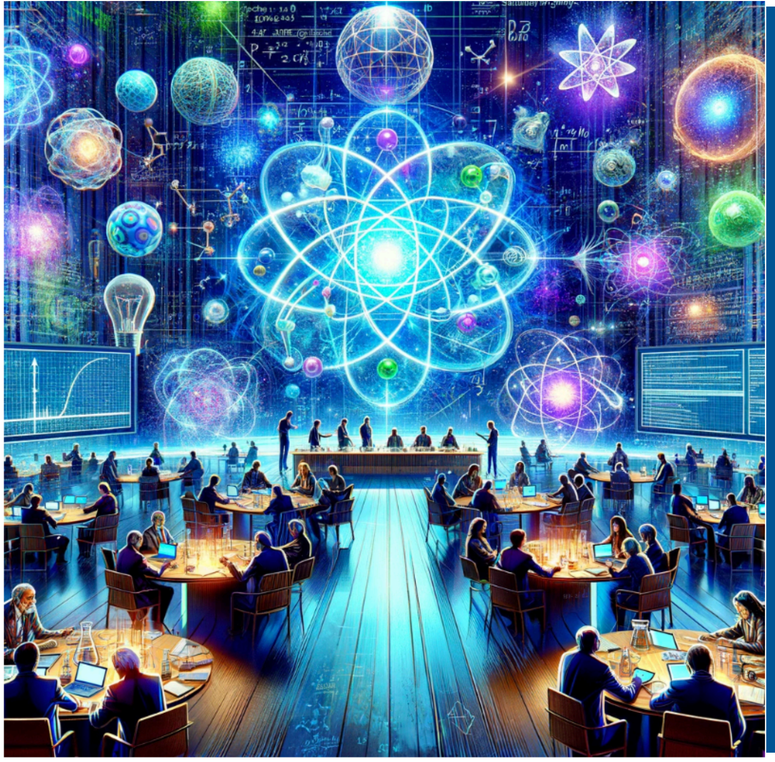


Present and Future Perspectives in Hadron Physics

LNF 17-19 June 2024

Dedicated to the memory of Carlo Guaraldo

Introducing LaVA - Lattice Virtual Academy

Maria Paola Lombardo INFN Firenze

on behalf of the LaVA Group

lattice virtual academy

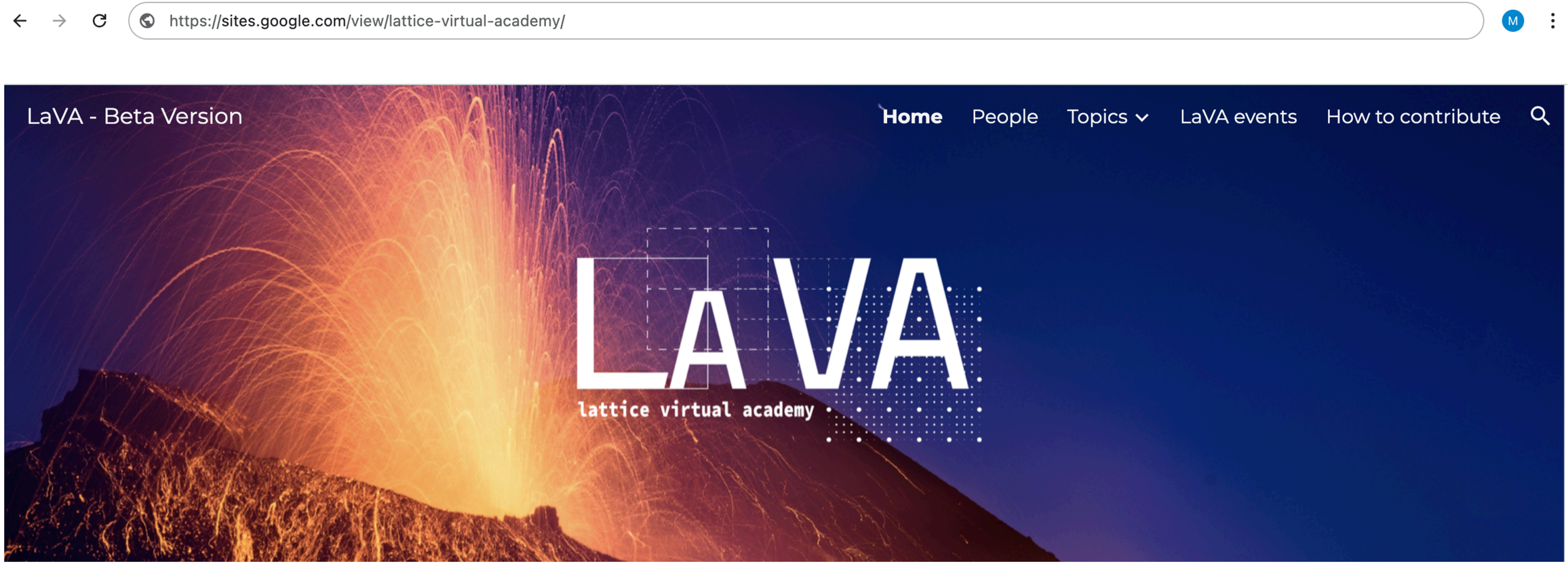
cost EUROPEAN COOPERATION IN SCIENCE & TECHNOLOGY

COSMIC WISPERS

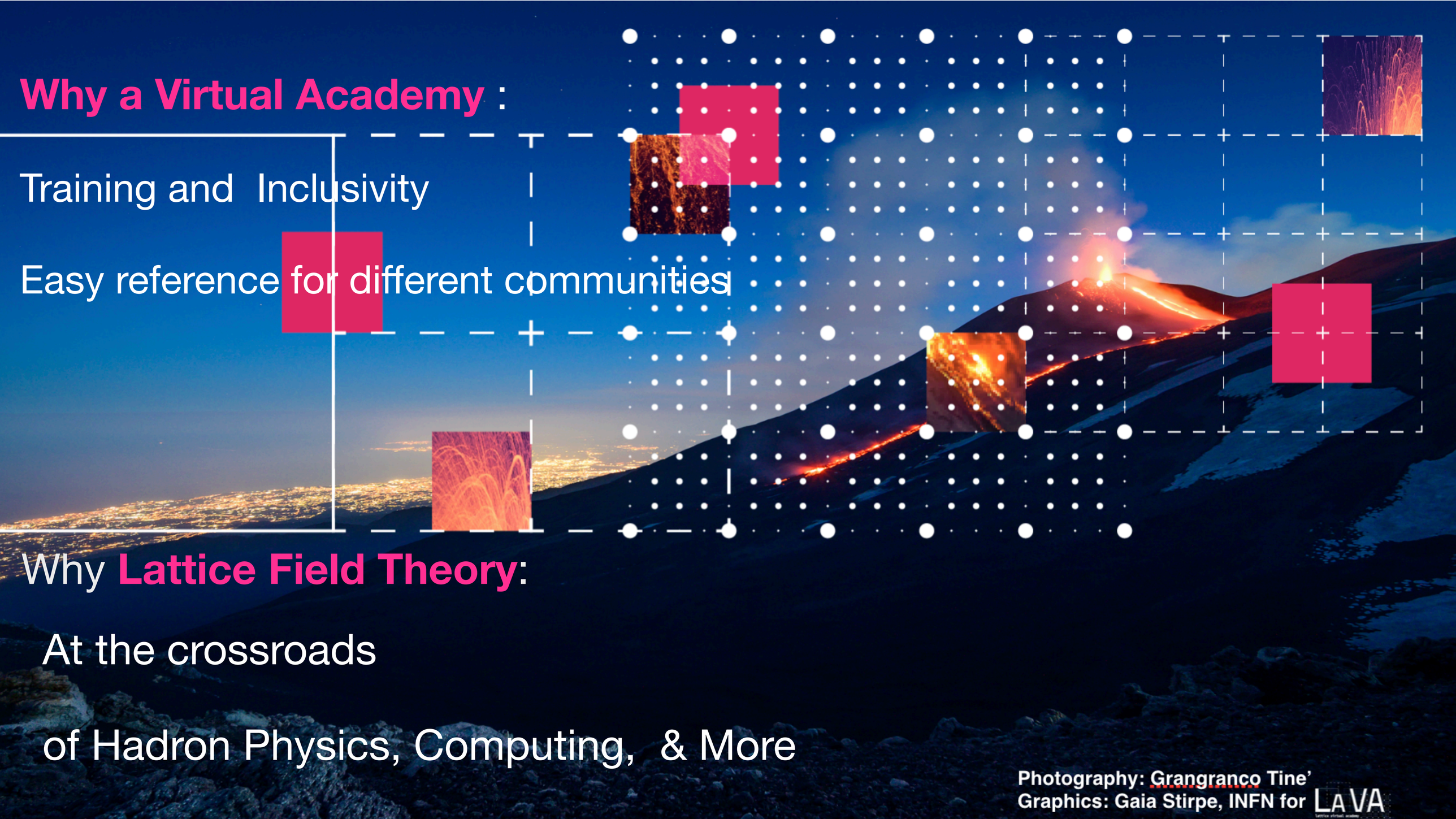
STRONG 2020

EuroHPC Joint Undertaking

..in a nutshell, LaVA is a WEB site ….



LaVA is a virtual platform for advanced e-learning in Lattice Field Theory



Why a Virtual Academy :

Training and Inclusivity

Easy reference for different communities

Why **Lattice Field Theory**:

At the crossroads

of Hadron Physics, Computing, & More

Photography: Grangranco Tine'
Graphics: Gaia Stirpe, INFN for LAVA

Lattice Field Theory

This week: talks by Gert Aarts “Hadrons under extreme conditions”

Mike Peardon “NA6-LatticeHadrons”

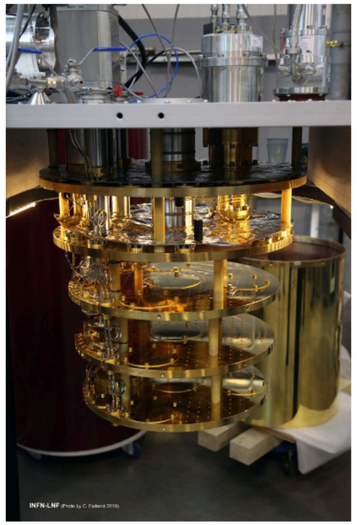
Lattice at the crossroads: Axions as a case study

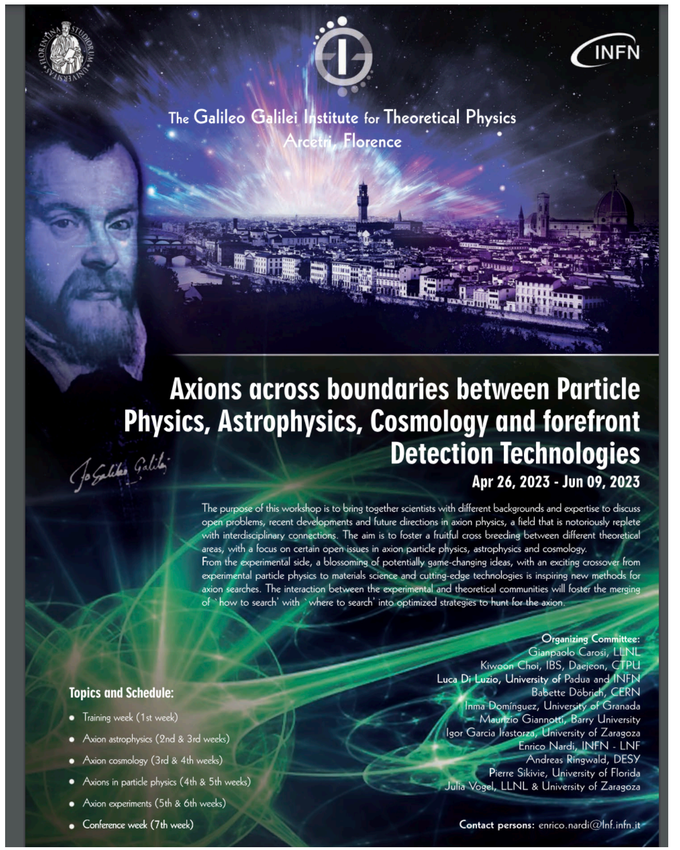
Wherever we go,

we hear about axions!

experimental searches@**LNF**

QUAX





COST Action on Cosmic Wispers:

COSMIC WISPERS

Claudio Gatti,**LNF** and MpL on the management comm

Axion **theory:**

GGI program

Coordinated

by Enrico Nardi, **LNF**

Lattice at the crossroads: Axions as a case study

Details on the lattice role in QCD axion on the

‘QCD topology’ section

coordinated by C. Bonanno of

the Strong-2020 Nt-6 deliverable:

ELSEVIER

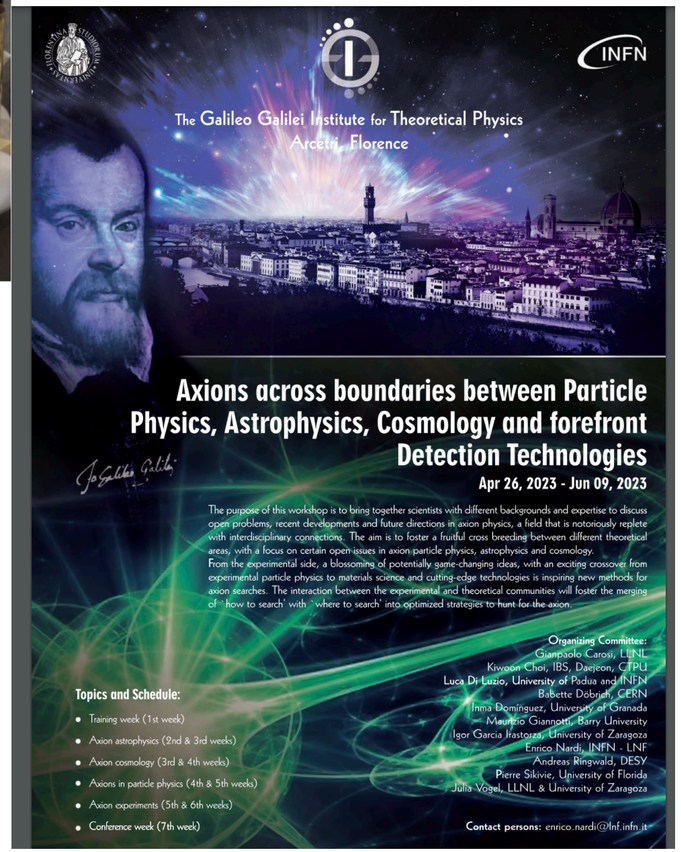
Progress in Particle and Nuclear Physics

Volume 133, November 2023, 104070

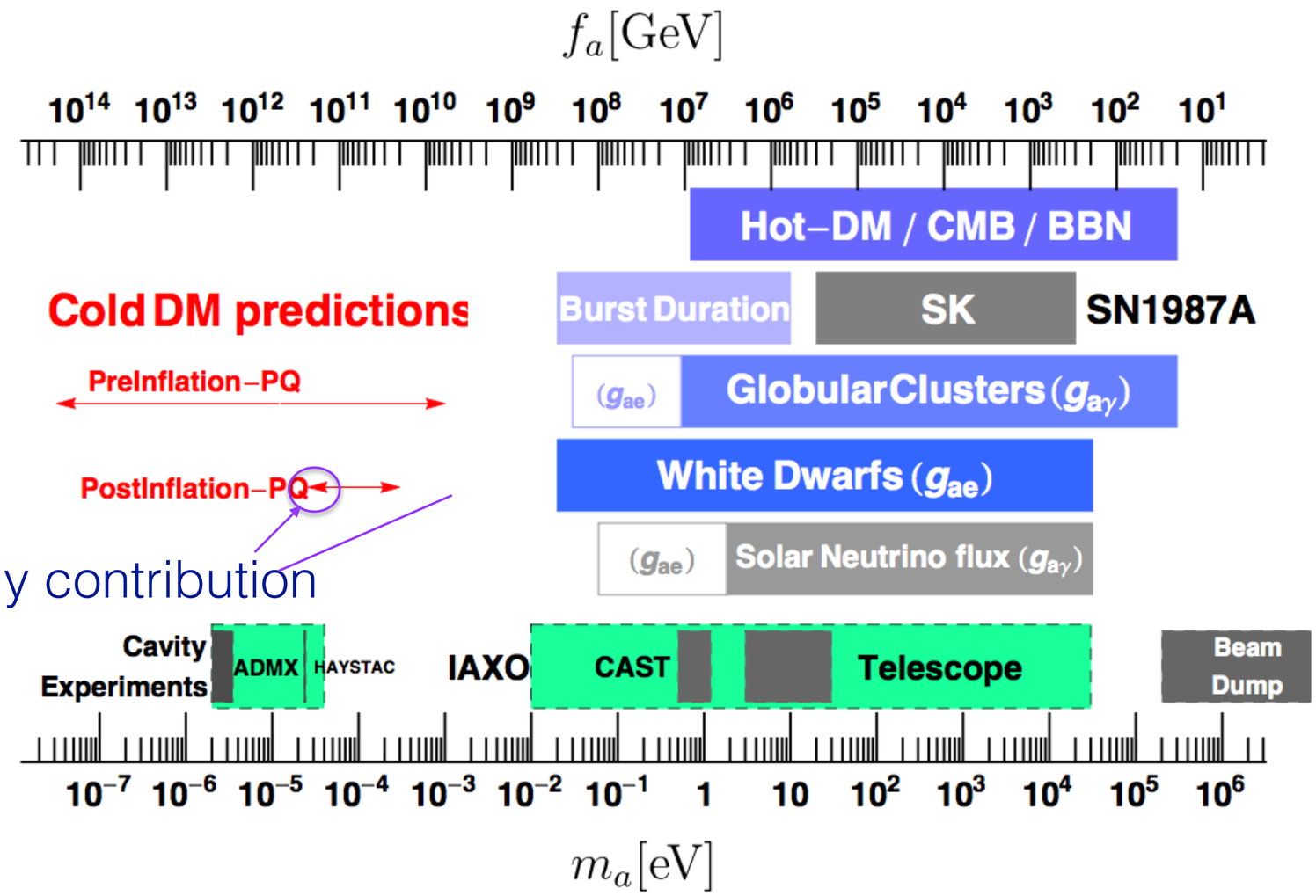
Review

Phase Transitions in Particle Physics: Results and Perspectives from Lattice Quantum Chromo-Dynamics

QUAX

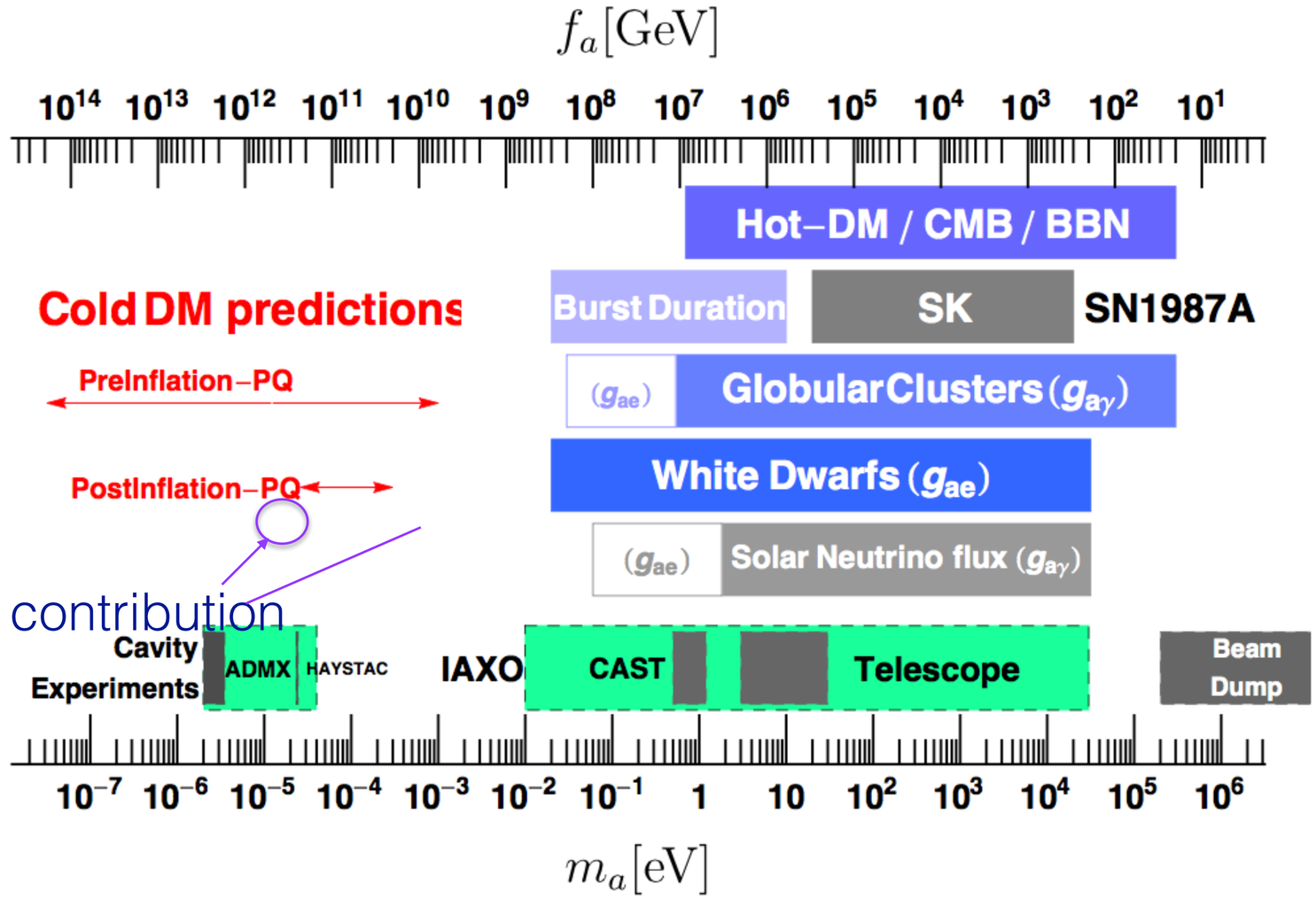


Lattice Field Theory and QCD axion



Lattice topology contribution

Lattice Field Theory and QCD axion



Lattice topology contribution

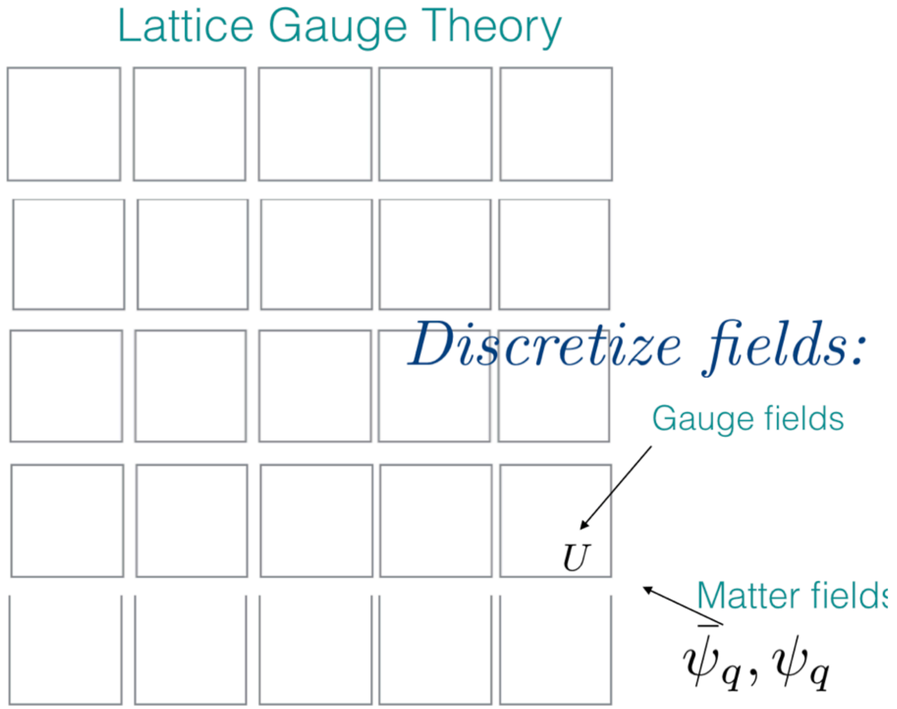
Placing these limits is highly non trivial:

Lattice Field Theory should be made accessible

Computing

Computational Strategy:

1) Rotation to imaginary time + discretisation



2) Monte Carlo Simulation

$$\langle 0|\mathcal{O}|0\rangle = \frac{\sum_\alpha \mathcal{O}_\alpha e^{-S_\alpha}}{\sum_\alpha e^{-S_\alpha}}.$$

Computationally Expensive!!!

The European landscape: EuroHPC

https://eurohpc-ju.europa.eu/

Leading the Way in European Supercomputing

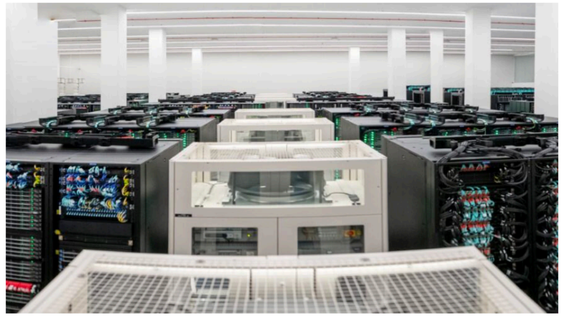
EuroHPC JU is a joint initiative between the EU, European countries and private partners to develop a World Class Supercomputing Ecosystem in Europe.

LUMI supercomputer

CSC (Image credits: Fade Creative)

LEONARDO supercomputer

Cineca



MareNostrum5 supercomputer

BSC

From the EuroHPC site

Budget

The EuroHPC Joint Undertaking is jointly funded by its members with a budget of around EUR 7 billion for the period 2021-2027.

Five domains:

Lattice

Biochemistry, Bioinformatics, Life Sciences, Physiology and Medicine

Chemical Sciences and Materials, Solid State Physics

Computational Physics: Universe Sciences, Fundamental Constituents of Matter

Earth System Sciences and Environmental Studies

Engineering, Mathematics and Computer Sciences

From the EuroHPC site

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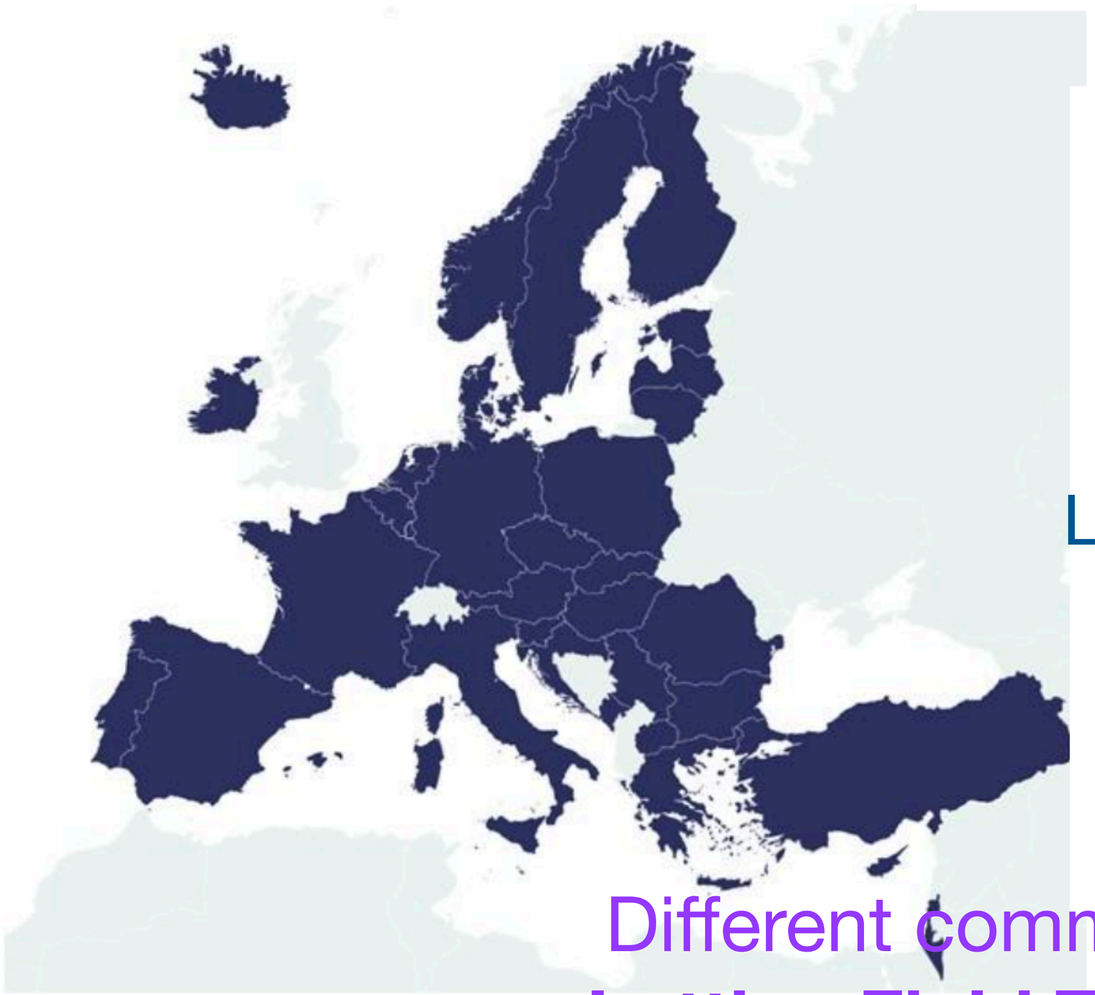

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Biochemistry, Bioinformatics, Life Sciences, Physiology and Medicine

Chemical Sciences and Materials, Solid State Physics

Lattice — Computational Physics: Universe Sciences, Fundamental Constituents of Matter

Earth System Sciences and Environmental Studies

Engineering, Mathematics and Computer Sciences

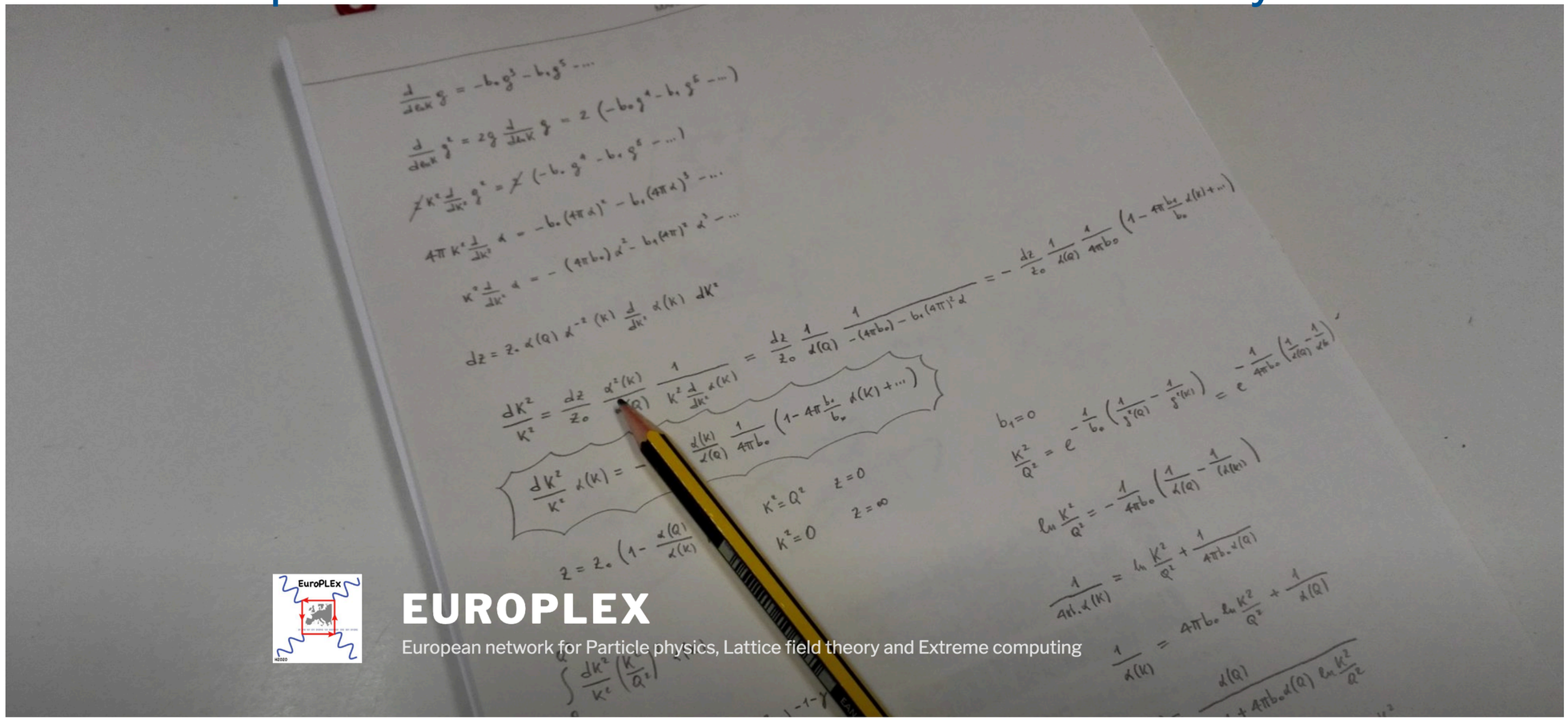
Different communities should know about Lattice:

Lattice Field Theory should be made accessible

Training

Many excellent on-line resources available:

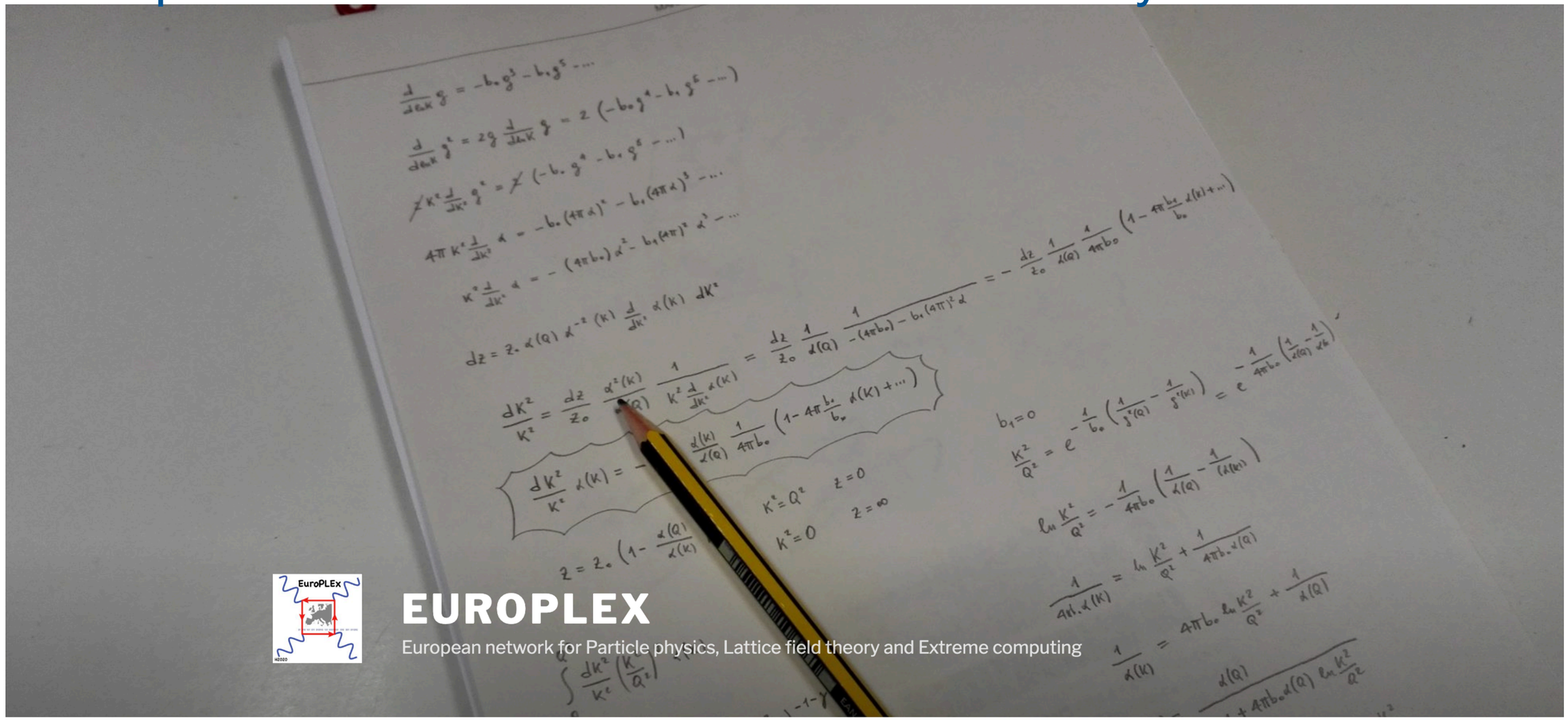
One example: Marie-Curie network coordinated by Francesco di Renzo



Many more examples of online schools during the pandemic

Many excellent on-line resources available:

Example: Marie-Curie network coordinated by Francesco di Renzo



Excellent on-line resources on **Lattice Field Theory:**

They should be preserved and enhanced

LaVA is a virtual platform for advanced e-learning in Lattice Field Theory

https://sites.google.com/view/lattice-virtual-academy

Launching event: February 2023

C. Bonanno

M. Peardon

MpL

LaVA meeting @ECT*

20 - 24 February, 2023

LaVA is a virtual platform for advanced e-learning and mixed learning in Lattice Field Theory and related areas which is under development within the Strong-2020 project and supported by FBK and by the INFN communication office. The first preparatory meeting took place from 20 to 24 February, 2023 at ECT*. The webpage of the meeting can be found here.

Presentation to the community: July 2023

Plenary talk by C. Bonanno at Lattice 2023

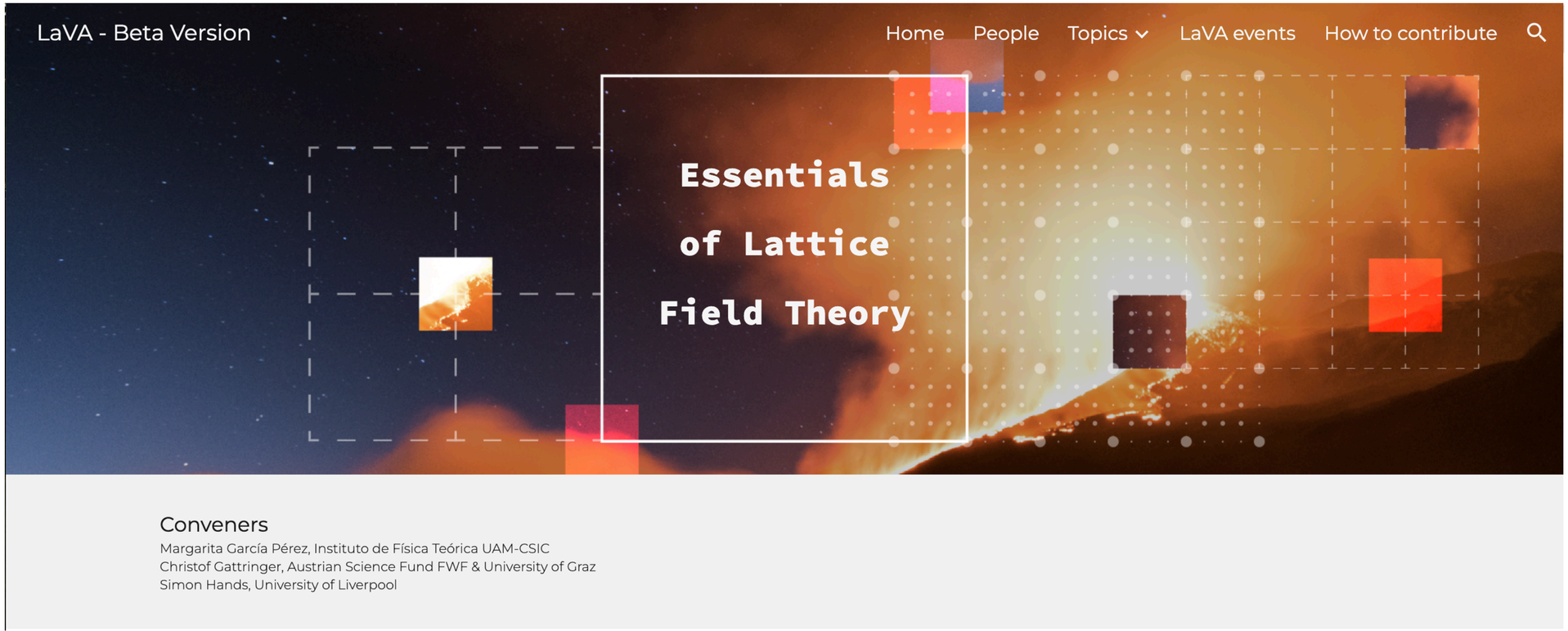
https://pos.sissa.it/453/109

First completed set of Lectures on

Essentials of Lattice Field Theories

by

Margarita-Garcia Perez, Christof Gattriger, Simon Hands Spring 2024



Prototypical lecture:

8 Strong coupling expansion

- Strong coupling expansion
- Wilson loop / area law
- Glueballs
- Limitations of a strong coupling expansion

Slides

Modular structure, easy to keep up-to-date

What Next:

A home for LaVA

A strong and successful ECT* tradition in training:

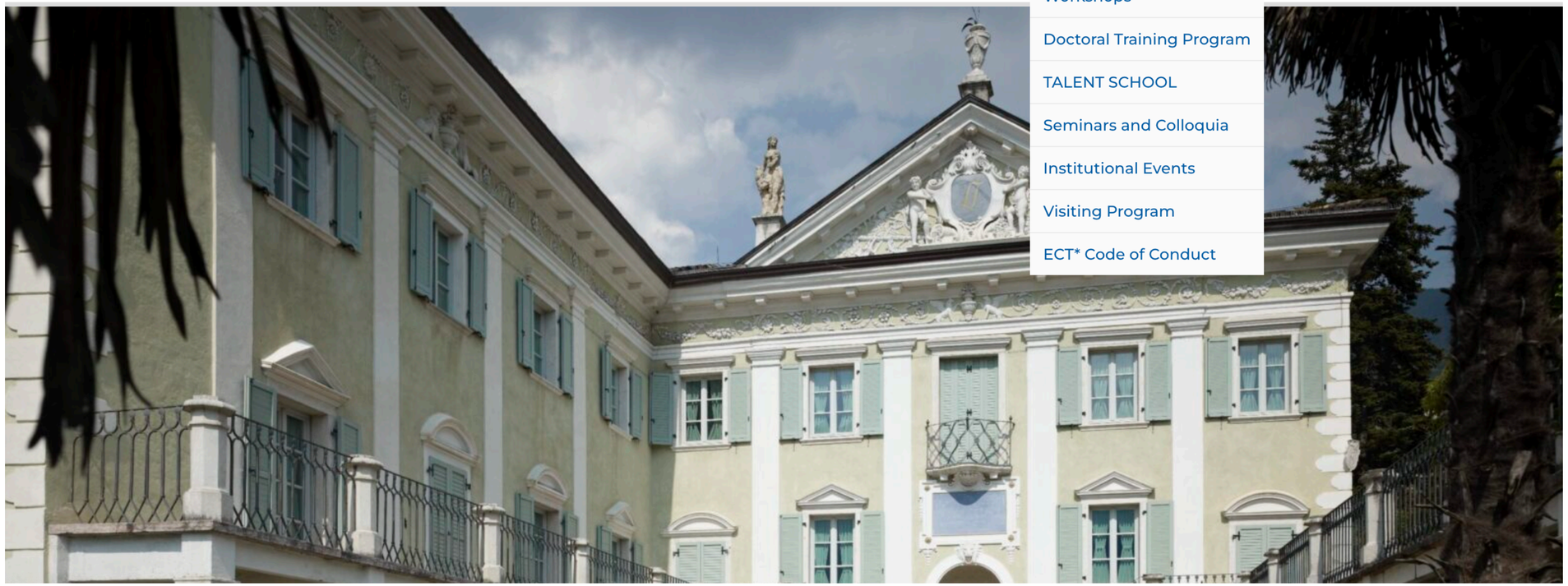
FONDAZIONE BRUNO KESSLER | ECT* EUROPEAN CENTRE FOR THEORETICAL STUDIES IN NUCLEAR PHYSICS AND RELATED AREAS

1993-2023

Fbk.eu Magazine Phonebook Job opening Canale YouTube Twitter TRENTINO

About Us | External Funding | Activities | Research | Outreach | Publications | People

- Workshops
- Doctoral Training Program
- TALENT SCHOOL
- Seminars and Colloquia
- Institutional Events
- Visiting Program
- ECT* Code of Conduct



A crucial support from the previous ECT* Director GERT AARTS:

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Internal organization:

Barbara Gazzoli, ECT* - Project Assistant

Francesca Guerzoni, Petra Jansen - FBK - Web and Communication

Many thanks!

To be continued: ongoing discussions with the

incoming ECT* Director Ubirajara Van Kolck

Goal: to make ECT* the official home of LaVA

Please visit:

https://sites.google.com/view/lattice-virtual-academy

Contacts:

lava@ectstar.eu

Thanks!

Photography: Grangranco Tine'
Graphics: Gaia Stirpe, INFN for LAVA