

A photograph of the Hollywood sign on a hill in Los Angeles. The sign is made of large white letters and is set against a backdrop of a dry, hilly landscape with sparse vegetation. The sky is clear and blue.

HOLLYWOOD

PHYSICS

Prof Dr Carsten P Welsch, University of Liverpool

Overview



Hollywood
Physics



- Particle accelerators
- Superheroes
- New Technologies
- Antimatter



THE **FLASH**

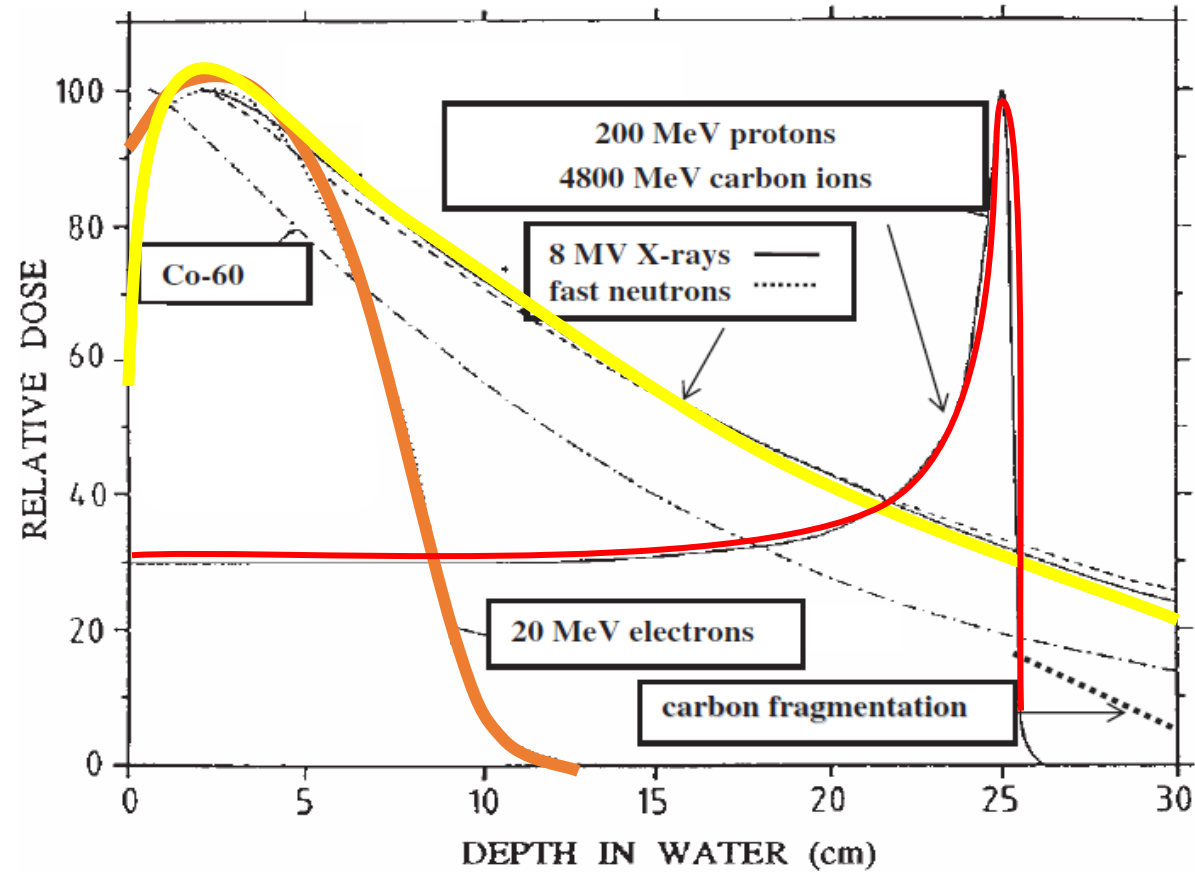




Proton beams

Can help beating cancer sooner

© Thomas Kästenbauer



Ion Beam Therapy

Beating cancer sooner

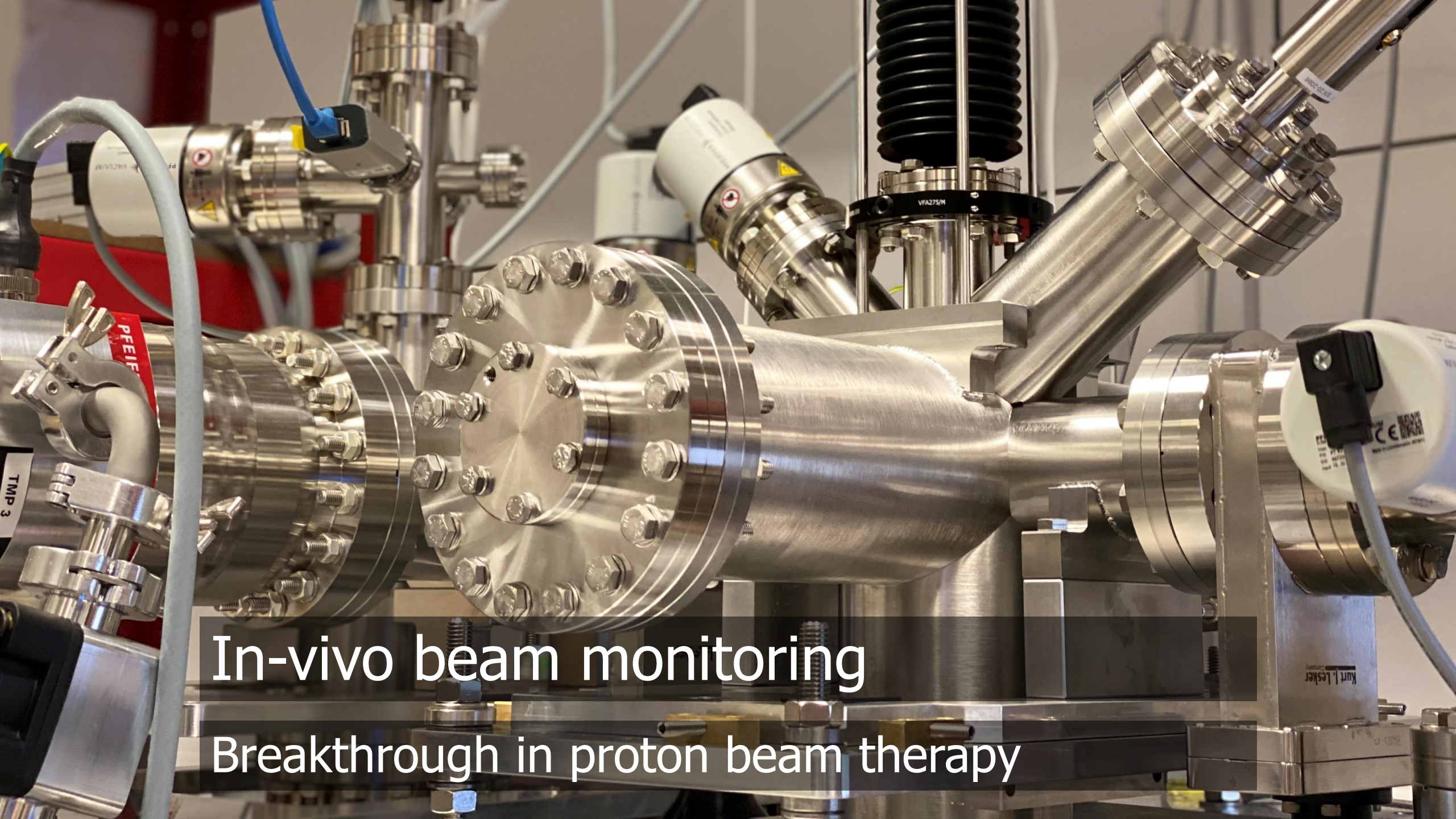




Optimization of Medical Accelerators



Funded by the
European Union



In-vivo beam monitoring

Breakthrough in proton beam therapy







Can we create new elements?

Facility for Antiproton and Ion Research (FAIR)

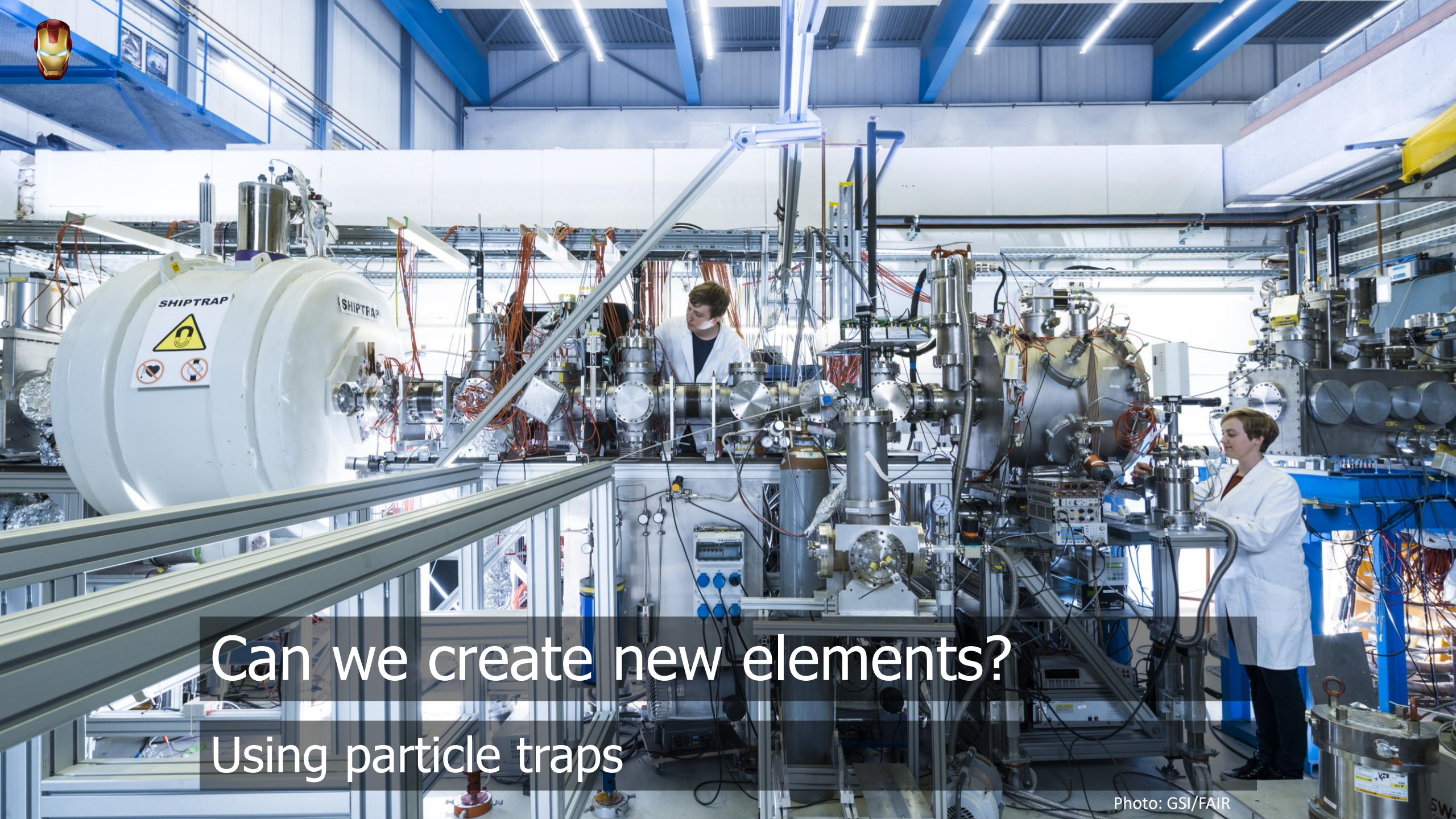
Photo: GSI/FAIR

A female scientist wearing an orange hard hat and safety glasses is working on a large, complex scientific instrument. The instrument has a cylindrical body with various components, including a glowing orange light source and a metallic mesh structure. She is holding a small component of the instrument. The background is a blurred industrial or laboratory setting with various equipment and cables.

Can we create new elements?

Super heavy element R&D

Photo: GSI/FAIR



Can we create new elements?

Using particle traps





How to capture a T-X cyborg?

High field magnets



Particle Detector

Search for new particles and new physics



Grid computing

The world connects to understand new physics

Photo: CERN



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Science and
Technology
Facilities Council



UNIVERSITY OF
LIVERPOOL



The Science of **STRANGER THINGS**



A promotional image for the TV show Stranger Things. It features the main cast of seven teenagers walking at night in front of a building. From left to right: a boy in a red and white striped polo shirt and blue shorts; a boy in a grey tank top; a girl in a colorful patterned shirt and blue jeans; a boy in a green shirt; a girl in a white t-shirt and yellow shorts; a boy in a grey t-shirt and dark pants; and a girl in a purple dress. The scene is lit with warm yellow light from the building and a strong red light from above. A red sign with the word 'EMERGENCY' is visible in the top right corner.

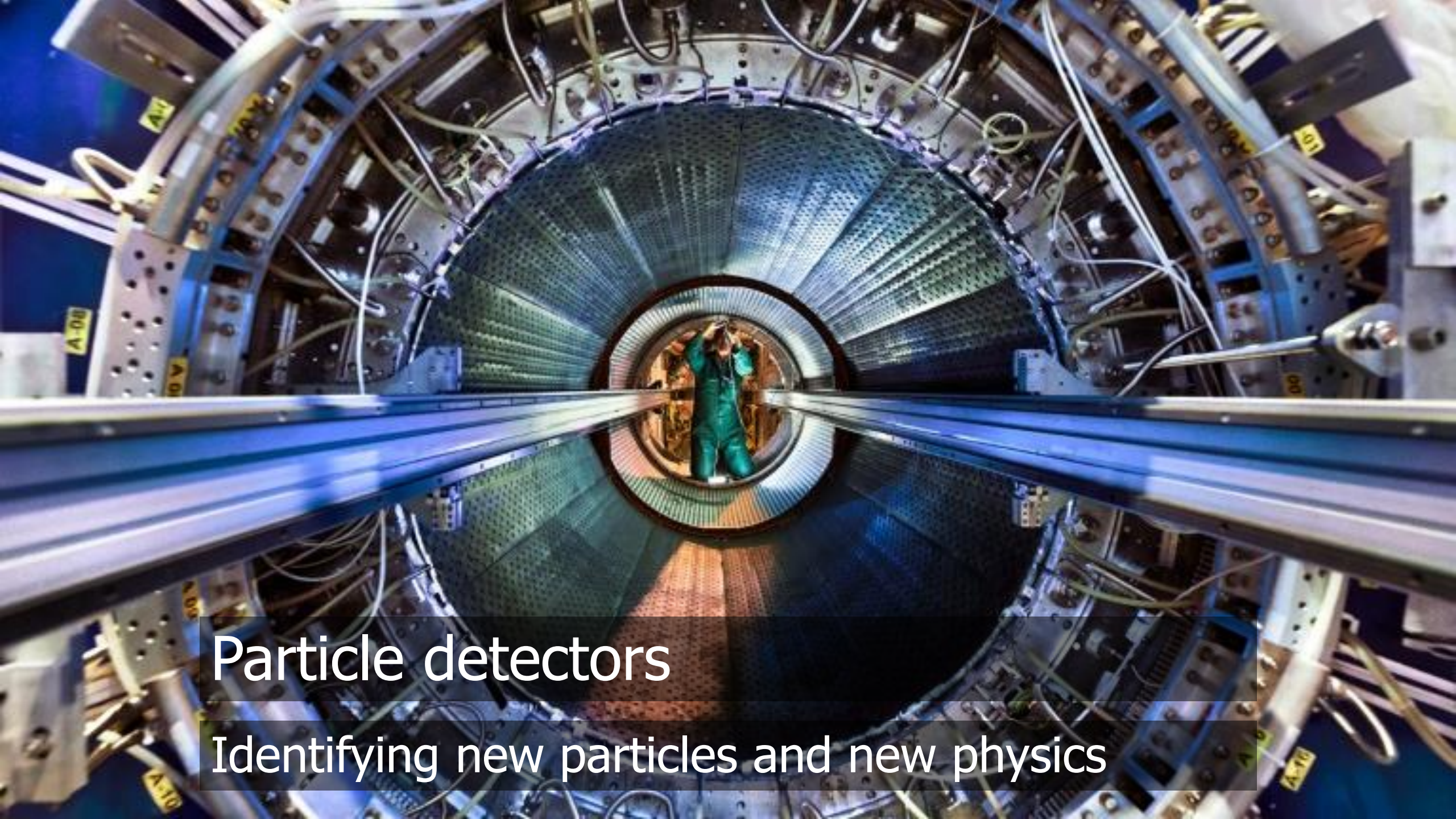
Stranger Things

Set in 1980s Hawkins, Indiana



Parallel dimensions

Opening a portal to other worlds

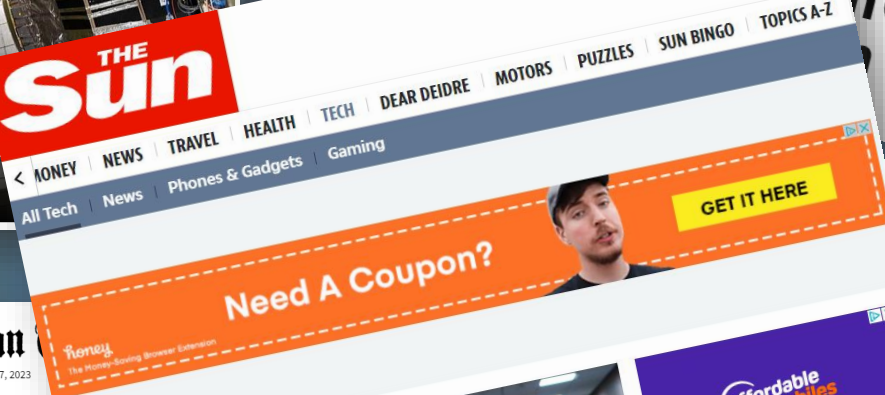


Particle detectors

Identifying new particles and new physics



THE Sun



Tech
STRANGER DANGER CERN's July 5 experiment linked to Stranger Things and 'upside down' by conspiracy theorists

Tyler Baum

Published: 17:19, 4 Jul 2022 | Updated: 0:15, 5 Jul 2022

Entertainment

ENTERTAINMENT

'Stranger Things'

Sign in

UK Edition

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NEW YORK POST

MAY 17, 2023



'Things' fans make wacky claim
Large Hadron Collider is portal to the

July 6, 2022 | 5:50pm | Updated



Coming to a ground near you Courtesy Wikicommons

The Large Hadron Collider is apparently opening a portal to hell

Swallow me, hole

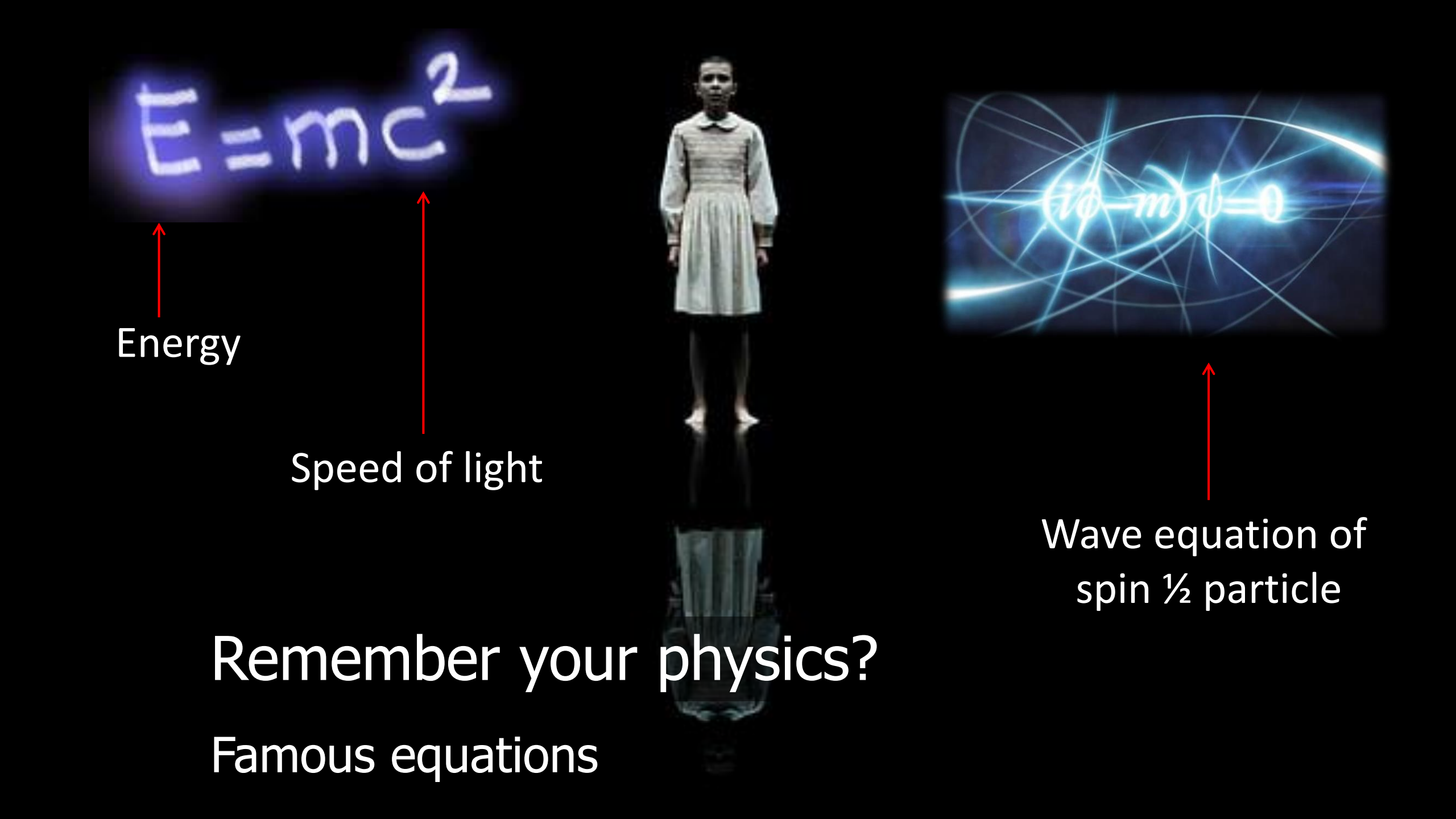
Global no

Opening a portal to other worlds

A young girl with dark hair, wearing a white hospital gown with a small black floral pattern, is shown from the chest up. She is wearing a head-mounted EEG cap with several white and red electrodes and wires. She has a serious, focused expression and is looking directly at the camera. Her hands are resting on a light-colored surface in front of her. To her right, a red Coca-Cola can is partially visible. The background is a wall of grey rectangular tiles.

Telekinesis

Unknown forces?


$$E=mc^2$$

Energy

Speed of light

$$(i\hbar \nabla - m)\psi = 0$$

Wave equation of
spin $\frac{1}{2}$ particle

Remember your physics?

Famous equations



ACCELERATORS VALIDATING ANTIMATTER PHYSICS

Dr Lee De
Liverpool
UK



Funded by the
European Union

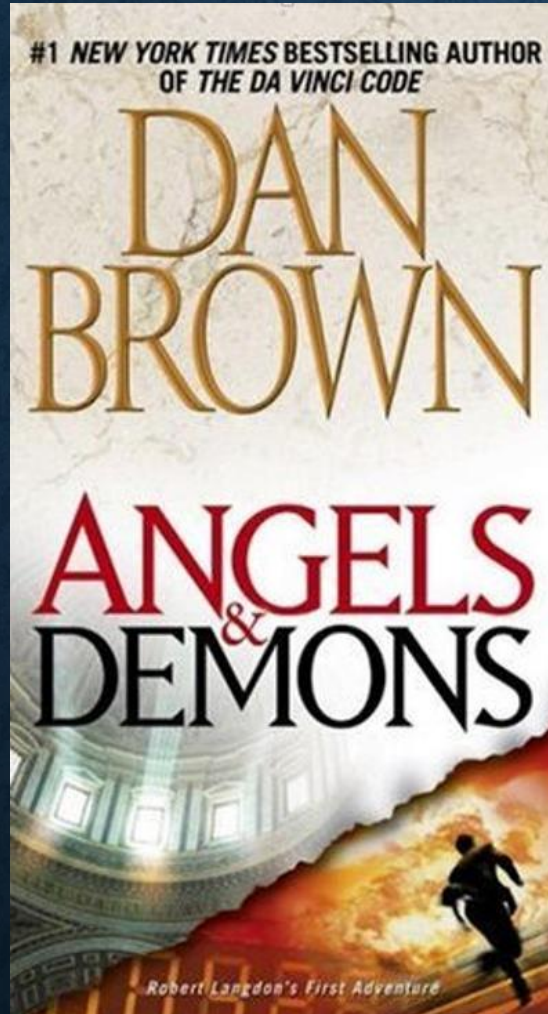


Antimatter matters!

AVA helps us understand nature in all its facets

Photo: CERN

BUILDING AN ANTIMATTER BOMB?



DAN BROWN'S "ANGELS & DEMONS"





Does the LHC exist @ CERN ?

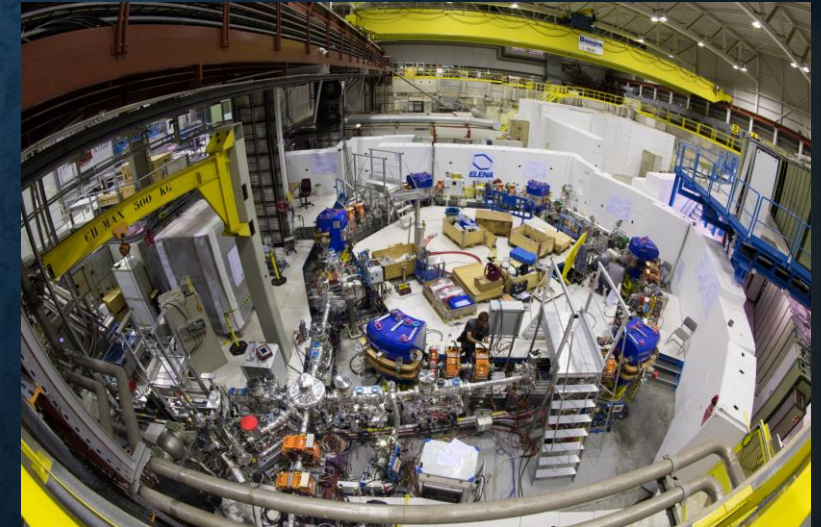
➡ Yes. Most powerful accelerator ever built.
In operation since 2009.



Is the LHC used for the
production of antimatter ?

No.

But:
Antiproton Decelerator.



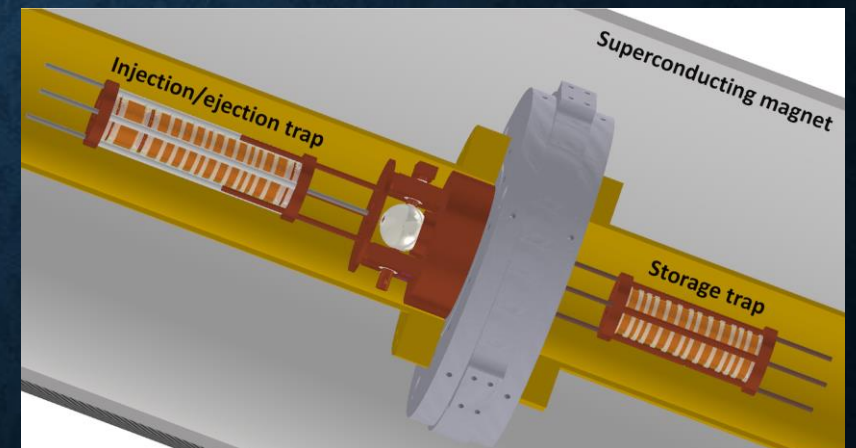


Can we transport antimatter to the Vatican?

No.

Well,...not yet.

BASE - STEP
New project to better understand antimatter.





**What's needed to build an
antimatter bomb ?**

**Let's do a little
Experiment !**

WHAT, IF MATTER MEETS ANTIMATTER?



Anakin

Weight each:

~ 100 g



Darth Vader

**Don't invite them
together to your party !**

Mass that
disappears

5,000 kilowatt-hours !

Equivalent of 500 (!) nuclear power plants

Energy from 4200 Megatons of TNT

A THREAT ?

$$\text{Efficiency} = \frac{\text{Energy released}}{\text{Mass of fuel used}}$$

Annihilation:	100.0 %
Nuclear fission:	0.1 %
Nuclear fusion:	some 0.1 %
Chemical fuel:	0.000 000 3 %

 **Annihilation: 1000 x more "bang for the gram"**

BLOW UP THE VATICAN ???

Missing 'detail':

If all the antiprotons we have made in the history of the world were annihilated at the same time....

→ Not enough energy to
boil a pot of tea !!!





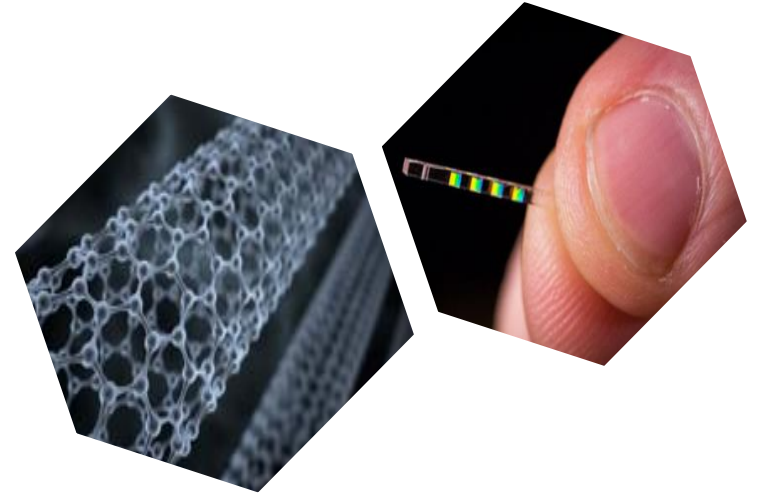
AEGIS at CERN

Fundamental studies

A detailed photograph of the AEGIS particle trap assembly. The device is a complex, cylindrical metal structure with multiple layers of coils and various mechanical components. It is mounted on a base and has several wires connected to it. The assembly is shown in a close-up view, highlighting its intricate design.

Trapping antiparticles

Can we optimize the way we catch and trap?



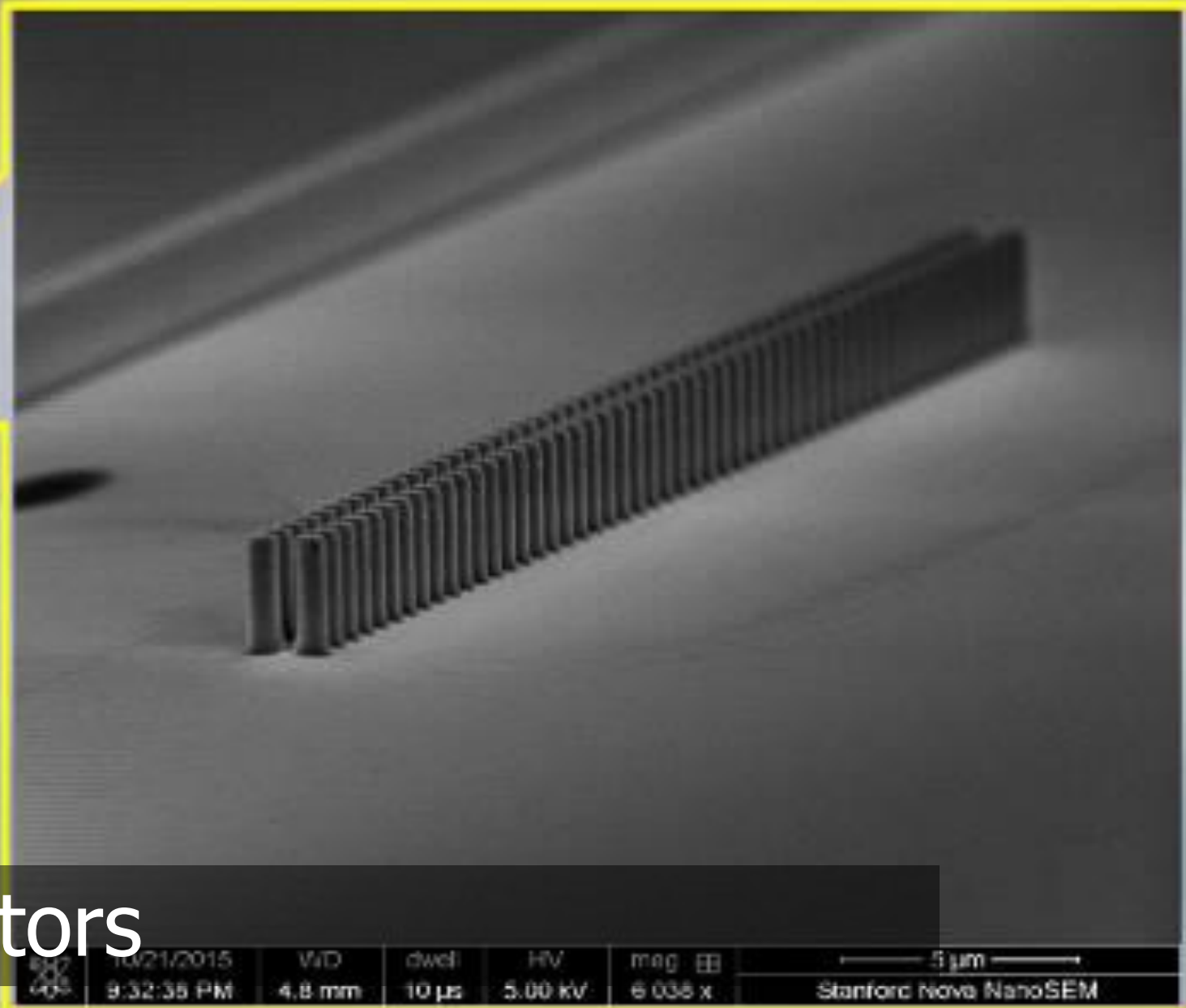
Using high gradients

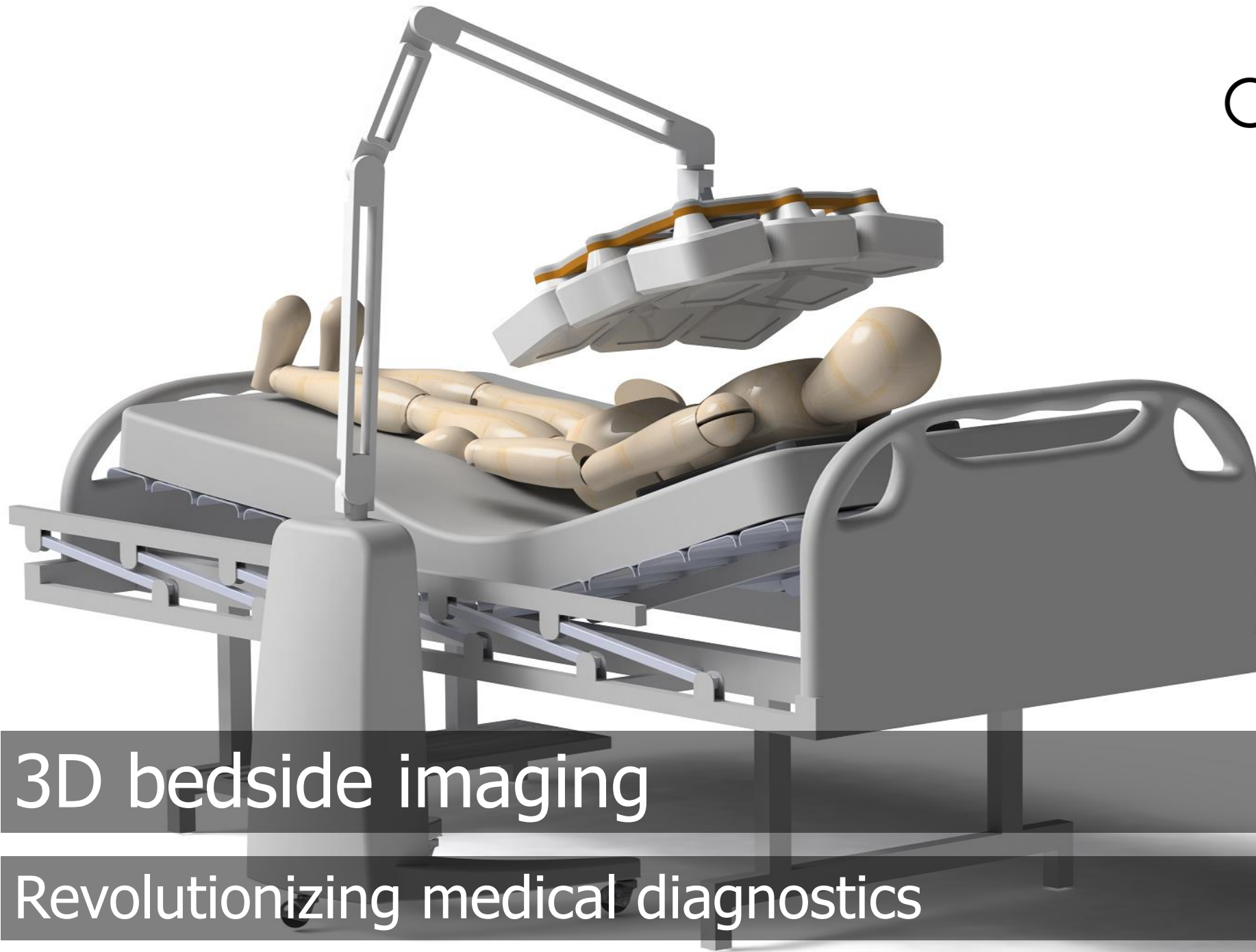
Shrinking the size

Enabling new
applications

Micro Accelerators

Pioneering new technologies





3D bedside imaging

Revolutionizing medical diagnostics



Accelerator Research
for sCIence and soCIety

EuPRAXIA



Funded by the
European Union