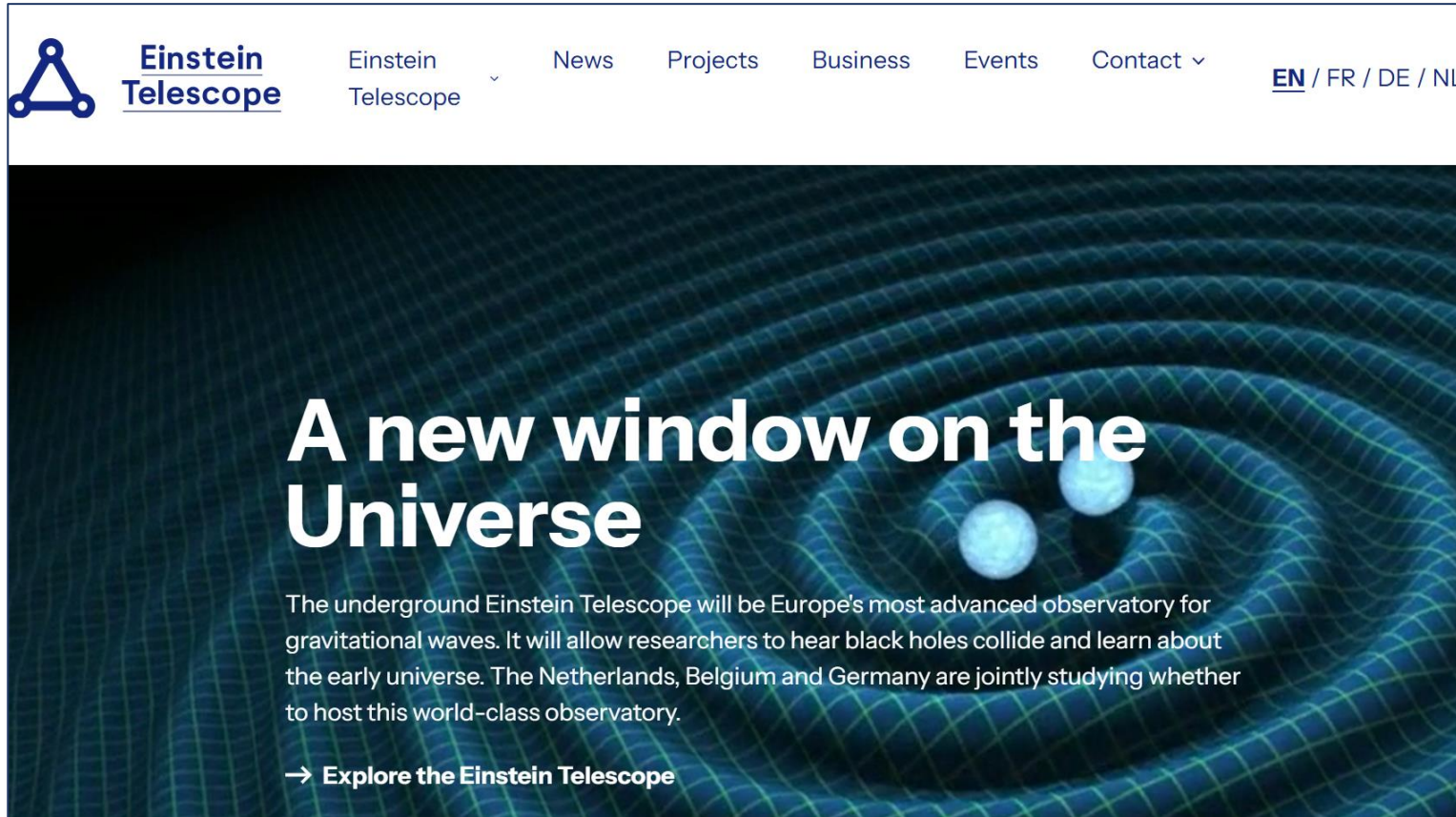
funding

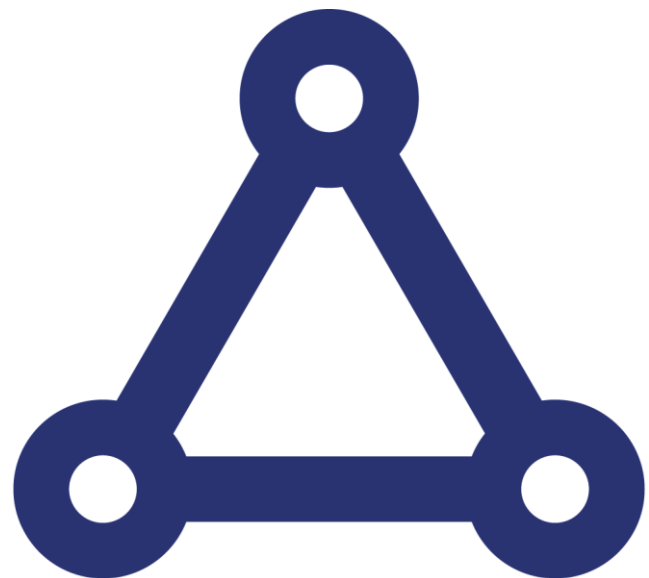


Timeline



Stay informed: Einstein Telescope newsletter





Einstein
Telescope