



EuCAIF

European

Coalition

for AI

in Fundamental Physics

European Coalition for AI in Fundamental Physics

 **Upcoming**

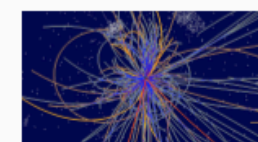
EuCAIFCon 2026

August 24 - 28, Heidelberg



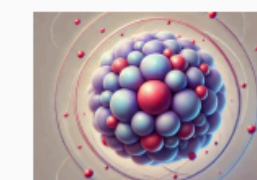
Theoretical physics

Crafting mathematical frameworks to predict and explain the fundamental laws of nature.



Particle physics

Unlocking the secrets of the tiniest building blocks of the universe.



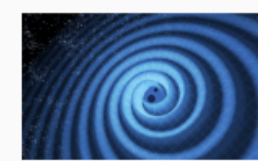
Nuclear physics

Studying atomic nuclei to understand the forces that power stars and shape the elements around us.



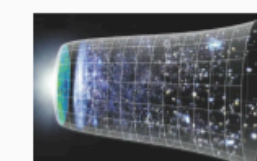
Astroparticle physics

Exploring cosmic rays, neutrinos, and dark matter to reveal the universe's mysteries.



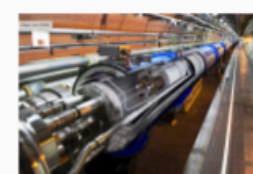
Gravitational waves

Listening to the ripples in spacetime to witness the most violent cosmic events.



Cosmology

Investigating the origins, evolution, and ultimate fate of the universe on the grandest scales.



Accelerator physics

Pushing the frontiers of technology to accelerate particles and probe the structure of matter.

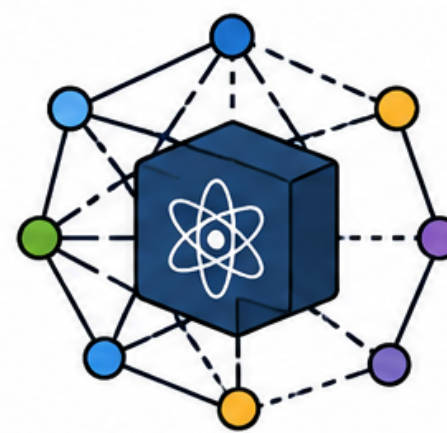
No community can build **Scientific AI** alone.

Shared Infrastructure



Common compute, tools and platforms

Shared Models



Foundation models for physics

Shared Benchmarks



Common tasks, metrics and datasets

Shared Training



People, skills and knowledge

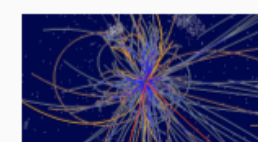


Together we accelerate discoveries.



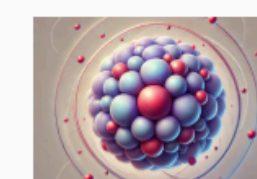
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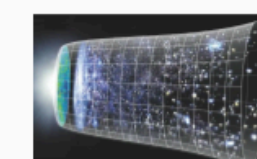
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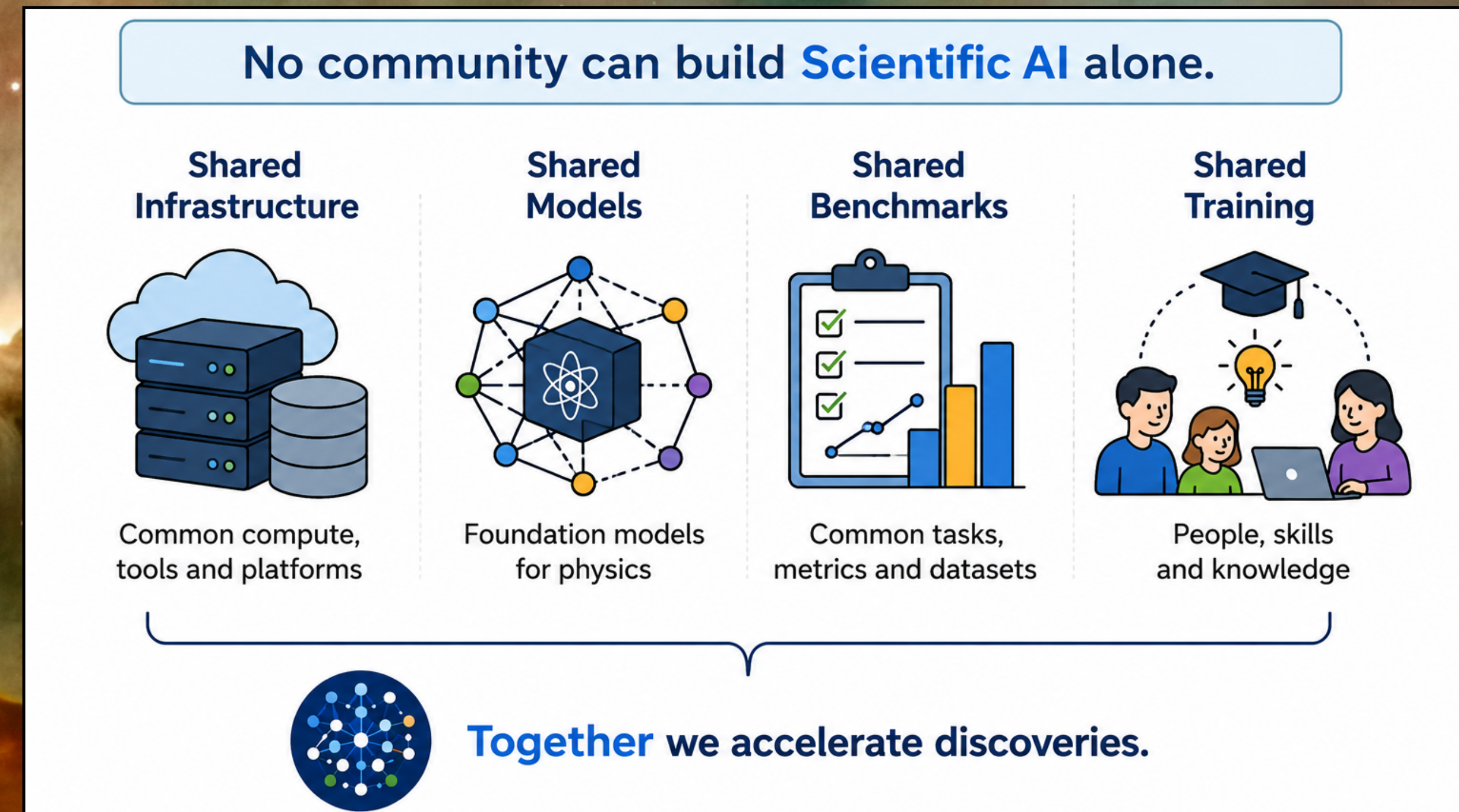
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EuCAIF is creating a **network of researchers at European institutions** to **build bridges** between **fundamental physics and AI-research** and to **connect high-caliber scientists** (i) visibly advancing both fields, (ii) leading the community in Europe, and (iii) training the young generation realizing this transformation.



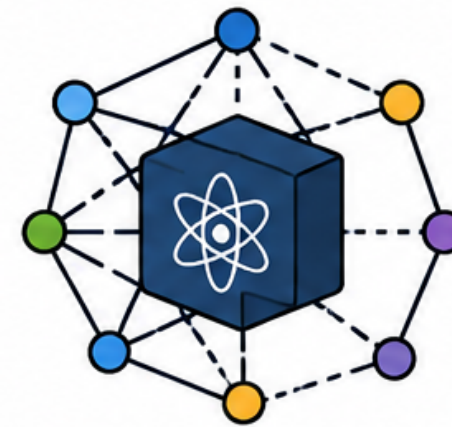
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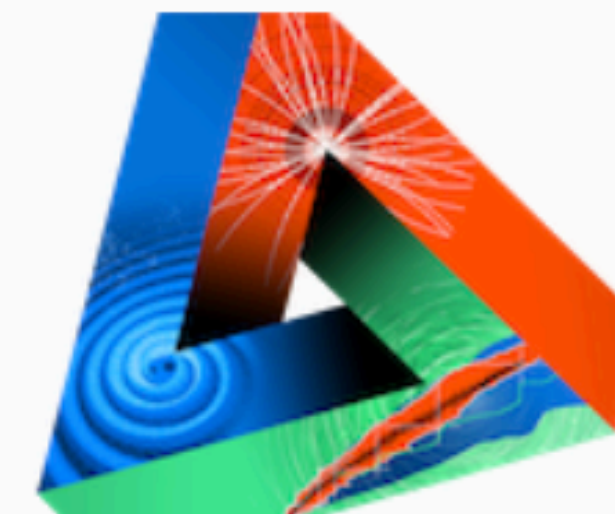


People, skills and knowledge



Together we accelerate discoveries.

EuCAIF is an European initiative for advancing the use of Artificial Intelligence (AI) in Fundamental Physics. Members are working on particle physics, astroparticle physics, nuclear physics, gravitational wave physics, cosmology, theoretical physics as well as simulation and computational infrastructure.



JENAA

Joint ECFA-NuPECC-APPEC Activities

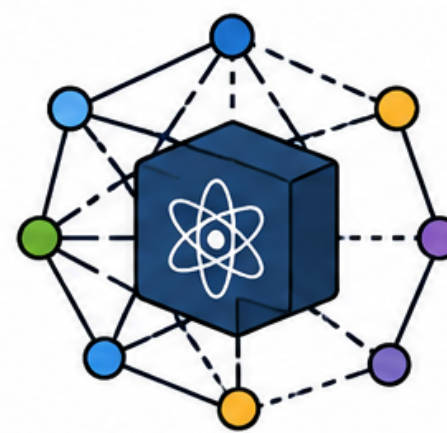
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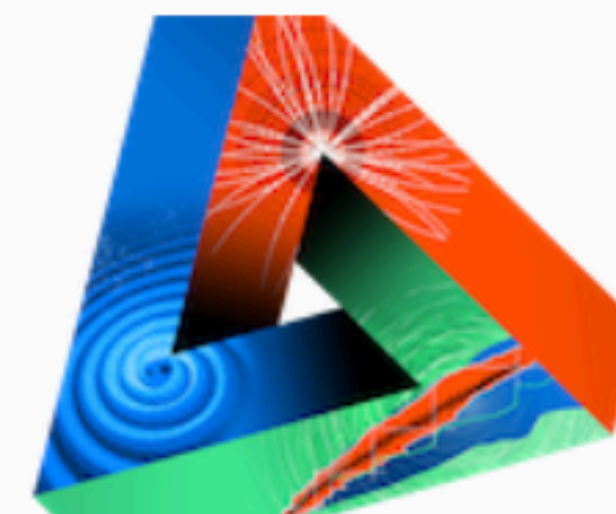


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JENAA

Joint ECFA-NuPECC-APPEC Activities

2019 - call for **EoIs** to promote synergies among three communities
2023 - “Birth” of EuCAIF as endorsed EoI to JENAA



Strategic White Paper on AI Infrastructure for Particle, Nuclear, and Astroparticle Physics: Insights from JENA and EuCAIF

Sascha Caron,^{*a,b} Andreas Ipp,^{*c} Gert Aarts,^d Gábor Bíró,^{e,f} Daniele Bonacorsi,^{g,h} Elena Cuoco,^{g,h} Caterina Doglioni,ⁱ Tommaso Dorigo,^{j,k} Julián García Pardiñas,^l Stefano Giagu,^m Tobias Golling,ⁿ Lukas Heinrich,^o Ik Siong Heng,^p Paula Gina Isar,^q Karolos Potamianos,^r Liliana Teodorescu,^s John Veitch,^p Pietro Vischia,^t Christoph Weniger^u

^{*} *Convener*

^a *IMAPP, Radboud University, Nijmegen, The Netherlands*

^b *Nikhef, Science Park, Amsterdam, The Netherlands*

^c *Institute for Theoretical Physics, TU Wien, Wiedner Hauptstraße 8-10, 1040 Vienna, Austria*

^d *Department of Physics, Swansea University, SA2 8PP, Swansea, United Kingdom*

^e *HUN-REN Wigner Research Centre for Physics, 29-33 Konkoly-Thege Miklós út, H-1121 Budapest, Hungary*

^f *Eötvös Loránd University, Institute of Physics and Astronomy, 1/A Pázmány Péter sétány, H-1117 Budapest, Hungary*

^g *Physics and Astronomy Department (DIFA), Alma Mater Studiorum- Università di Bologna, Italy*

^h *INFN Sezione di Bologna Viale C. Berti Pichat 6/2 - 40126 Bologna, Italy*

ⁱ *University of Manchester, Oxford Road, M13 9PL, Manchester, United Kingdom*

^j *Luleå University of Technology, Laboratorievägen 14, Luleå, Sweden*

^k *Istituto Nazionale di Fisica Nucleare, sezione di Padova, via F. Marzolo 8, 35131 Padova, Italy*

^l *Laboratory for Nuclear Science, Massachusetts Institute of Technology (MIT), 77 Massachusetts Ave, Cambridge, MA 02139, USA*

^m *Department of Physics, Sapienza University of Rome, Italy*

ⁿ *Département de Physique Nucléaire*

^o *Physics Department, Technical University of Munich*

^p *School of Physics and Astronomy, University of Exeter*

^q *Institute of Space Science - INFLP, Bucharest, Romania*

^r *Physics Department, University of Liverpool*

^s *Brunel University of London, Kingston, UK*

^t *Universidad de Oviedo and ICTEA, Oviedo, Spain*

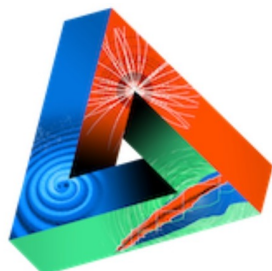
^u *GRAPPA, Institute of Physics, University of Amsterdam, The Netherlands*

E-mail: scaron@nikhef.nl, and caron@nikhef.nl

Artificial Intelligence

We recommend establishing a dedicated organizational structure to coordinate strategic investments in Artificial Intelligence for fundamental physics. We also recommend conducting a feasibility study to compare a centralized Graphics Processing Unit (GPU) facility with federated and hybrid High Performance Computing infrastructures. Additionally, we advocate for supporting physics-specific large language models, foundation models, and benchmarking while prioritizing scalable computing, robust data infrastructure, and Machine Learning operations.

JENA White Paper on European Federated Computing



JENAA

Joint ECFA-NuPECC-APPEC Activities

The JENA Computing Initiative

March 30, 2025

The Joint ECFA-NuPECC-APPEC (JENA) Activities launched an initiative ([JENA Computing](#)) in 2023 to promote the increasing need for discussions on the strategy and implementation of European federated computing at future large-scale research facilities. In workshops and dedicated working groups on specific topics, expert groups from all relevant research areas were formed to compile an overview of existing strategies in the individual countries and communities. Here we present a summary of the resulting [Working Group Reports](#), including the most important recommendations from these areas of computing. Furthermore, an additional chapter on sustainability in the field of computing is included. This version of the JENA White Paper on European Federated Computing serves as a basis for discussion at the [JENA Seminar](#) in April 2025 and as input to the European Strategy for Particle Physics - 2026 update ([ESPPU](#)), and may be revised thereafter.

Contributors:

JENA board representatives:

Paris Sphicas, Lidija Zivkovic (ECFA)
Eberhard Widmann, Sissy Körner (NuPECC)
Carlos Peña Garay, Julie Epas (APPEC)

Members of the JENA Computing Initiative:

Stefano Bagnasco, Concezio Bozzi, Simone Campana, Sascha Caron, Xavier Espinal, Andreas Haungs (chair), Alberto Iess, Andreas Ipp, Marc Labiche, Giovanni Lamanna, Paul Laycock, Marek Lewitowicz, Adrien Matta, Gonzalo Merino, Johan Messchendorp, Arnau Rios, Stefan Roiser, Thomas Schörner, Graeme A Stewart, Patrice Verdier

[Link to White Paper](#)

[Link to White Paper](#)

EuCAIF - Objectives



Infrastructure

Shared, federated computing for science

- Federated computing and data infrastructure
- Tools, software and open platforms
- Sustainable and secure by design



Foundation Models

AI models tailored to scientific data

- General-purpose and domain-specific models
- Pre-training, fine-tuning and adaptation
- Open, reproducible and reusable



Benchmarks & Datasets

Common tasks and data to measure progress

- Community benchmarks and metrics
- Curated datasets and data standards
- Reproducibility and open science



Community & Training

People, skills and knowledge exchange

- Schools, workshops and tutorials
- Careers, diversity and next generation
- Cross-community collaboration



Funding & Strategy

A common voice for impact and investment

- Engage with EU initiatives and programs
- Support proposals and coordinate efforts
- Contribute to European strategies



EuCAIF - Organisation

Management board
(5 persons)

Rotating from steering group, in office since Mai 2026 (elected):

- Elena Cuoco (DIFA - Alma Mater Studiorum University of Bologna and INFN, Italy)
- Ik Siong Heng (University of Glasgow, United Kingdom)
- Judith Katz (DESY Hamburg)
- Johan Messchendorp (GSI/RUB, Germany)
- Tilman Plehn (Heidelberg University, Germany)
- *Former members: Sascha Caron (Nikhef) and Christoph Weniger (UvA)*

+ International
Advisory Board

EuCAIF “Fellows”
(presently 69 scientists)

EuCAIF (junior) fellows. Fellows oversee the EuCAIF initiative’s strategic direction, provide guidance, and participate in regular meetings to make key decisions, including electing management board members. Scientists based in Europe with a strong track record and high visibility in AI and fundamental physics can apply for a (renewable) five-year EuCAIF fellowship.

Members
(....)

EuCAIF members. We welcome anyone involved in AI applications to fundamental physics research to become a EuCAIF member, with a special focus on young researchers at the PhD and postdoc levels. Diversity in geography and research fields is a core value of EuCAIF’s mission. To become a member, candidates must receive endorsements from two EuCAIF fellows. If interested, please contact us for more information.

Governance guidelines and procedures: [see this link!](#)

EuCAIF - Fellows



ROLE OF FELLOWS

Fellows guide the strategic direction of EuCAIF, contribute to its activities, and participate in regular meetings, including the election of Management Board members.



GROWTH

Initial proposal

39
Fellows



Current

69
Fellows

+ ongoing applications



SELECTION PROCESS

- ✓ Open call for Fellow applications
- ✓ Each application reviewed by **3 Fellows**
- ✓ Evaluation based on:
 - AI contributions
 - Publications in *AI for fundamental physics*
- ✓ Selection following the established Fellow Selection Procedure



NEW: JUNIOR FELLOWS



Advanced early-career researchers



Typically tenure-track (or equivalent)



Not yet holding a tenured or permanent position at a European institution

EuCAIF - Working Groups and Activities

- **WG 1: Foundation models & discovery**
- **WG 2: AI assisted co-design** of future ground- and space-based detectors
- **WG 3: FAIR-ness & sustainability**
- **WG 4: ML and AI Infrastructure for JENA**
- **WG 5: Building bridges** - Community, connections and funding
- **WG 6: Simulation Based Inference**
- **WG 7: LLMs and agents**

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New

EuCAIF - Working Groups and Activities

Since 2024

- WG 1: **Foundation models & discovery** —> *example community initiative toward AI foundation models: EuCAIF Open Data and Simulator Day*
 - WG 2: **AI assisted co-design** of future ground- and space-based detectors —> *connection with MODE and potentially with IHL*
 - WG 3: **FAIR-ness & sustainability**
 - WG 4: **ML and AI Infrastructure for JENA** —> *completed White Paper!* 
- WG 5: **Building bridges** - Community, connections and funding —> *Funded cost action “AIFORIA” (CA25172) to support EuCAIF activities*
 - WG 6: **Simulation Based Inference** —> *starting...*
 - WG 7: **LLMs and agents** —> *planned kick-off in Heidelberg*

New



RAISE: Resource for AI Science in Europe

Science for AI and AI in science ~100M/year

RAISE is conceived as a **virtual research institute for excellent European research on and with AI**. It will pool computational power, data, talent and research funding and make this available to European researchers. By creating synergies and stimulating a cross-disciplinary dynamic among excellent researchers and labs working with AI, it aims to unlock scientific breakthroughs and develop novel AI technologies, reinforcing Europe's global competitiveness in AI science.

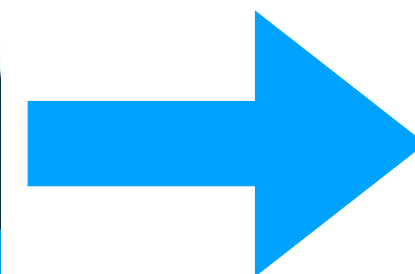
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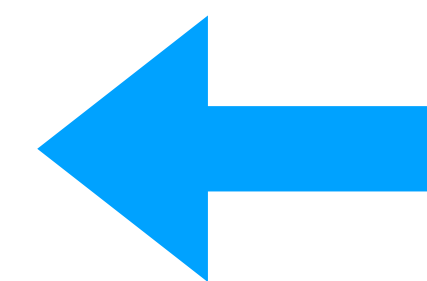


SCIANCE - coordinating support action for RAISE lead by EuCAIF Fellows (physics)
Kick-off meeting at EuCAIFCon 2026

EuCAIF Conference



EuCAIFCon 2024 in Amsterdam

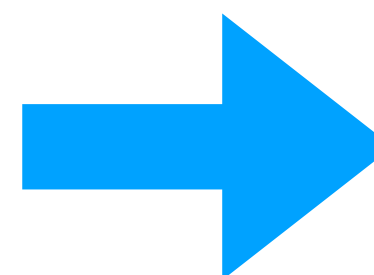


>270 participants
160 contributions
Talks+posters+panel discussions
Working Group Meetings

30 April 2024 to 3 May 2024
Amsterdam, Hotel CASA

Jun 16 – 20, 2025
THotel, Cagliari, Sardinia, Italy

EuCAIFCon 2025 in Cagliari



>200 participants
156 contributions
Talks+posters+panel discussion
Working Group Meetings
SciPost Physics Proceedings



EuCAIF Conference - upcoming!

Call for Abstracts

Opening day

Submission deadline

Feb 6, 2026, 2:37 PM

Jul 31, 2026, 11:59 PM

EuCAIFCon 2026

Heidelberg,
Aug 24 – 28, 2026

Local organizing committee:

- Henning Bahl (bahl@thphys.uni-heidelberg.de)
- Ranit Das (das@thphys.uni-heidelberg.de)
- Sascha Diefenbacher (diefenbacher@thphys.uni-heidelberg.de)
- Caroline Heneka (heneka@thphys.uni-heidelberg.de)
- Marvin Kohls (m.kohls@gsi.de)
- Johan Messchendorp (j.messchendorp@gsi.de)
- Ayodele Ore (ore@thphys.uni-heidelberg.de)
- Tilman Plehn (plehn@uni-heidelberg.de)

Plenary Speakers:

- Adrian Oeftiger (Linacre College)
- Dario Hügel (Barra Labs)
- Emille Ishida (Clermont Auvergne)
- Jan Kieseler (KIT)
- Johann Brehmer (CuspAI)
- Lucie Flek (University of Bonn)
- Luigi DelDebbio (University of Edinburgh)
- Mario Krenn (University of Tübingen)
- Maximilian Dax (ELLIS Institute Tübingen)
- Michelle Kuchera (Florida State University)
- Nicole Hartman (TUM)
- Ramon Winterhalder (University of Milan)
- Roberto Trotta (SISSA)
- Tristan Bereau (University of Heidelberg)

[Link to Indico](#)



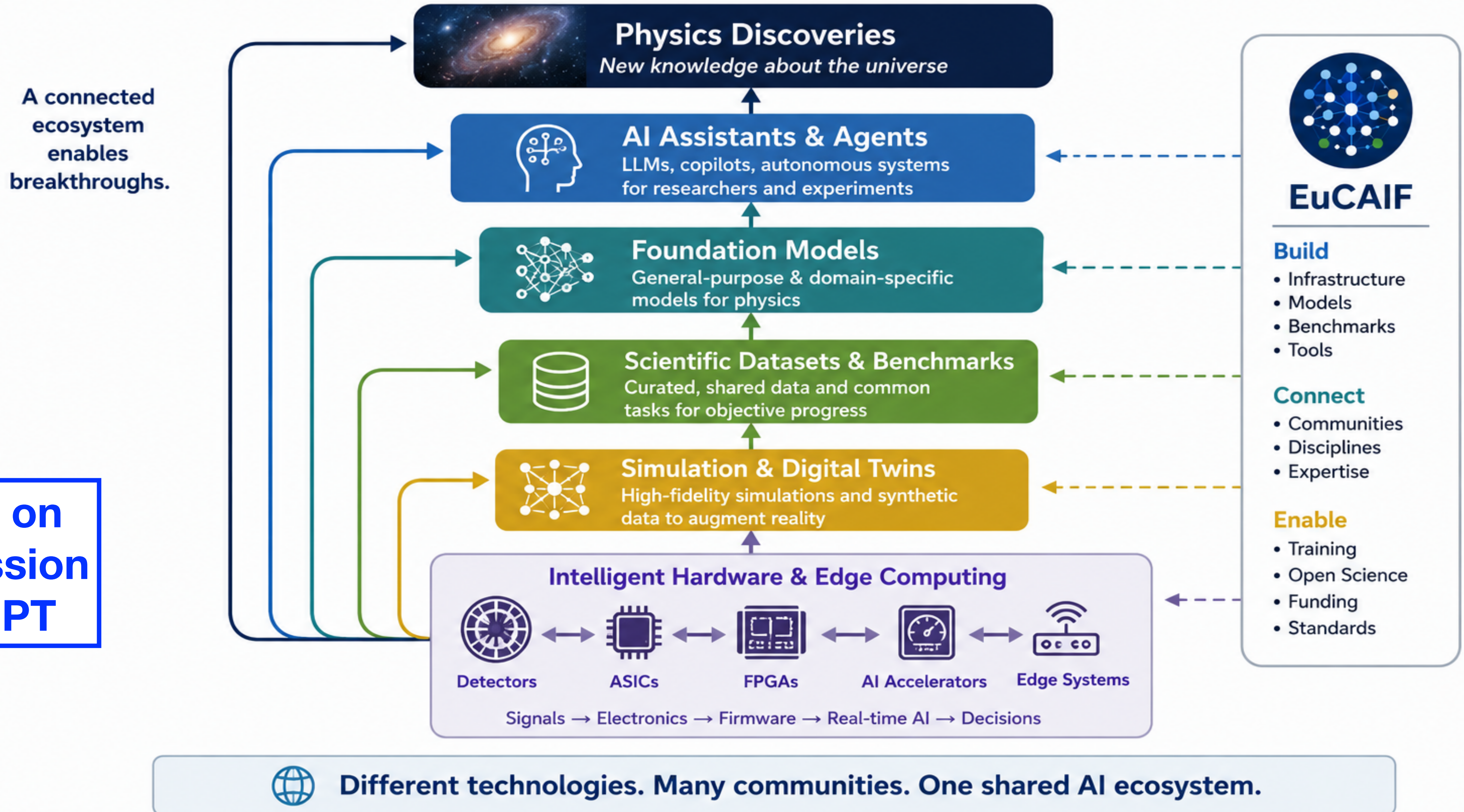
EuCAIF

What can EuCAIF offer to IHL?

What can IHL offer to EuCAIF?

The Scientific AI Stack

EuCAIF connects every layer – from intelligent hardware to discovery



EuCAIF and IHL/CmF - take aways

- **AI is becoming infrastructure for fundamental physics**
 - No single experiment or laboratory can build this infrastructure alone.
- **EuCAIF aims to connect communities across Europe**
 - Shared European AI infrastructure
 - Access to AI expertise
 - Foundation models and benchmarks
 - Training and open science
 - Visibility in European strategy
 - Coordinated funding
- **The Intelligent Hardware Lab is where scientific AI begins**
- **EuCAIF is where it becomes a European ecosystem!**

