

EUROPEAN
PLASMA RESEARCH
ACCELERATOR WITH
EXCELLENCE IN
APPLICATIONS



WP2: Dissemination and Public Relations

Carsten Welsch (Cockcroft Institute/University of Liverpool)
Susanna Bertelli (INFN)



This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101079773



Based at CI/ULIV

WP2 Leader

Prof Carsten P Welsch



Based at INFN-LNF

WP2 Deputy-Leader

Dr Susanna Bertelli



Minh Cao



Dr Ricardo Torres



Alexandra Welsch

...and many others!

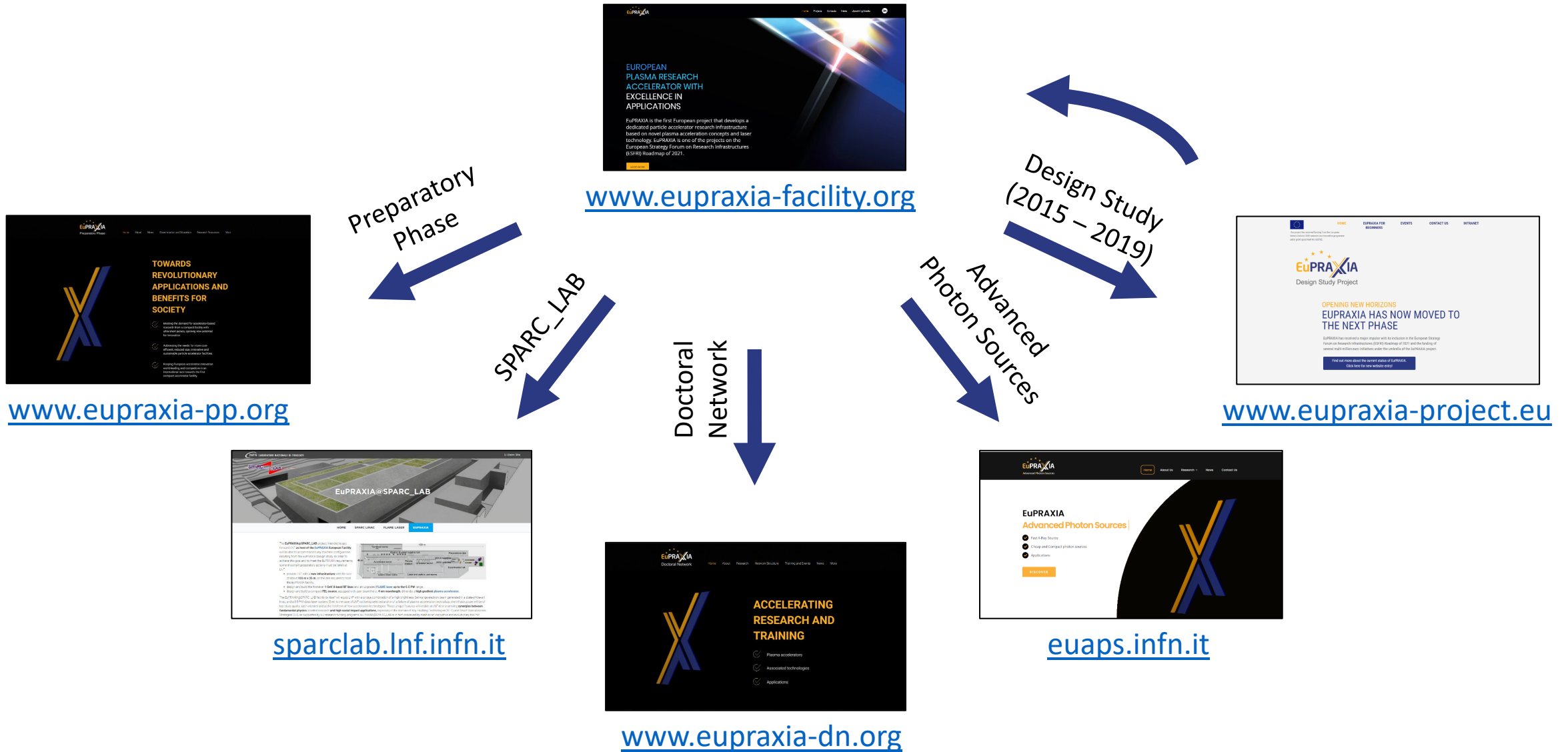
Milestones

- M2.1 Project website update and maintenance plan (M03) – **COMPLETED**
- M2.2 Update of dissemination, exploitation & communication plan (M06) – **COMPLETED**
- M2.3 Detailed plans for EuPRAXIA industrial meetings (M12) – **COMPLETED**

Deliverables

- D2.1 Website update (M6) – **COMPLETED**
- D2.2 Dissemination, exploitation & communication plan updated (M6) – **COMPLETED**
- D2.3 EuPRAXIA Brochure published (M12) – **COMPLETED**
- D2.4 EuPRAXIA Symposium and outreach event (M24) – **NEXT WEEK!**
- D2.5 EuPRAXIA Open innovation forum and 2nd Symposium (M46)

Audience	Messages
General public	<ul style="list-style-type: none"> • Societal benefits of particle accelerators in general and compact accelerators in particular.
Policy makers and funding agencies	<ul style="list-style-type: none"> • Scientific and economic advantage of plasma accelerator facilities in general and EuPRAXIA in particular.
Scientific community and potential user community	<ul style="list-style-type: none"> • Scientific and technical applications of EuPRAXIA. • Opportunities to users for scientific discovery and technical development. • Technical specifications of the different beamlines to be offered in EuPRAXIA.
Industry	<ul style="list-style-type: none"> • Opportunities for commercial collaboration, product development and exploitation. • Tender opportunities.
EuPRAXIA community	<ul style="list-style-type: none"> • Scientific and technical developments resulting from research in EuPRAXIA.





TOWARDS REVOLUTIONARY APPLICATIONS AND BENEFITS FOR SOCIETY

- ✓ Meeting the demand for accelerator-based research from a compact facility with ultra-short pulses, opening new potential for innovation.
- ✓ Addressing the needs for more cost-efficient, reduced size, innovative and sustainable particle accelerator facilities.
- ✓ Keeping European accelerator innovation world-leading and competitive in an international race towards the first compact accelerator facility.

DESIGNING THE FUTURE

FIRST COMPACT ACCELERATOR FACILITY

[LEARN MORE](#)

EuPRAXIA-PP is a project designed to develop the organizational, legal, financial and technological aspects of the EuPRAXIA infrastructure, following the recommendations of the European Strategy Forum on Research Infrastructures (ESFRI).

MANAGEMENT

The overall approach of EuPRAXIA is that of a big science collaborative project. A managerial structure and clear responsibilities are established, including milestones and deliverables. An overall planning and a resource-loaded schedule are agreed within the project. As far as possible a flat hierarchy with direct communication channels between all levels of management will be implemented. At the same time an open scientific approach will be pursued, based on technical excellence. Several committees will advise the project management and will regularly evaluate the progress of the EuPRAXIA-PP project.

Project Coordinator

Coordinator: Ralph W. Assmann (INFN/DESY)
Deputy: Massimo Ferraro (INFN)

The **project coordinator** is the coordinating person of the EuPRAXIA Preparatory Phase project. They are responsible to supervise and coordinate EuPRAXIA-PP Work Package tasks to their full completion, and in this capacity, they will follow up on milestones and deliverables, and monitor the use of resources.

Management Support Team

The project coordinator will be supported by the **management support team**. They shall assist the management in communicational and financial matters, as well as event organization and media.

Steering Committee

The project is directed by the **steering committee**. It is responsible for the coordination and management of the work packages. The committee consists of work package leaders and experts and will be chaired and organized by the project manager.

Collaboration Board

Review of the work progress and final decisions regarding modifications to the work program or the allocation of the funding, on the accession and withdrawal of partners as well as on default and termination, will be made by the collaboration board representing the members of the consortium. The collaboration board consists of one representative of each of the project partner organizations.

THE EuPRAXIA FILES

The EuPRAXIA Files is a collection of publicly available abstracts of published articles that are relevant to the EuPRAXIA project. Putting together the latest research in plasma accelerators, the aim is to facilitate the work of the many researchers involved in EuPRAXIA and to highlight the scientific outcomes of the various projects supporting the initiative.

Click on the preferred issue to download via the link!

Issue 1 - May 2016

[click here to download](#)

Issue 2 - October 2016

[click here to download](#)

Issue 3 - March 2018

[click here to download](#)

Issue 4 - August 2017

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Issue 5 - December 2017

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Issue 6 - January 2018

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Issue 7 - May 2019

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Issue 8 - March 2023

[click here to download](#)

Issue 9 - June 2023

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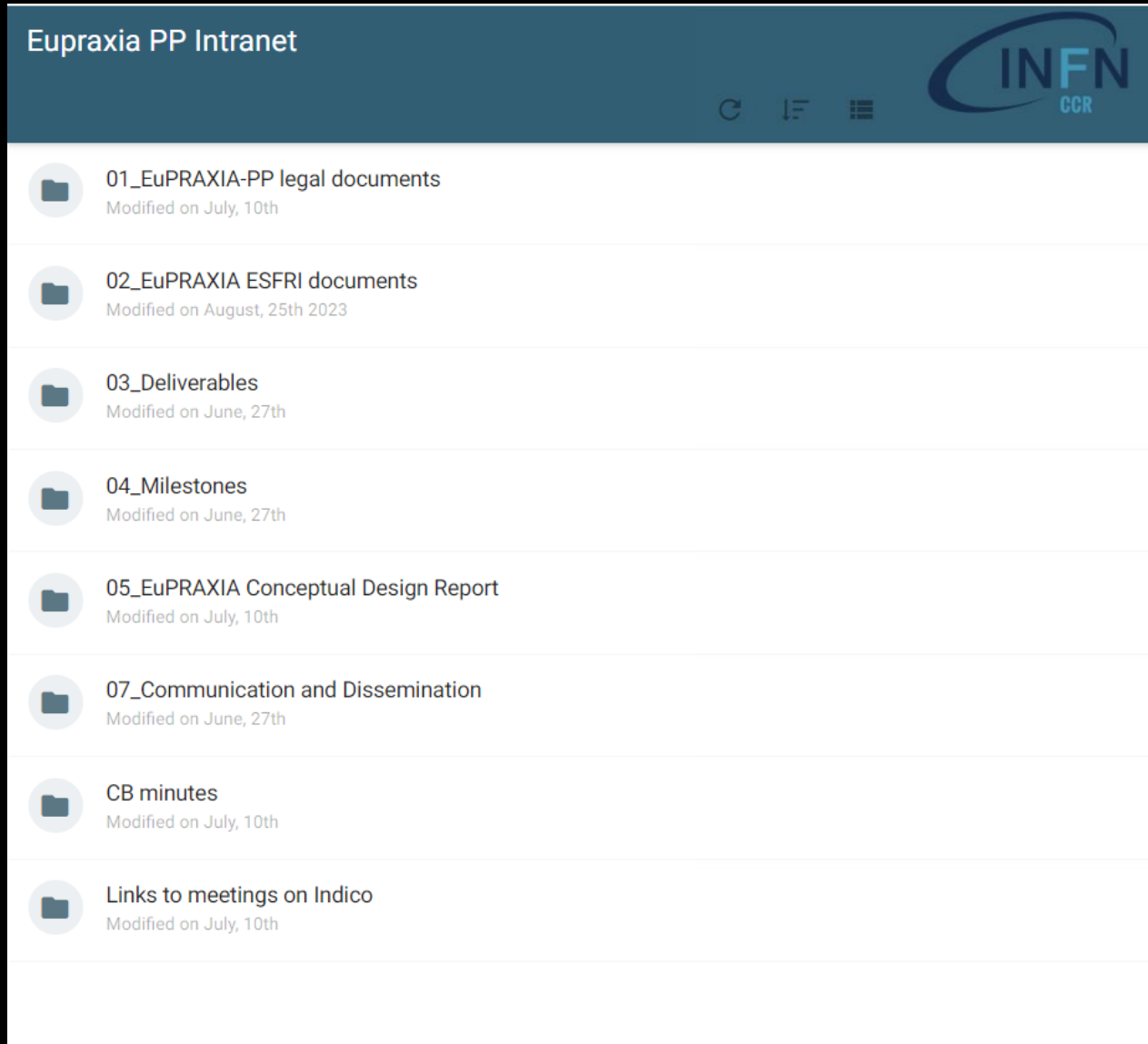
Issue 10 - October 2023

[click here to download](#)

Intranet can be accessed through the EuPRAXIA-PP website.

The link will take you to Pandora, where you are asked for the password.

**TOWARDS
REVOLUTIONARY
APPLICATIONS AND
BENEFITS FOR
SOCIETY**



The screenshot shows the Eupraxia PP Intranet interface. At the top, there is a dark blue header with the text "Eupraxia PP Intranet" on the left and the "INFN CCR" logo on the right. Below the header, there is a list of folders, each represented by a folder icon and a title, with a modification date below each title. The folders are:

- 01_EuPRAXIA-PP legal documents
Modified on July, 10th
- 02_EuPRAXIA ESFRI documents
Modified on August, 25th 2023
- 03_Deliverables
Modified on June, 27th
- 04_Milestones
Modified on June, 27th
- 05_EuPRAXIA Conceptual Design Report
Modified on July, 10th
- 07_Communication and Dissemination
Modified on June, 27th
- CB minutes
Modified on July, 10th
- Links to meetings on Indico
Modified on July, 10th

Internal documents.

Only accessible to
EuPRAXIA-PP members.

*(Please get in touch with
Claudia Pelliccione in case
of any access issues)*

- The project releases regular **news articles** showcasing scientific results, events, general project and partner updated on the project’s website.
- Highlight articles feature regularly in CERN’s *Accelerating News*.

LATEST NEWS

6 hours ago

Taking the pulse of plasma-based Free Electron Lasers

A group of researchers including distinguished members of the EuPRAXIA collaboration have just published a review article in...

Jun 12

Guiding of Charged Particle Beams in Curved Plasma-Discharge...

In a recently published paper in Physical Review Letters, Riccardo Pompili (INFN-LNF) and his colleagues present a novel...

Jun 10

Professor Welsch contributes to 2024 KoWi Annual Conferenc...

The 2024 KoWi Annual Conference on EU Research & Innovation Funding with its about 350 participants is at the heart ...

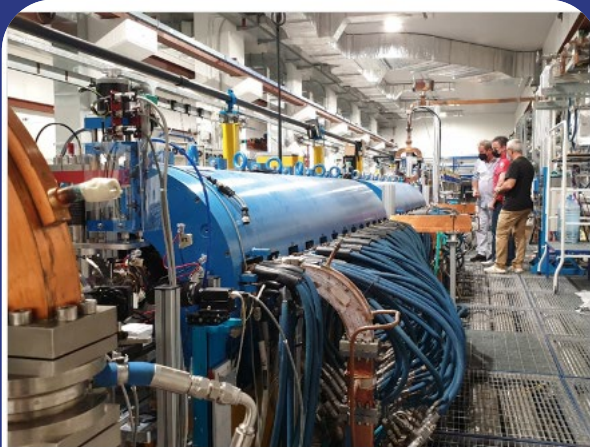
ARIES
Accelerator Research and Innovation for European Science and Society

IFAST
Innovation Fostering in Accelerator Science and Technology

EuPRAXIA (EUP)
European Plasma Research Accelerator with Excellence in Applications

KTT
Knowledge and Technology Transfer

ACO
Accelerator Communication and Outreach



Sep 9

Taking the pulse of plasma-based Free Electron Lasers

A group of researchers including distinguished members of the EuPRAXIA collaboration have just published a review article in...

Latest news about an article in **Nature Photonics** published by *M. Galletti, R. Assmann, M. E. Couprie, M. Ferrario, L. Giannessi, A. Irman, R. Pompili, and W. Wang*

We need your contributions!

- Research articles are supported by **international press releases**;
- We work with **mainstream and scientific media** on stories for **science-engaged and general audiences**.



CERN COURIER Reporting on international high-energy physics

Physics Technology Community In focus Magazine

ACCELERATORS | FEATURE

Europe targets a user facility for plasma acceleration

24 April 2023

Ralph Assmann, Massimo Ferrario and Carsten Welsch describe the start of the ESFRI project EuPRAXIA, which aims to develop the first dedicated research infrastructure based on novel plasma-acceleration concepts.

Surf's up Simulation of electron-driven plasma wakefield acceleration, showing the drive beam (orange/purple), the plasma electron wake (grey) and witness beam (orange). Credit: A Martinez de la Ossa/DESY

Energetic beams of particles are used to explore the fundamental forces of nature, produce known and unknown particles such as the Higgs boson at the LHC, and generate new forms of matter, for example at the future FAIR facility. Photon science also relies on particle beams: electron beams that emit pulses of intense synchrotron radiation, for example at DESY, or X-ray free electron lasers (XFELs) such as the European XFEL.

BBC NEWS MUNDO

Noticias América Latina Internacional Qatar 2022 Hay Festival Economía

Centroamérica Cuenta BBC Extra

Star Wars: ¿cuánto es ciencia y cuánto es ficción en la exitosa saga?

Carsten Welsch* The Conversation

23 diciembre 2019

La ciencia respalda la idea de la existencia de un campo de energía que 'rodea' a los planetas. Este campo de energía es el campo de fuerza, que es una fuerza hipotética que se utiliza para explicar la existencia de los fenómenos de la saga Star Wars.

laboratory news Field Sector Digital

Home Physics Minding the gap

Minding the gap

12 Sep 2018 by bobbjott.d.bobbjott.c

Scientists have shown that lasers can accelerate electrons to immense energies within a few centimeters of plasma. Their aim now is to build a useful machine.

Edwin Cartledge

Surfing the Wakefield

A rendering, based on simulation data, of an intense laser pulse (red) in a plasma, driving a wakefield of plasma waves consisting of electron shells. An electron beam (orange) is being accelerated by the high electric field.

When it comes to visualising ultra-fast phenomena, especially biological ones – the Terahertz gap. Now, a pan-European consortium – the EuPRAXIA – is collaborating to design the world's first high-energy plasma-based accelerator.

To capture the fastest movements – such as proteins unfolding or molecules vibrating – you need a light source that operates at a similar speed.

International scientists collaborating on the EuPRAXIA project are edging closer to making this a reality. They are designing a new generation of particle accelerator that will be stronger and more compact than the accelerators used by industry today. One problem with the existing technology is the size of the infrastructure required. The Large Hadron Collider, for example, uses a circular tunnel 27km long with radio frequency cavities at intervals to propel the particles to the highest speeds currently possible.

CONSORTIUM

80 institutions and companies from 16 countries have signed a Consortium Agreement for EuPRAXIA, either for ESF or the Preparatory Phase project or both.

- Istituto Nazionale di Fisica Nucleare, Italy (Coordinator)
- Agenzia Nazionale per le Nuove Tecnologie, Emergenti e Sviluppo Economico Sostenibile, Italy
- ALBA-CCLXX, Spain
- Ampelis, France
- Instituto Superior Técnico, Portugal
- Centro de Estudios Puñados Ultracortos Ultraintense, Spain
- Centre National de la Recherche Scientifique, France
- CERN
- Commissariat à l'Énergie Atomique aux Énergies Alternatives, France
- Consiglio Nazionale delle Ricerche, Italy
- Deutscher Elektronen-Synchrotron DESY, Germany
- Ecole Polytechnique Fédérale de Lausanne, Switzerland
- Elettra - Sincrotrone Trieste, Italy
- EUBEC, Czech Republic
- Forschungszentrum Jülich, Germany
- Fraunhofer-Institut für Laser Technik, Germany
- GSI Helmholtzzentrum für Schwerionenforschung GmbH, Germany
- Hebrew University of Jerusalem, Israel
- Helmholtz-Zentrum Dresden-Rossendorf, Germany
- Helmholtz-Institut Jena, Germany
- Helmholtz-Zentrum Dresden-Rossendorf, Germany
- Imperial College London, UK
- Institute for Molecular Science, National Institute of Natural Science, Japan
- Institute of Accelerating Systems and Applications, Greece
- Institute of Plasma Physics and Laser Microfusion, Poland
- Kernal Photon Science Institute, National Institute for Quantum and Biomedical Science and Technology, Japan
- Karlsruhe Institut für Technologie, Germany
- Lawrence Berkeley National Laboratory, USA
- LIGO University of Technology, Poland
- Ludwig-Maximilians-Universität München, Germany
- Lund University, Sweden
- Military University of Technology, Poland
- NORDUNA Centrum Badań Jądrowych, Poland
- National Technical University of Athens, Greece
- Osaka University, Japan
- Paul Scherrer Institut PSI, Switzerland
- Pécsi Tudományegyetem University of Pecs, Hungary
- BIKEN SPring-8 Center, Japan
- Sapienza Università di Roma, Italy
- Science and Technology Facilities Council, UK
- Shanghai Jiao Tong University, China
- Swiss Federal Laboratories for Materials Science and Technology, Switzerland
- Synchrotron SOLEIL, France
- Szeged Tudományegyetem, Hungary
- Theias Lab, France
- The Queen's University of Belfast, UK
- Université Côte d'Azur, France
- Università degli Studi di Milano-Bicocca, Italy
- Università degli Studi di Roma Tor Vergata, Italy
- University of California Los Angeles, USA
- University of Liverpool, UK
- University of Manchester, UK
- University of Oxford, UK
- University of Padua, Italy
- University of Strathclyde, UK
- University of Warsaw, Poland
- University of York, UK
- Warsaw University of Technology, Poland
- Wigner Research Centre for Physics, Hungary

European plasma research accelerator with excellence in applications

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DESIGNING THE FUTURE

www.eupraxia-pp.org
www.eupraxia-facility.org

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101019725. It is supported by in-kind contributions by its partners and by additional funding from UK and Switzerland.

TOWARDS REVOLUTIONARY APPLICATIONS AND BENEFITS FOR SOCIETY

Leaflet contains information about plasma accelerators, project partners and goals of EuPRAXIA-PP in a nutshell. **Already updated!**

EuPRAXIA

EUROPEAN PLASMA RESEARCH ACCELERATOR WITH EXCELLENCE IN APPLICATIONS

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- Highly ethical 2
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- Highly available 2
- Highly accessible 2
- Highly inclusive 2
- Highly diverse 2
- Highly equitable 2
- Highly just 2
- Highly fair 2
- Highly honest 2

INTRODUCTION

EuPRAXIA is the first European project that develops a dedicated accelerator-driven research infrastructure based on novel plasma concepts and laser technology. It is ultimately expected to boost the expertise of the European scientific communities in compact, sustainable, high-brightness, high-intensity, high-repetition rate, highly tunable, highly stable, highly reliable, highly flexible, highly efficient, highly compact, highly cost-effective, highly sustainable, highly innovative, highly collaborative, highly open, highly transparent, highly accountable, highly responsible, highly ethical, highly safe, highly secure, highly resilient, highly robust, highly reliable, highly available, highly accessible, highly inclusive, highly diverse, highly equitable, highly just, highly fair, highly honest, highly open, highly transparent, highly accountable, highly responsible, highly ethical, highly safe, highly secure, highly resilient, highly robust, highly reliable, highly available, highly accessible, highly inclusive, highly diverse, highly equitable, highly just, highly fair, highly honest.

USER APPLICATIONS AND OPPORTUNITIES

The EuPRAXIA facility offers opportunities for a variety of different applications. These include materials and basic science, high-energy physics, material processing and analysis, physical science as well as medicine and life sciences.

Brochure offers description of facilities and excellence centres, technical capabilities, and scientific opportunities. **Use it with your funding agencies!**

EuPRAXIA

Preparatory Phase

TOWARDS REVOLUTIONARY APPLICATIONS AND BENEFITS FOR SOCIETY

- ✓ Plasma-based accelerators
- ✓ Opening new potential for innovation
- ✓ Path to more cost-effective accelerators

This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101019725. It is supported by in-kind contributions by its partners and by additional funding from UK and Switzerland. The information herein reflects only the views of its authors and the Research Executive Agency is not responsible for any use that may be made of the information contained.





THE EuPRAXIA FILES

ISSUE 12 – May 2024

FOREWORD FROM THE COORDINATOR

A new issue of the EuPRAXIA Files is presented here, collecting the most relevant books and papers recently appeared in literature about accelerators, lasers and plasma science and strictly correlated with technologies that will be used at EuPRAXIA. I present the Files with particular pleasure, as in March, the EuPRAXIA Collaboration Board choose me as the new EuPRAXIA ESFRI Preparatory Phase Project Coordinator, succeeding to Ralph Assmann, which has lead the Collaboration since the early Design Study in 2015, moved to a prestigious position at GSI-FAIR Laboratory. To Ralph we convey all our gratitude for the nearly 10 years of effective and high-level running of the EuPRAXIA dream.

Together with him, I share this dream, to setup a network of brilliant people across Europe, to foster an ESFRI infrastructure for advanced particle acceleration, in the field of accelerators, lasers and plasma technology, based on two “physical” pillars (two beam-driven and laser-driven FELs) and on a set of clusters of excellence around the most important European Laboratories.

The EuPRAXIA files is an intelligent and clever way to make this network effective, looking after the many successes and new ideas in the field. A big thanks to the authors.

I wish you a fruitful reading,

Pierluigi Campana

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The screenshot shows the website interface for 'THE EuPRAXIA FILES'. At the top, there is a navigation menu with links for Home, About, News, Dissemination and Education, Research Resources, and More. Below the title, a paragraph explains that the files are a collection of publicly available abstracts of published articles relevant to the EuPRAXIA project. A link is provided to click on the preferred issue to download via the link.

The main content area displays a grid of 12 issue cards, each with the issue number, date, and a 'click here to download' link:

- Issue 1 - May 2016
- Issue 2 - October 2016
- Issue 3 - March 2018
- Issue 4 - August 2017
- Issue 5 - December 2017
- Issue 6 - January 2018
- Issue 7 - May 2019
- Issue 8 - March 2023
- Issue 9 - June 2023
- Issue 10 - October 2023
- Issue 11 - February 2024
- Issue 12 - May 2024

Lectures and Seminars

Information about the science and technology of EuPRAXIA



Print Materials

Magazines, books and press releases, explaining the science behind plasma accelerators.



FAQ's

Frequently asked questions about plasma accelerators and their applications.

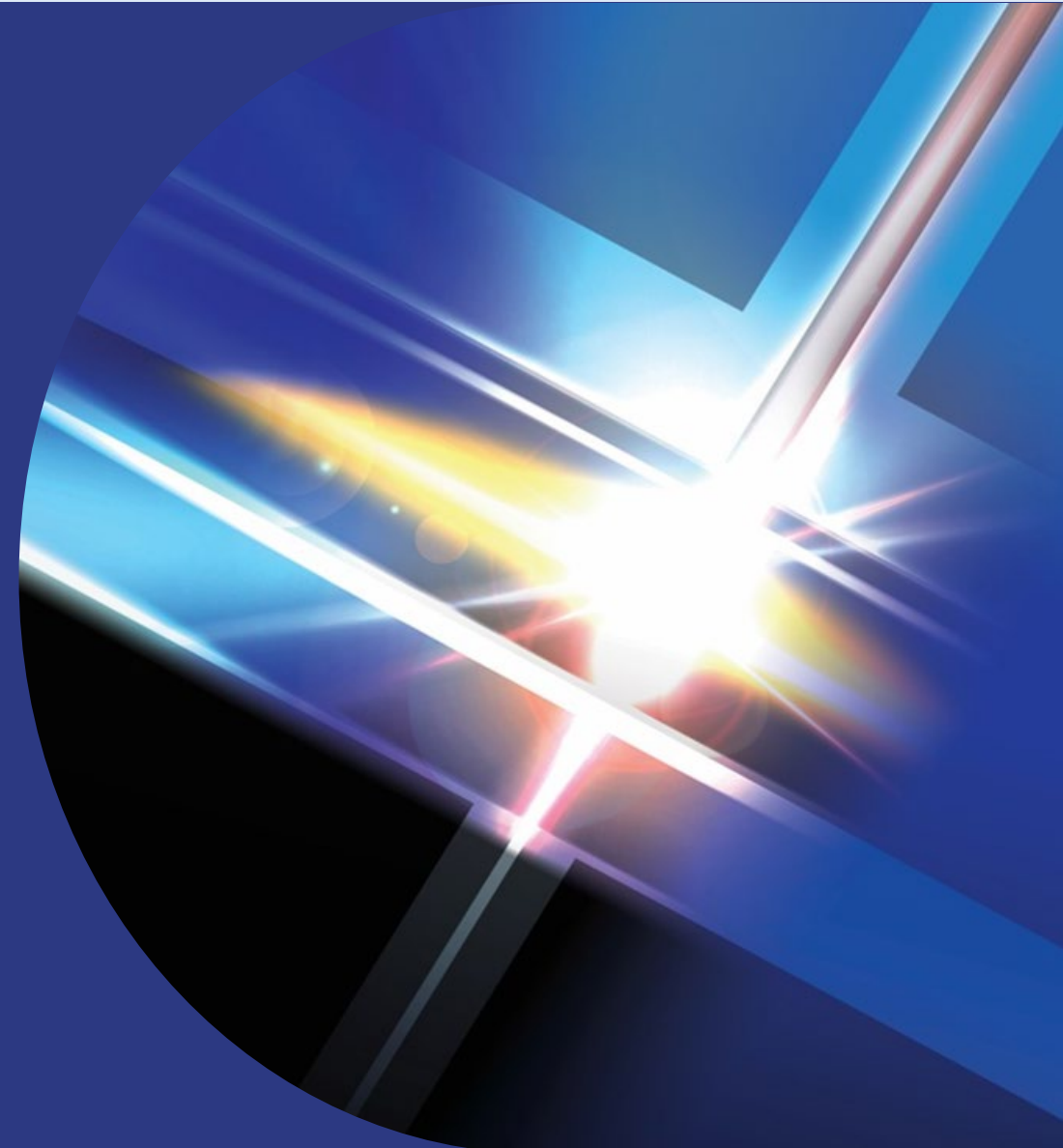


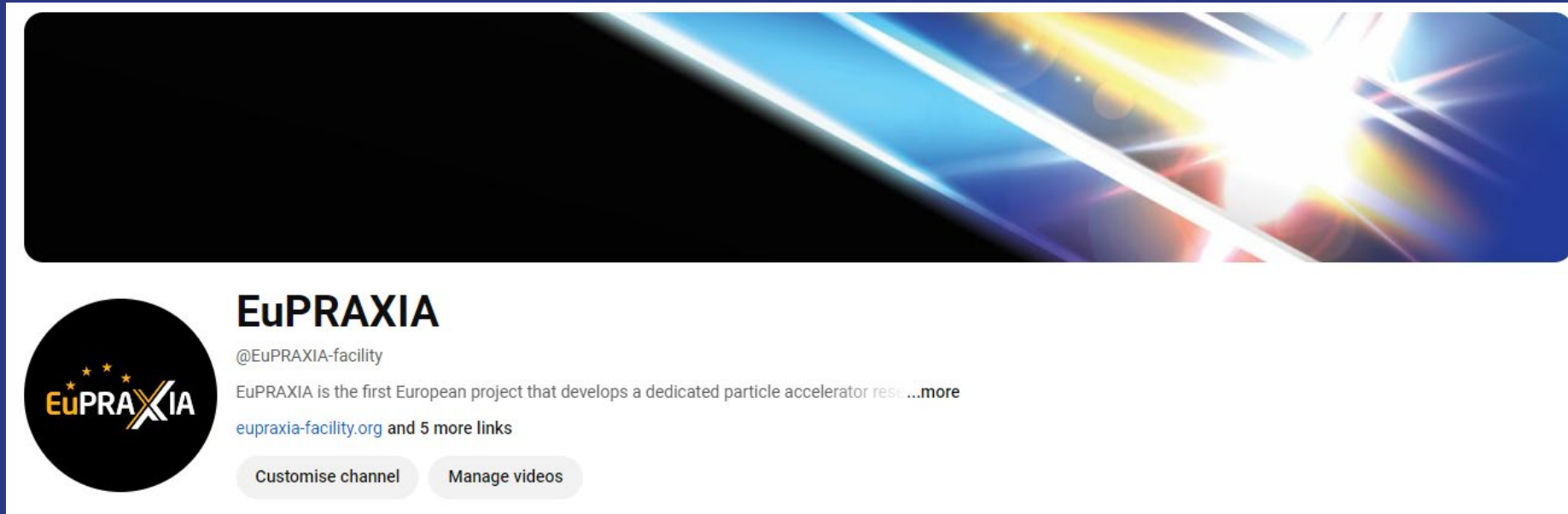
Contact Us

Get in touch to know how we can bring our outreach to you.



- Lectures:
 - Short lectures designed for school children
 - using simple and easy-to-understand language
- Seminars:
 - Approximately 1-hour long seminars
 - Designed for science-engaged audiences, students and researchers,
 - focused on the science and technology of EuPRAXIA.
 - These seminar videos will be recorded during the brand-new **EuPRAXIA Seminar Series!**





- EuPRAXIA Seminar Series:
 - Monthly online seminars with speakers from academia, research centres and industry, presenting insights into cutting-edge research on laser- and electron-beam–driven plasma wakefield acceleration
 - Recordings will be published on the **EuPRAXIA YouTube channel** @EuPRAXIA-facility

- Collection of **frequently asked questions** about plasma accelerators and their applications.
- Published as part of our **teaching resources** for schools, students and anyone who shares our excitement for plasma accelerators.

Frequently asked questions

What is a particle accelerator? ▼

How are particles accelerated? ▼

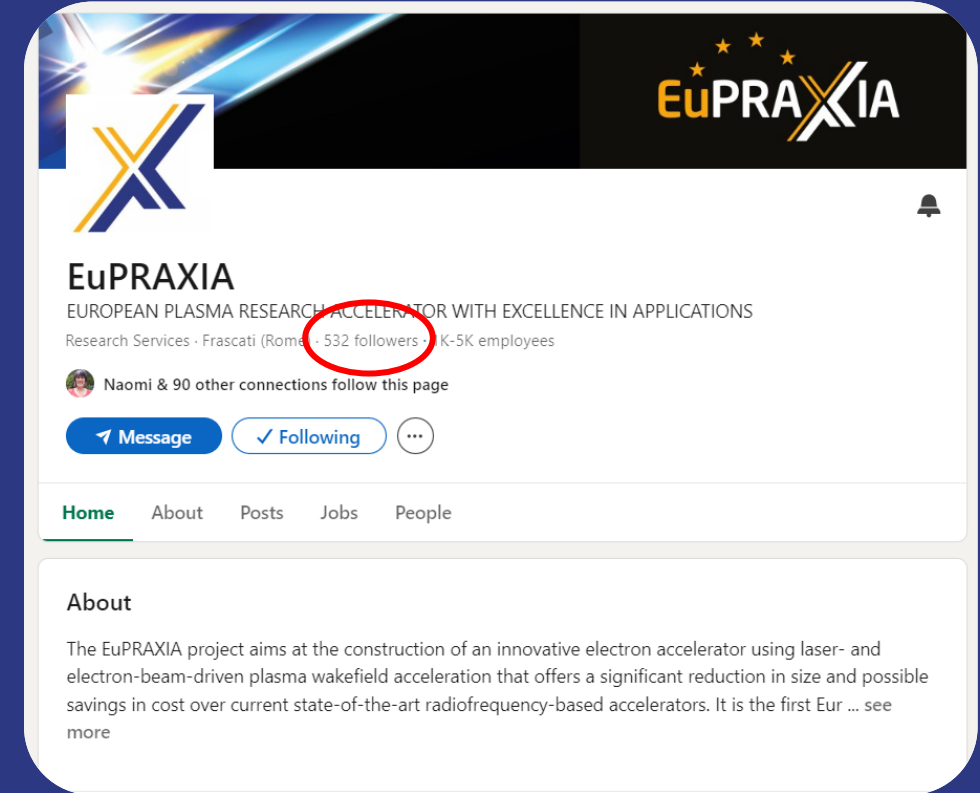
How are the particles really accelerated? ▼

What is the practical purpose of particle accelerators? ▼

What is plasma? ▼

How are plasmas generated? ▼

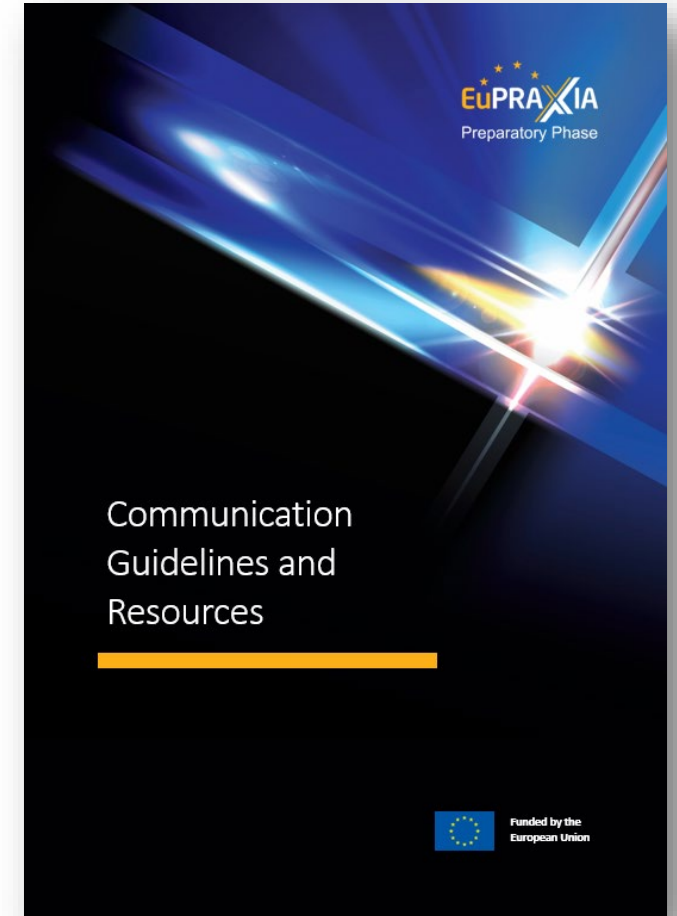
- All activities are supported by ULIV's and INFN's established **social media** channels:
 - X/Twitter: @livuniphysics, @QUASAR_6group, @INFN_, @INFN_LNS
 - Facebook: @theQuasarGroup, @IstitutoFisicaNucleare, @infn.lns
 - Instagram: @livuniphysics, quasar_6group, @infn_insights, @Inf_infn
 - LinkedIn: **EuPRAXIA**, QUASAR Group Project T.E.A.M.
- Social media **campaigns** to boost visibility



WP2 Team is putting together a 'Style Guide' for EuPRAXIA

- Visual language and style
- Basic rules for dissemination
- List of available promotional resources
- Links to downloadable materials (logos, templates, promotional literature, etc.)

Soon available to all partners.



A vertical poster for the EuPRAXIA Satellite Event at BSBF 2024. It features the event title at the top, a circular graphic with the EuPRAXIA logo and a satellite image, a QR code, and a URL for registration. The text 'SCAN QR CODE TO REGISTER YOUR ATTENDANCE' is at the bottom.

**Big Science
Business
Forum
2024**

EuPRAXIA

**EuPRAXIA Satellite
Event at BSBF 2024**



<https://agenda.infn.it/event/42729>

SCAN QR CODE TO REGISTER
YOUR ATTENDANCE

1 – 4 October 2024, Trieste

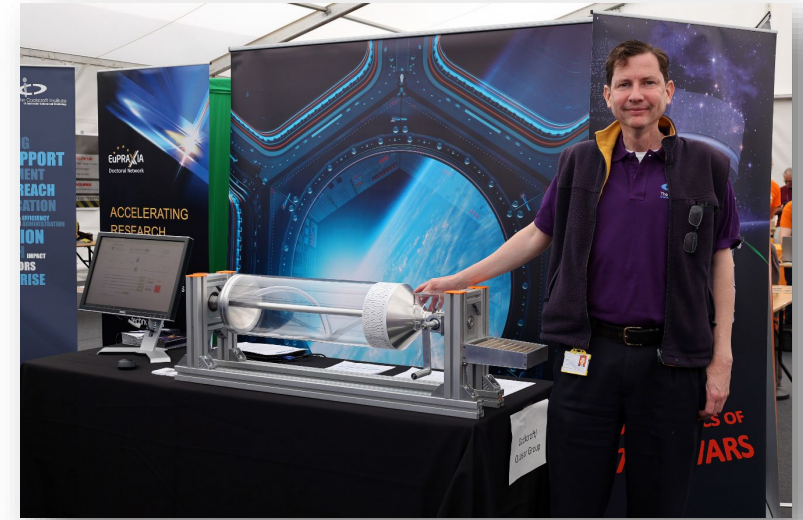
EuPRAXIA Satellite Event (1st October)

- Overview of the EuPRAXIA's current status
- Collaboration and engagement opportunities for industry
- Funding possibilities
- Discussions and networking
- Distribution of WP5 survey

INFN booth

- Information and promotion of EuPRAXIA

- Public open day on Saturday, 15th July 2023 - school visits in the week leading up to it.
- 40 schools visited across all age groups.
- 25/40 schools from deprived of North West England.
- 5,300 general public of all ages came to the Open Day. Activities included walkthrough of CLARA, demonstration stands, tours of vacuum and magnet labs, lectures, and many stands run by universities.







FrankfurterRundschau

UKRAINE-KRIEG POLITIK PANORAMA ENTRACHT FRANKFURT MEINUNG

Startseite > Panorama

Star Wars und die Wirklichkeit

Erstellt: 15.01.2020 Aktualisiert: 15.01.2020, 18:06 Uhr

Kommentare



Ein Lichtschwert gehört zur Grundausstattung jedes ordentlichen Jedi-Ritters. © picture alliance / kpa

Auch wenn das Lichtschwert noch auf sich warten lässt: Science Geschichten haben seit jeher reale Entwicklungen vorweggenommen. Zum Beispiel Laserkanonen.

Zurzeit fliegen im Kino wieder Raumschiffe im Hyperraum, wer Lichtschwerter geschwungen und Laserwaffen abgefeuert. Doch wissenschaftliche Realität steckt in den „Star-Wars“-Filmen wie aktuellen Werk „Der Aufstieg Skywalkers“? Könnten sie Wissenschaft inspirieren, haben sie das gar schon?

Recent entries

- Got your physics degree... now what?
- Photography prize, Tesla collision course, climate-change cross stitch
- Physics of ski jackets, the eerie sound of thin ice, how figure skaters linger in mid-air
- 12 things we learned about the National Physical Laboratory
- Happy Hedgehog Day, play like Einstein, Hawking could be in court over NHS

Popular tags

- astronomy
- science and society
- Physics World magazine
- art and science
- particle physics
- CERN
- LHC
- out and about
- history of physics
- science communication
- industry
- NASA
- Physics World
- women in physics
- education


IOP Physics World - the member magazine of the Institute of Physics

Home News Blog Multimedia In depth Events

Blog

Star Wars fact or fiction, Wikipedia editor in space stellarator tour

Posted on Dec 1, 2017 5:51 pm



Fact and fiction: Carsten Welsch. (Courtesy: Code)

By Hamish Johnston

What is it about *Star Wars* that captivates the imaginations of people? Carsten P. Welsch, who is head of physics at the University of Liverpool and a nearby Cockcroft Institute, gave a presentation called “Physics of Star Wars” to an audience of hundreds of secondary school children, undergraduate and PhD students and university staff.

BBC NEWS | MUNDO

Star Wars: ¿cuánto es ciencia y cuánto es ficción en la exitosa saga?

24 de diciembre de 2019 • 10:45

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From laser beams to proton beams: how 'Star Wars' continues to predict the science of the future

20-12-2019




With the next *Star Wars* blockbuster hitting the big screen, scientists have revealed how, over the past four decades, the science fantasy of the films has predicted some of the biggest scientific breakthroughs of this generation.

Science Focus

News Future tech Nature Space Human body Everyday science

Home > Space > How the science of Star Wars is turning fiction into fact



How the science of Star Wars is turning fiction into fact

By [Professor Carsten Welsch](#) Published: 12th December, 2017 at 00:00

[Try 3 issues of BBC Science Focus Magazine for £5!](#)

Professor Carsten Welsch uses the science of Star Wars to explain how we're using more than the Force to push the boundaries of physics.

Also: Regional TV, UK and US radio stations

UNIVERSITY OF LIVERPOOL SURFATRON CATCH THE WAVE OF ACCELERATORS EuPRAXIA

Amplitude: 4.00 cm
 Wavelength: 10.00 cm
 Frequency: 2.50 Hz
 Injection Vel: 10.00 cm/s
 Friction: 0.00 E-2

Velocity Gain: 0.00 cm/s
 Highest Score: 0.00 cm/s

Phase velocity: 25.00 cm/s

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Science in School

The European journal for science teachers

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Surfatron: catch the wave of accelerators

Ricardo Torres

Try your hand at Surfatron, a game that lets students experience the challenges faced by particle accelerator scientists while learning the physics of waves.

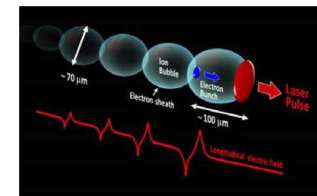
Introduction

Accelerator science is a constantly evolving field. New technological advances allow large colliders – like the Large Hadron Collider (LHC) – to reach higher energies and discover new particles. At the same time, particle accelerators that are used in hospitals for cancer treatment may offer a safer, more effective, and more affordable service.

New technology, which could revolutionize the field of accelerators, relies on the ability of scientists to inject a beam of particles with a well-defined energy into a suitable plasma wave to gain energy, much in the same way as a surfer catches a wave at sea to be pushed forward.

Surfatron illustrates the same process, by simulating the motion of a ball on an undulating track. The purpose of the game is to get the ball – the surfer – to gain as much speed as possible by finding the optimum parameters of the wave (amplitude, wavelength, and frequency) and launching the ball at the right time with the appropriate initial speed.

www.scienceschool.org/article/2023/surfatron-catch-the-wave-of-accelerators



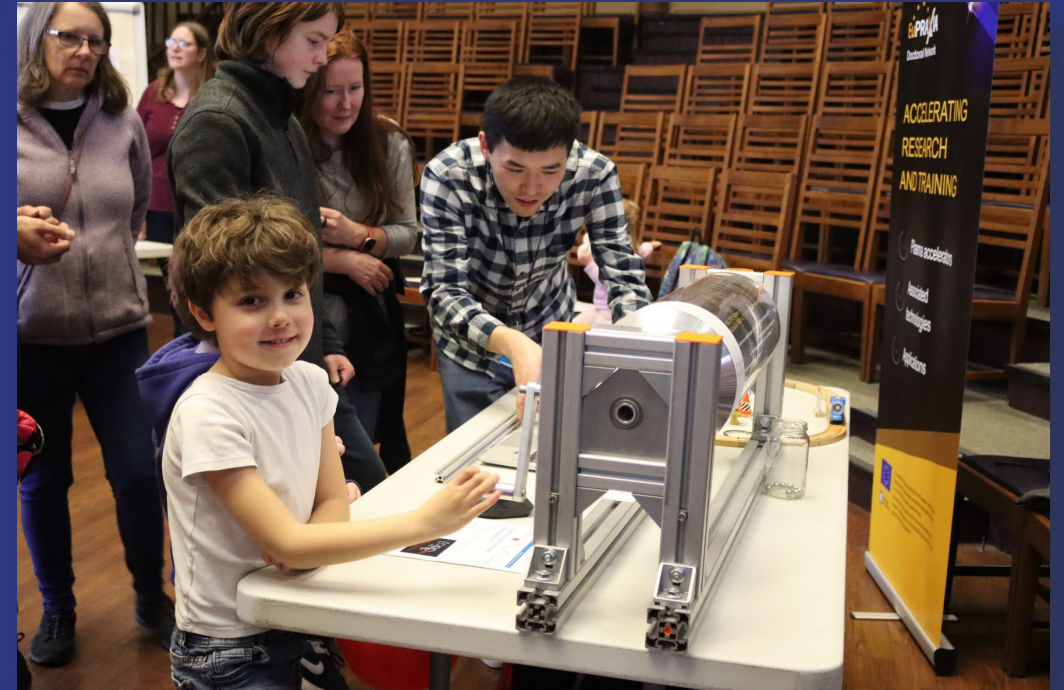
A laser pulse travelling through a gas of ionized atoms creates a wake of plasma waves that can be used to accelerate electrons to a very high energy.

Image courtesy of Ricardo Torres

To play the game, students have to manipulate the amplitude, wavelength, and frequency of a wave, helping them to understand intuitively the properties of waves and the basic working principles of linear particle accelerators, while learning to interpret velocity plots.



'Shining a Light on Particle Physics + Accelerators'
Liverpool Cathedral, March 2024.



British Science Week event
Victoria Gallery and Museum, March 2024



- Media training pioneered in AVA network, now adapted to EuPRAXIA Doctoral Network
- Delivered in Manchester's Media City with industry partner Carbon Digital
- Relying on Virtual Production.







OUTREACH TALK

Hollywood Physics

Professor Carsten P Welsch will take a look at a few of cinema's most mind-boggling moments of scientific inaccuracy. He will talk about where Hollywood gets the physics wrong and how the correct science would impact on the films, as well as about how the actual experiments in his research group often go beyond even the most exciting movie plots.

Date: Tuesday, 24 September 2024

Time: 21:30

Place: Hotel Hermitage, Sala Maria Luisa



Prof Carsten P Welsch
University of Liverpool / INFN

LNF fosters scientific literacy with specific programs encompassing a wide range of activities to communicate the importance of science in expanding our understanding of the Universe along with the applications of research and technology-based outcomes in everyday life.

Many of these initiatives focus on EuPRAXIA's main topics to present the project.

Guided tours	Seminars	Lab-based activities	Public events
<ul style="list-style-type: none"> ✓ LNF Visitor Centre ✓ Accelerators ✓ Labs, facilities ✓ Historical sites 	<ul style="list-style-type: none"> ✓ Modern physics ✓ Latest issues in research ✓ History of Physics 	<ul style="list-style-type: none"> ✓ science demos ✓ hands-on 	<ul style="list-style-type: none"> ✓ Open day ✓ ERN ✓ Science Festivals

Activities carried out both inside and outside LNF site
 Collaborations with other INFN units, universities and research centres

In 2023, over 25,000 people were reached

TARGET AUDIENCES

A large pink circle representing the first target audience.

Student
program

A large yellow circle representing the second target audience.

Teacher
program

A large orange circle representing the third target audience.

General
public

A large blue circle representing the fourth target audience.

Industries
Companies
Research
centres

A large green circle representing the fifth target audience.

Policy
makers
Politicians

Activities with a focus on EuPRAXIA

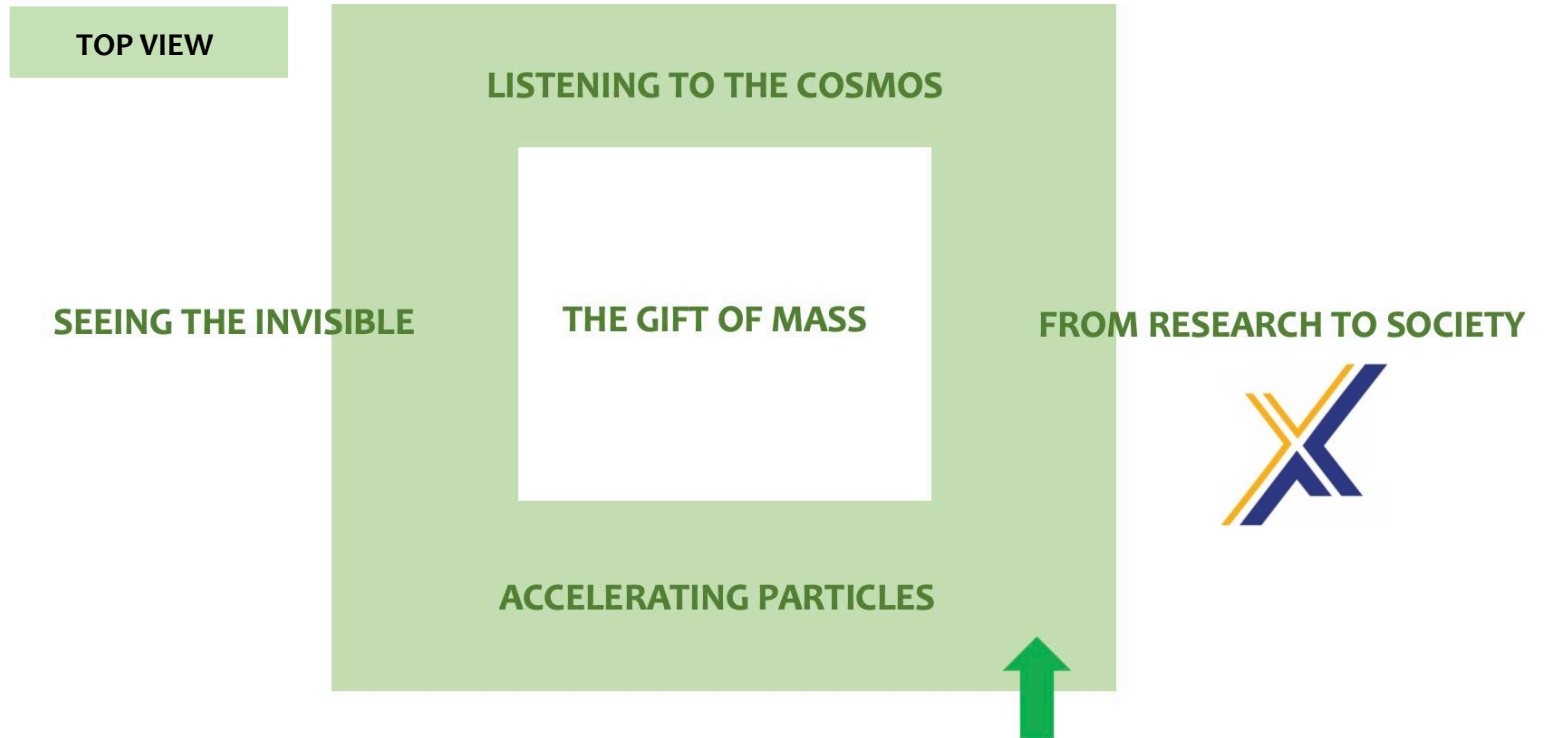
- Seminars (in person and streamed online on the INFN-LNF YouTube channel) – *4 times a year*
- Guided tours to the Bruno Touschek Visitor Centre and to SPARC_LAB/Plasma Lab – *monthly*
- Science demonstrations and experimental sessions on plasma accelerators
- News, videos, footage for reports and documentaries



Bridging science and society, sharing knowledge, place for formal and informal physics education activities

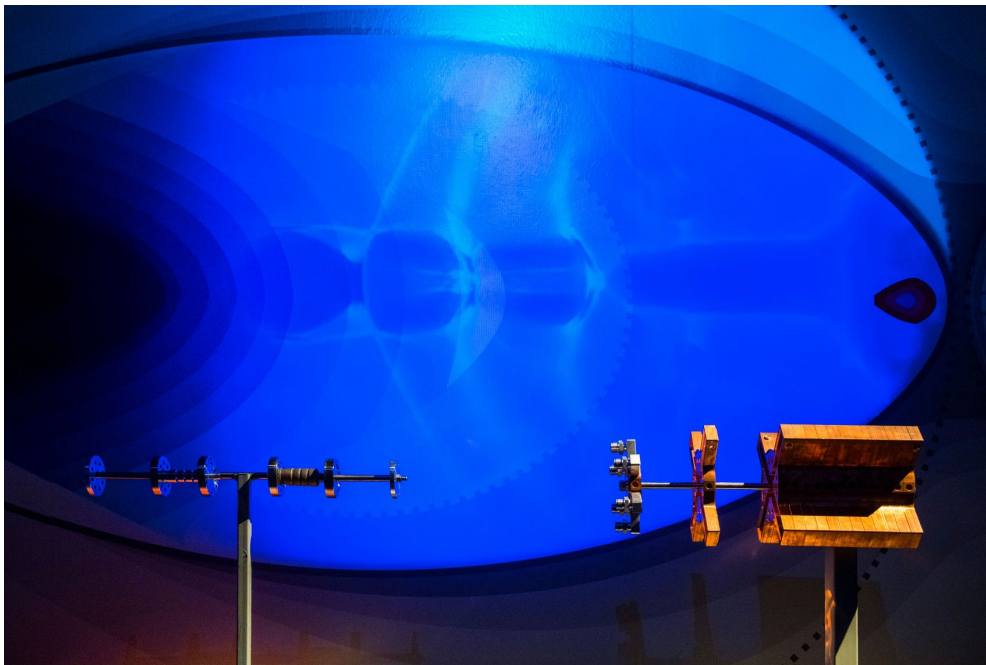
Chronicle the history of the Laboratory with a focus on particle accelerators and detectors

Parts of experiments, video mapping, multimedia, hands-on/body-on experiments, installations

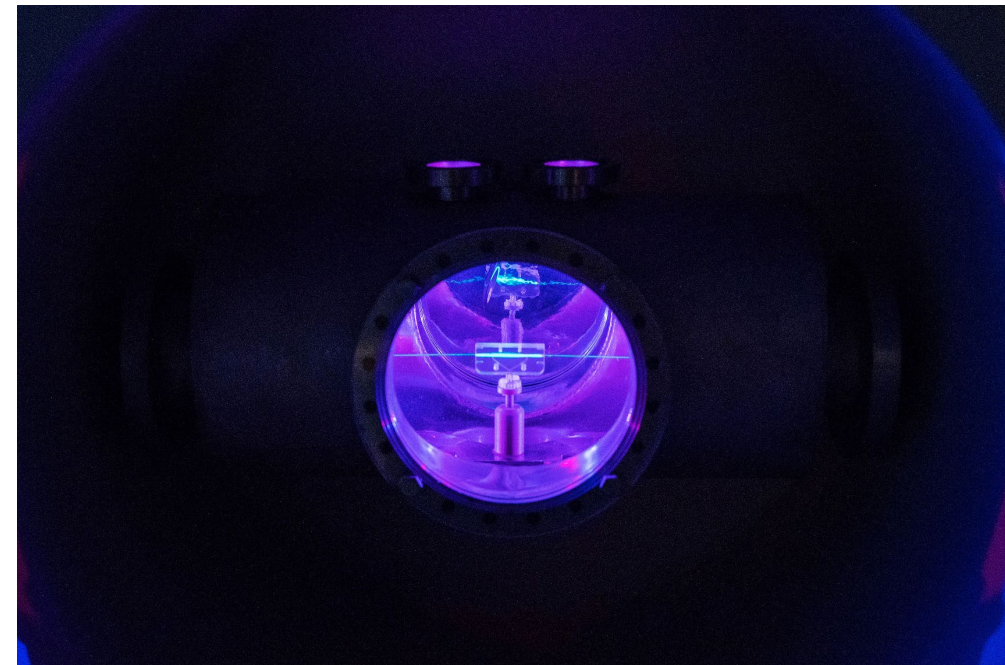




Future developments – From Research to Society



Radiofrequency cavity

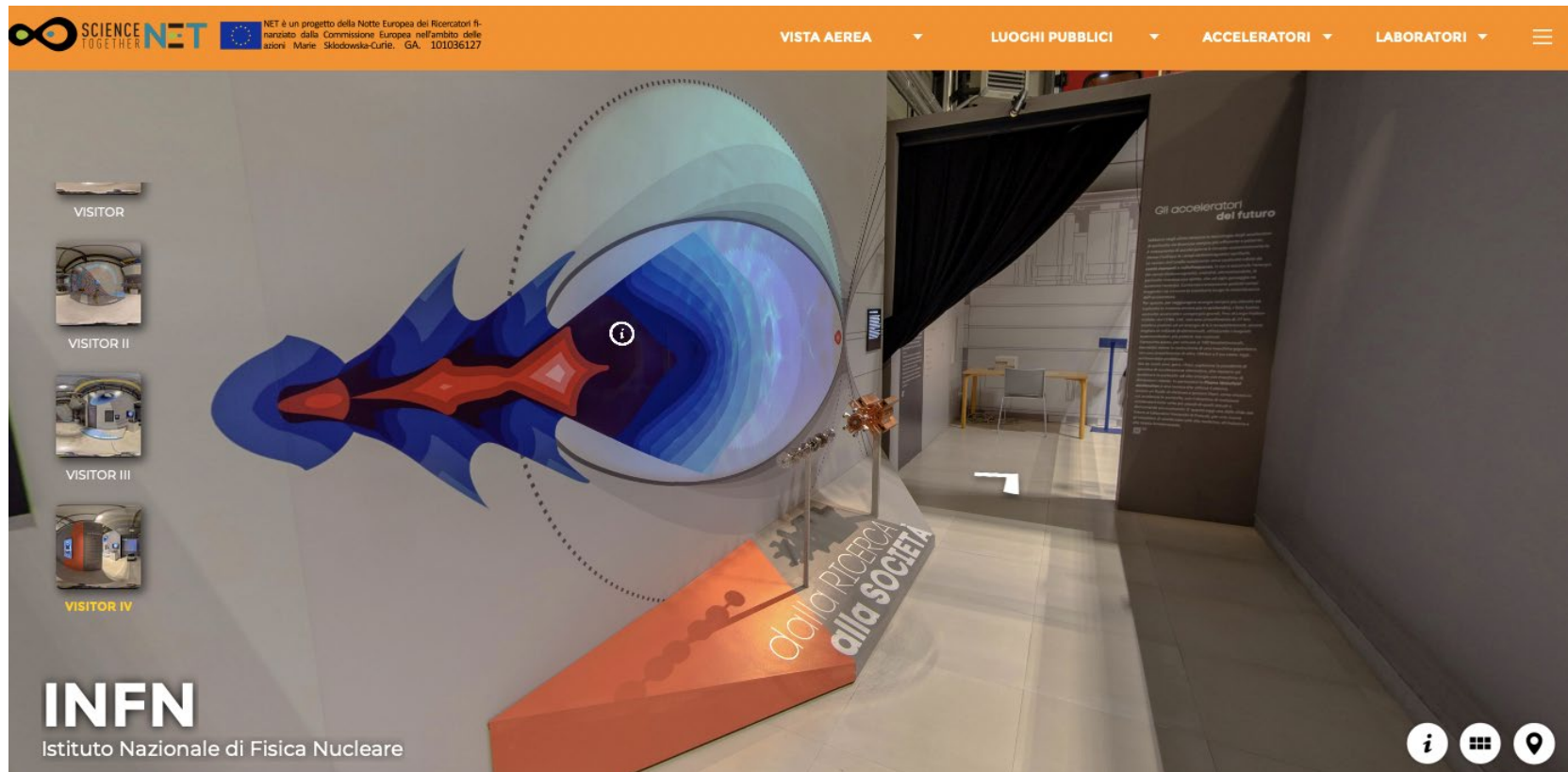


Gas-Filled Capillary Plasma for Laser Wakefield Acceleration



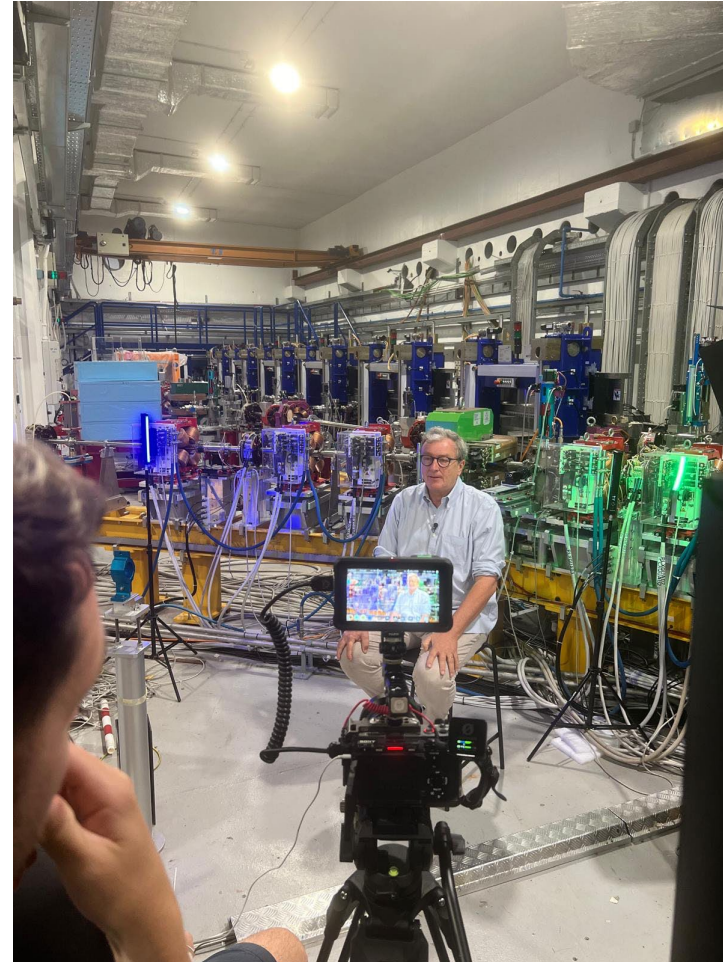
Virtual tour

<https://www.teravista.it/inf/>



ECFA
Plenary
Meeting
July 2024





Documentary on the legacy of Enrico Fermi – Focus tv

Student program

Primary School
Middle School
High School
University

The main goals are:

- to inspire and to motivate students towards science;
- to raise awareness of the latest issues in physics and their societal impact;
- to encourage STEM careers.

Events carried out related to EuPRAXIA-PP

INSPYRE International School on modern Physics and Research, April

INFN LNF Summer School, June

Target: High school students

Type of activity: lectures, hands-on activities, guided tours

Discussed topics: modern physics, research and technology and their applications, focus on accelerators

Number of total participants: **82 students**

Excellence course for Bachelor's and Master's students, July

Accelerators Physics

Type of activity: lectures, guided tours, hands-on experiments

Number of participants: **37 students**

Guided Tours to the Bruno Touschek Visitor Centre and LNF experimental sites

Target: High, middle and primary school students, University students

Type of activity: informal education, out-of-school learning, guided tours

Discussed topics: INFN research activities, general and modern physics and applications

Number of participants [Sept 2023 – May 2024] : **3931 students**

Job Placement Day Rome Technopole - March, 20 2024

Target: University students

Type of activity: presentation of INFN research activities, careers perspectives and job opportunities

Number of participants : **25 students**

Teacher program

Middle School
High School

The main missions are:

- raising awareness towards different research fields
- supporting teachers in teaching/learning physics with a focus on experiments
- sharing experiences and knowledge and enhancing curiosity for physics to be transferred to students

Events carried out related to EuPRAXIA-PP

High School Teachers

Title: Incontri di Fisica/Physics Meetings

Type of activity: training and refresher course aimed to promote and support learning/teaching of modern Physics, frontal lectures, hands-on experiments (see experimental activity: Plasma accelerators)

Dates: November

Number of participants: 140

Middle School Teachers

Title: AggiornaMenti

Type of activity: training and refresher course aimed to promote and support learning/teaching using hands-on methodology

Dates: January-February and July

Number of participants: 45

General public

Events carried out related to EuPRAXIA-PP

OpenLabs, INFN LNF Open Day

Type of activity: guided tours, public lectures, exhibitions, laboratory-based activities, scientific demonstrations and a very rich program for kids. Corner dedicated to EuPRAXIA-PP

Date: 18 May 2024

Number of participants: 2,200

European Researchers' Night – sciNce Together NET project

Call HORIZON-MSCA-2023-CITIZENS-01

Type of activity: informal education, lifelong learning, exhibition, corner dedicated to EuPRAXIA-PP

Dates: 29-30 September 2023

The activity took place at: Città dell'Altra Economia, Roma

Number of participants: 15,000 (in 2023)

Guided Tours to the Bruno Touschek Visitor Centre

Type of activity: informal education, lifelong learning

Discussed topics: INFN research activities, modern physics and its applications

Number of participants: 200



Upcoming activities

Implementation of exhibits for primary and middle school students aimed at presenting the key concepts at the basis of particle accelerators.

Activity in collaboration with INFN Kids, national public outreach project supported by INFN Third Mission Commission

EuPRAXIA event for schools

(to be defined)

Target: High school students

Number of expected participants: 150

Type of outreach events: plenary talk in the Auditorium and guided tour

Target: primary middle school pupils

Number of expected participants: 100 (50 primary school pupils and 50 middle school pupils)

Type of outreach events: hands-on laboratory-based experience on electricity or matter and light

Electricity: structure of atom, characteristics of the electron, Coulomb's law, conductors and insulators, charging: friction, induction and contact/conduction, electrostatic machines, electric discharge in gases (plasma ball).

Matter and light: states of matter and main characteristics, atomic structure, phases of change (experiments involving heat and vacuum), focus on plasma, analysis of gas discharge tube containing Hydrogen, Neon and Mercury using a spectroscope realized by students with low-tech materials.

Upcoming activities

Video mapping, virtual and augmented reality-based products, whose realization is currently ongoing, will be realized to explain to the audience how particle accelerators work and the development of medical devices in the field of particle accelerators, alongside experimental tests for their validation.

Activity carried out in the framework of Piano Nazionale di Ripresa e Resilienza - Missione 4 Istruzione e Ricerca - Componente 2 - Investimento 1.5 ("PNRR"), funded by the European Union - Next GenerationEU - Progetto "Ecosistemi dell'Innovazione" - Rome Technopole



- We have created a clear and strong **EuPRAXIA brand** – very important for a future distributed user facility.
- We maintain an attractive **website** and various **social media channels**.
- Very close connection between INFN and ULIV through **weekly meetings**.
- Our regular news articles and press releases target **diverse audiences**, amplified by established media contacts.
- We engage the **general public** through innovative outreach events and science festivals.
- All of our activities are closely connected with EuPRAXIA-DN, APS, etc.