

# CNRS Helmholtz Dark Matter Lab (DMLab)



Thomas Schoerner (DESY) and Dirk Zerwas (DMLab)

DMLab Steering Committee Meeting

October 16, 2025



# Steering Committee Meeting 16/10/2025

## Steering Committee

### French Members 2024:

- Christelle Roy
- Patrice Verdier (chair)
- Vincent Poireau
- Laurent Vacavant

### German Members 2024:

- DESY: Beate Heinemann
- GSI: Yvonne Leifels
- KIT: Marc Weber
- External: Klaus Desch

## Article 4 – Committees

### (1) Steering Committee

The Steering Committee is the principal decision-making body of the Laboratory and takes the most important decisions. It especially decides on strategic issues regarding Laboratory's Programme.

The Steering Committee is composed of 8 (eight) members listed in Annex 2 or their representatives, with entitlement to vote:

- Four (4) representatives appointed by CNRS - IN2P3,
- Four (4) representatives appointed by the Helmholtz Centers.

The Director and the Deputy Director assist the Steering Committee in an advisory capacity.

### French Members:

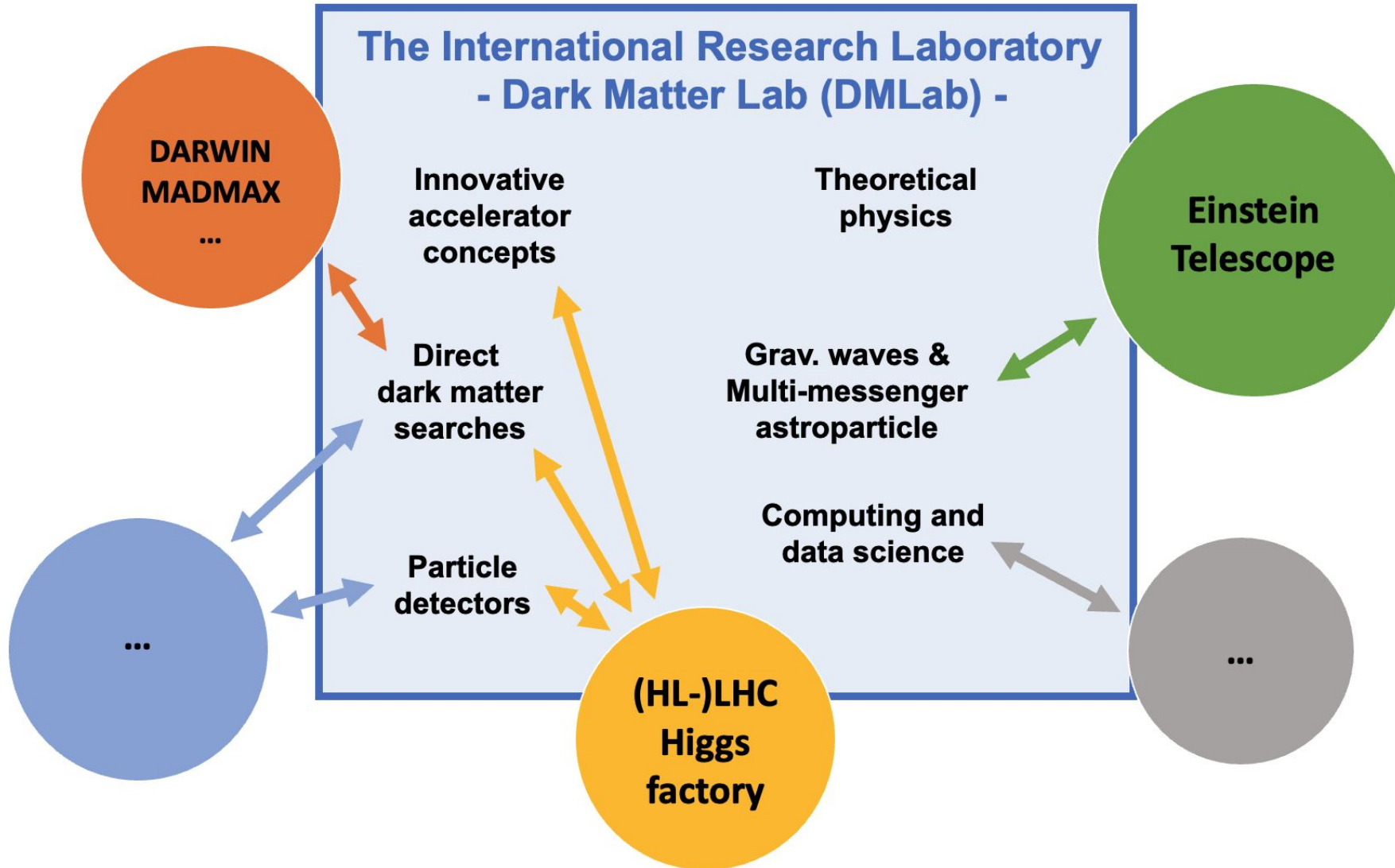
- Christelle Roy
- Patrice Verdier (chair)
- Nicolas Leroy
- Laurent Vacavant

### German Members:

- DESY: Ties Behnke
- GSI: Yvonne Leifels
- KIT: Marc Weber
- External: Klaus Desch

# Scientific Topics of DMLab

Organized around the central theme of dark matter



## IRL goal:

- develop new ideas
- across topic boundaries
- glued by dark matter

## Charge to the lab:

1. **Personnel at DESY, KIT and GSI**
  - a. F: affectation
  - b. D: sabbatical
2. **Working visits** (typically 1-2 weeks) to DESY, KIT, GSI
3. **Workshops** broad and narrow
4. **Funding** acquisition
5. **Develop** French-German collaboration

# Steering Committee 16/10/2025

## Projects

### Projects status:

- High Precision for Dark Matter (Bluemlein/Boudjema) retired
- Germanium Detectors (Duchene/Gerl) left
- Merger of 2 pheno+exp projects in 1

### Annual Meetings:

- Oct 17-18, 2024@LPNHE
- Oct 16-17, 2025@Bonn

### Workshops:

- Oct 15, 2025@Bonn

<b>Direct Searches</b>	Darwin	Julien Masbou (Subatech)	Klaus Eitel (KIT)
	MadMax	Fabrice Hubaut (CPPM)	Axel Lindner (DESY)
<b>GW and MM Astroparticles</b>			
<b>Accelerators</b>	Laser-plasma acceleration of Electrons	Nicolas Delerue (IJCLab)	Matthias Fuchs (KIT)
	Laser-plasma acceleration of Hadrons	Medhi Tarisien (LP2i)	Vincent Bagnoud (GSI)
<b>Computing and ML</b>	Precision and Machine Learning	David Rousseau (IJCLab)	Margarete Mühlleitner (KIT)
	High Precision for Dark Matter	Fawzi Boudjema (LAPTH)	Peter Marquard (DESY)
<b>Particle Detectors</b>	Tracking Detectors	Marc Winter (IJCLab)	Ingrid-Maria Gregor (DESY)
	CBM-MVD	Auguste Besson (IPHC)	Michael Deveau (GSI)
	Calorimeters	Roman Poeschl (IJCLab)	Katja Krueger (DESY)
<b>Theory</b>	Dark Matter, Gravity, Cosmology	Adam Falkowski (IJCLab)	Geraldine Servant (DESY)
	Dark Sector searches in Neutrino Experiments	Juergen Brunner (CPPM)	Peter Marquard (DESY)
	DM Gravity Cosmology	Daniele Steer (APC)	Thomas Konstandin (DESY)
	Probing Strongly Interacting BSM	Giacomo Cacciapaglia (IP2I)	Christophe Grojean (DESY)
	Strangeness in Nuclear Matter	Joerg Aichelin (Subatech)	Elena Bratkovskaya (GSI)
	FIPs	Luc Darme (IP2I)	Felix Kahlhöfer (KIT)

# Steering Committee 16/10/2025

## Additional Funding/PhD/Internships

### **2025 DFH-UFA: successful**

- DFH-UFA: 10.8K

### **2025 BBVA: requested 0Euros**

- Spanish call (detector related)
- long shot: 2/600 selected, none in our domain

### **2024 Procope24+: successful (and that's the short story)**

- DAAD: 6K
- French Embassy in Berlin: 4K

### **2024 MITI PhD Thesis:**

- Plasma: IJCLab “with” KIT

### **2024 Internship**

- DESY (Axion group)
- 3rd year Ecole Polytechnique

### **2022 MITI PhD Thesis:**

- Madmax: CPPM “with” DESY

# Steering Committee 16/10/2025

## Diversification and Interdisciplinarity

2025 introduced our new skin care brand



# Steering Committee 16/10/2025

## ANR-DFG

### **2024 ANR-DFG: HALOX (Direct Searches):**

- ANR:
  - 300K
  - 1 PostDoc
  - CPPM
- Germany:
  - 475K
  - 2 PhD
  - UHH and DESY

### **2023 ANR-DFG: CALO5D (detector development):**

- ANR:
  - 500K
  - 2PostDocs, 1PhD
  - IJCLab and LLR
- Germany:
  - 500K
  - 2 positions, upgraded to PostDoc by own funds
  - DESY, KIT, University of Mainz



# Publications

## Cumulative

- Configuration and Benchmarking of e+e- Processes with K4GeneratorsConfig, e-Print: [2509.20116](#) [hep-ph]
- ECFA Higgs, electroweak, and top Factory Study, e-Print: [2506.15390](#) [hep-ex], CERN Yellow Report 2025-005.
- The ILD Detector: A Versatile Detector for an Electron-Positron Collider at Energies up to 1 TeV, e-Print: [2506.06030](#) [hep-ex]
- Enhancing European Cooperation in the Search for Dark Matter, e-Print: [2504.01688](#) [hep-ex]
- The Critical Importance of Software for HEP, e-Print: [2504.01050](#) [hep-ex]
- The Linear Collider Facility (LCF) at CERN, e-Print: [2503.24049](#) [hep-ex]
- A Linear Collider Vision for the Future of Particle Physics, e-Print: [2503.19983](#) [hep-ex]
- A proposal for the Lohengrin experiment to search for dark sector particles at the ELSA Accelerator, e-Print: [2410.10956](#) [hep-ex] **Eur.Phys.J.C 85 (2025) 5, 600**
- Focus topics for the ECFA study on Higgs / Top / EW factories, e-Print: [2308.00515](#) [hep-ex]
- Technical Design Report for the LUXE Experiment, e-Print: [2308.00515](#) [hep-ex], **Eur.Phys.J.ST (2024)**
- SuSpect3: A C++ code for the supersymmetric and Higgs particle spectrum of the MSSM, e-Print: [2211.16956](#) [hep-ph], **Comput.Phys.Commun. 291 (2023) 108805**
- The Higgs boson mass as fundamental parameter of the minimal supersymmetric standard model, e-Print: [2202.06919](#) [hep-ph], **Eur.Phys.J.C 82 (2022) 7, 657**



# Acknowledgements

## Cumulative

- A.W. Romero Jorge, E. Bratkovskaya, T. Song, L. Sagunski, [Constraints on Kinetic Mixing of Dark Photons from Dilepton Spectra](#), arXiv:2507.11163
- Adrian William Romero Jorge, Elena Bratkovskaya, Laura Sagunski [Search for dark photons in heavy-ion collisions](#) arXiv:2409.20141

# Collaboration Examples

## Non exhaustive

### Software for future projects:

- Configuration and Benchmarking of  $e^+e^-$  Processes with K4GeneratorsConfig, e-Print: [2509.20116](#) [hep-ph]
- ECFA Higgs, electroweak, and top Factory Study, e-Print: [2506.15390](#) [hep-ex], CERN Yellow Report 2025-005.
- The Critical Importance of Software for HEP, e-Print: [2504.01050](#) [hep-ex]

DMLab/DESY impact: Thomas Madlener and Frank Gaede

### Travel to DMLab ECRs:

- Vijay Dhabhi (MADMAX)
- Jana Serhal (Plasma acceleration)
- Xia Xin (Calo)
- Mathieu Gross (Theory)
- (Eduardi Alviano) (Theory)
- Thibaud Houdy (MADMAX)

### Theory:

- short term visit lead to new ideas/projects

DMLab/DESY: Mathias Pierre and DESY Theory group

### Calo:

- Lessons from ATLAS and CMS: Hybridization/System tests
- SiW: great ASICs, great PCBs, great sensors, but ASU ok at best
- Developed 3M (they answer in F, not in ESP) with Valencia

DMLab/DESY impact: Ole Bach, HW and contact to ARISTO

### XLZD

- Computing

DMLab/KIT Klaus Eitel and Belina von Krosigk (Heidelberg)

### MADMAX:

- simulations booster (thesis Vijay Dabhi, 09/2025)
- booster assembly, alignment and insertion in cryostat
- measurement absorber impact

DMLab/DESY prototype: Erika Garutti, Axel Lindner and team

### Plasma

- long visit
- Simulations and experiment

DMLab/DESY Manuel Kirchen and his group

# Exchange

## Steering Committee 2024 follow up

### Follow up on SC discussion 2024

- Travel to France from KIT, GSI and DESY
  - CNRS program with MPG, could be extended to Helmholtz (theoretically)
  - SALTO Program
    - Application separate in Germany and France
    - But: the travel of a German scientist to France is paid for by the employer, not the host (500 Euros)
    - Limited to PostDocs and PhD students, permanent researchers excluded
    - Works like a funding agency with competitive bidding

## Beate Naroska Guest Professorship 2025

### Proposal for senior professorship

- FTX (and DMLab members signed on) proposed Ursula Bassler LLR
- Visitor first half of 2025

# DMInfraNet: Follow up of SC 2024

## The „raison d'être“

Large variety of dark matter candidates □ prime example for approaches from different angles, i.e. astro, HEP, nuclear

- very different experimental approaches employing different technologies.
- a lot of very diverse technical expertise at various places.
- existing / future experiments can significantly benefit from each other and from an improved networking among them, especially as experiments tend to grow in size and to surpass the capacities of (most) individual labs: accelerators, cryogenics, underground labs, magnets, DAQ systems, theory, ...

This is also reflected in the strategies of the bodies representing the respective communities (APPEC, ECFA and NuPeCC) and in the spirit of the previously established joint ECFA-NuPECC-APPEC symposia (JENAS).

- All in all, a matrix of host labs / institutions / facilities (local) and experiments (international).

# Authors

Contributors from 27 institutions in Europe: France, Germany, UK, Austria, Spain, Poland

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The DMInfraNet input was coordinated by

- Dirk Zerwas, DMLab
- Thomas Schörner DESY / DMLab
- Jochen Schieck, Director HEPHY, Vienna
- Florian Reindl, TU Vienna

# Topics Discussed / Listed in the Paper

A collection of activities as a starting point for discussions and synergy searches

## A Dark matter activities and infrastructures in Europe

### A.1 Underground facilities and related infrastructures

### A.2 Accelerator-related facilities

### A.3 The DRD collaborations

### A.4 Experiments

*Developments for directional detection, aiming at increasing the sensitivity in the neutrino fog/floor:*

*WIMP searches using liquefied noble elements such as Argon and Xenon:*

*Experiments aiming primarily at lower masses:*

*Searches for axions and axion like particles:*

*NaI-based experiments:*

## B Dark matter: a European affaire

The infrastructures and experiments discussed above are collaboratively built and exploited by teams from many different countries. Some examples (in alphabetical order) are given in the following. This results in a strongly correlated matrix.

**Austria** is involved in the direct dark matter detection experiments CRESST and COSINUS hosted at LNGS. The MaglevHunt experiment, currently under construction and to be operated in Austria, uses levitating mechanical sensors to detect DM.

**France** For WIMP searches, the IN2P3 labs LPNHE Paris and Subatech Nantes are involved in the XENON experiment at LNGS as well as being members of the Darwin and XLZD collaborations. Both labs and IJCLab participate in the DAMIC-M experiment, which is being installed at LSM. The Astroparticle and Cosmology laboratory (APC) in Paris has a leading role in direct dark matter searches in the DarkSide-20k experiment in which the CPPM Marseille is involved as well.

CPPM Marseille and IJCLab are participating in the axion searches in the MADMAX experiment. Saclay is part of the BabyIAXO experiment.

The Tesseract project is carried by the IP2I Lyon, LPSC Grenoble and IJCLab

The expertise on highly granular calorimeters of IJCLab has led to participation in LUXE-NPOD as well as in contributions to the study

# The Path Forward

## Ongoing threads of activity

- Leading discussions in order to try to get DMInfraNet or a similar thing mentioned in the European strategy
  - this would be a very good starting point for future joint initiatives and the quest for additional funding
- Define start-up projects with the help of binational funding: D-F, A-F
  - simulation, data management as ideal starting points for projects, potentially in conjunction with DM Data Centre in Munich
- Next community discussion around publication of strategy draft

Your advice to us?



# Steering Committee 16/10/2025

## Outreach

### 2025 Ambassade de France a Berlin Chargé des Universités NRW:

- Claire Demesmay
- Discussions with DMLab

### 2025 Epsilon (online journal):

- Clémentine Laurens
- Discussions with Julien Masbou, Marco Cirelli and Dirk
- [Online Article](#)

### 2024 Embassy attaché visit:

- Attaché pour la Science et la Technologie (Hugo Zusslin + Orane Belguerras), Jihane Maalmi and Dominique Breton (IJCLab)

### 2023 Sciences et Avenir:

- Coralie Lemke
- [Online Article](#)



# Conclusions

Year 3

## Realizations by the lab:

1. **Personnel at DESY, KIT and GSI**
  - a. **F: affectation**
  - b. **D: sabbatical**
2. **Working visits to DESY, KIT and GSI**
3. **Workshops** broad and narrow
4. **Funding** acquisition
5. **Develop** French-German collaboration