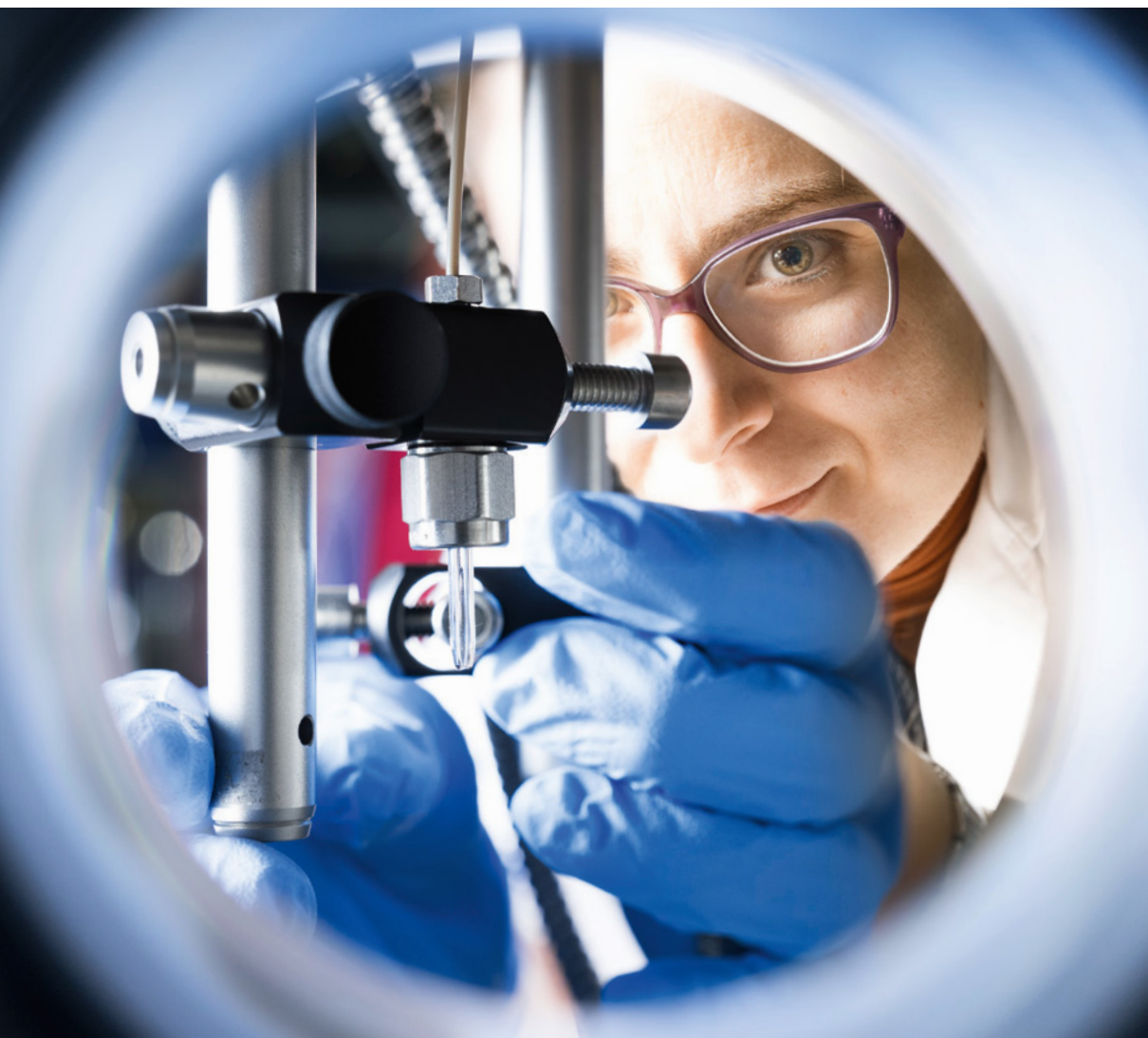


Enlightening Science

European
XFEL



European XFEL – the world's largest X-ray laser

European XFEL is a research facility of superlatives. Located near Hamburg, it delivers 27 000 X-ray flashes per second with a brilliance a billion times higher than the best conventional X-ray sources. With a total length of 3.4 kilometers and currently seven experiment stations it is the world's largest X-ray laser.



The X-ray free-electron laser (XFEL) is located underground. A 1.7km-long particle accelerator brings electrons to the high energies necessary for producing the X-rays. Construction was a joint effort by many partners.

Periodic arrangements of magnets called undulators force electrons on a slalom course. In the process, they emit X-ray radiation that amplifies more and more.

Our partners

Twelve partner countries were involved in constructing and now operate the European XFEL. At present, European XFEL's partner countries are Denmark, France, Germany, Hungary, Italy, Poland, Russia, Slovakia, Spain, Sweden, Switzerland and the United Kingdom. The research facility employs more than 550 people, from over 60 countries.

European XFEL cooperates closely with the research centre DESY and other organisations worldwide.

The construction costs of the European XFEL amounted to 1.54 billion Euro with Germany (the federal government, the city state of Hamburg, and the state of Schleswig-Holstein) contributing the largest fraction of the costs. To a great extent, the facility was realised by means of in-kind contributions by shareholders and partners.



Our research

Environment and sustainability

Society can only be sustainable by preserving natural environments. The subjects of our environmental research range from sustainable agriculture through natural pesticides to understanding Earth processes that are relevant to earthquakes or new ways of purifying water.



Climate and energy

Climate change is caused by the release of greenhouse gases, many of which come from burning fossil fuels for electricity generation and transport. Our research contributes to optimizing renewable energy sources, e.g. catalysts for producing hydrogen from water using sunlight.



Digitalization

Digital technologies play a crucial role in ensuring that Europe remains at the forefront of technological development. However, computer chips are reaching limits of size and speed. Our research into magnetic materials helps develop smaller and more energy-efficient data storage media.



Health

Viruses transferred from animals, antibiotic-resistant bacteria, lifestyle, and ageing all impact our health and wellbeing. Our research observes the molecular mechanisms of disease and how potential drug molecules bind to biomolecules involved in disease.



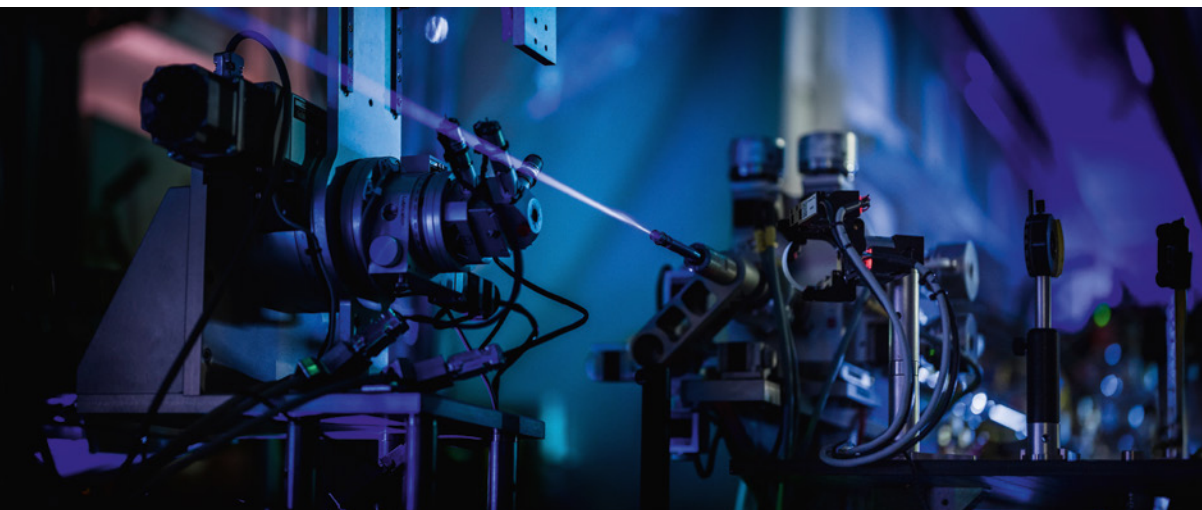
Fundamental research

Investigating fundamental scientific questions not only satisfies human curiosity, but also enables applied research. For example, our research on gases can help with atmospheric modelling, but can also tell us how molecules function in unprecedented detail.



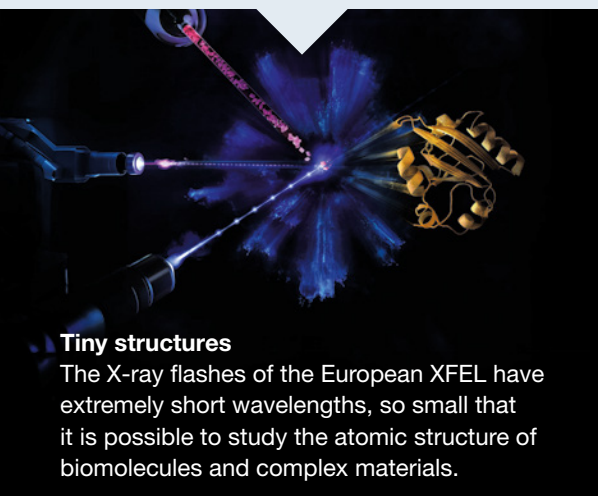
The X-ray flashes

X-rays are invisible - but this image shows the European XFEL beam. How is this possible? What we see in the picture are glowing nitrogen molecules that are excited to glow by the high-intensity X-ray beam. Although the intensity of the beam is very high, the glow is very weak, and this image was taken in complete darkness with an exposure time of 90 seconds. The beam seen in the image is made up of 800 pulses per second.



Extremely short pulses

The European XFEL's X-ray light has a wavelength between one hundred and one thousand times shorter than that of visible light. The pulses are very short, less than 25 femtoseconds. A femtosecond is to 10 seconds roughly what 10 seconds is to the lifetime of the universe, 13.7 billion years. The X-ray laser delivers 27 000 pulses per second and enables investigations into hereto unexplored scientific areas.



Tiny structures

The X-ray flashes of the European XFEL have extremely short wavelengths, so small that it is possible to study the atomic structure of biomolecules and complex materials.



Ultrafast processes

The X-ray flashes are so short that scientists can film extremely fast processes, opening up new research avenues in health, energy, climate change or magnetic data storage.

Facts and figures

About our facility

3.4 kilometres

Total length

6 – 38 metres

Depth of tunnels, varying due to the surface structure

17.5 billion electron volts (GeV)

Energy of the electrons at the end of the linear accelerator (1.7 kilometres)

99.99999996 % speed of light

Speed at which these electrons move

About our X-rays

27 000 flashes per second

0.05 – 4.7 nanometres (1 nanometre = 0.000001 mm)

Wavelengths

A few femtoseconds (1 fs is 0.000000000000001 or 10^{-15} seconds)

Duration of the flashes

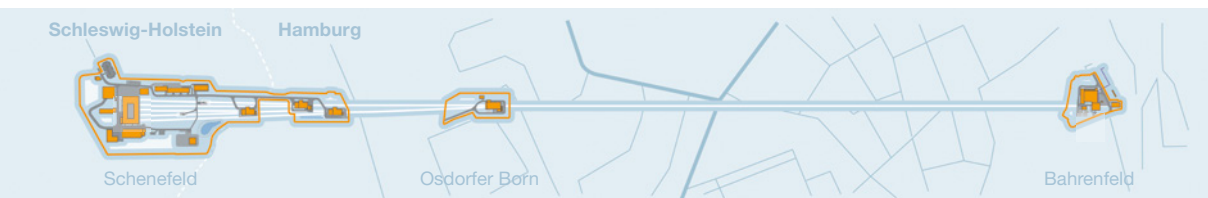


Opportunities at European XFEL

The European XFEL attracts scientists, engineers and technical staff from all over the world and from a wide range of disciplines. The facility will generate knowledge in technical and scientific disciplines that will shape our lives. Almost half of our staff come from abroad. English is the working language of the company.

European XFEL campus

The X-ray laser and the scientific instruments are located underground in tunnels and in the experiment hall. The 3.4-kilometre-long facility runs from the campus of the research centre DESY in Hamburg to the town of Schenefeld in Schleswig-Holstein. The Schenefeld site hosts the research campus, where international teams of scientists carry out experiments with the X-ray flashes. A modern and functionally-equipped guest house provides accommodation directly on campus. European XFEL is also part of the future Science City Hamburg Bahrenfeld.



Headquarters/experiment hall



Guest House



Lighthouse



BeamStop

The company restaurant BeamStop and the campus grounds are also open to the public. Follow the green line for a walking tour of the campus; blue and green plates display information about the buildings and natural landscape. The tour is open daily from 8:00–18:00 (in winter until sunset), please stay on the green line.

Scheduled to open in autumn 2024, the visitor and conference centre Lighthouse will house an interactive exhibition, two school labs and rooms for seminars and events.

More information is available at www.xfel.eu.