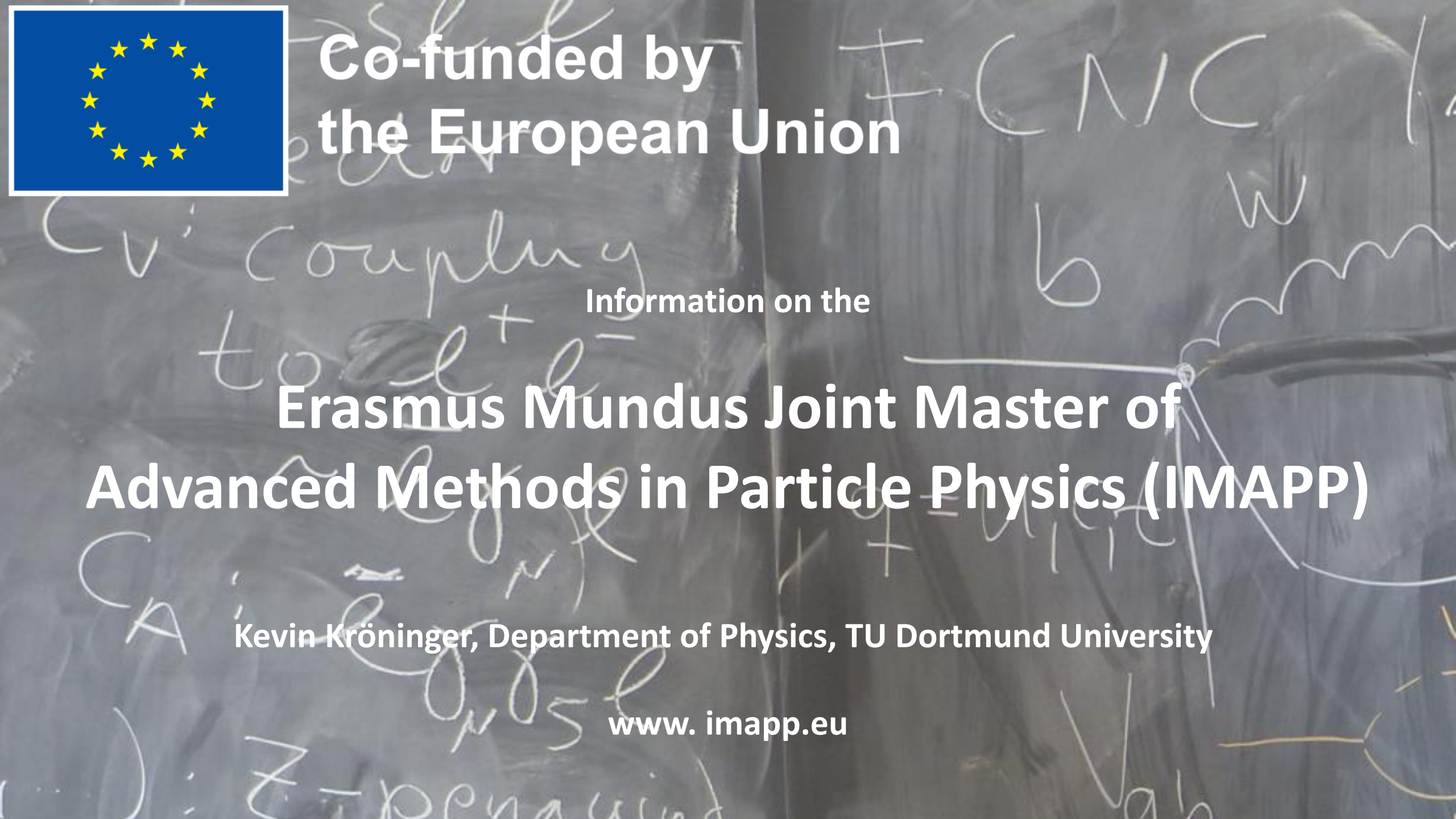


Co-funded by
the European Union

Information on the

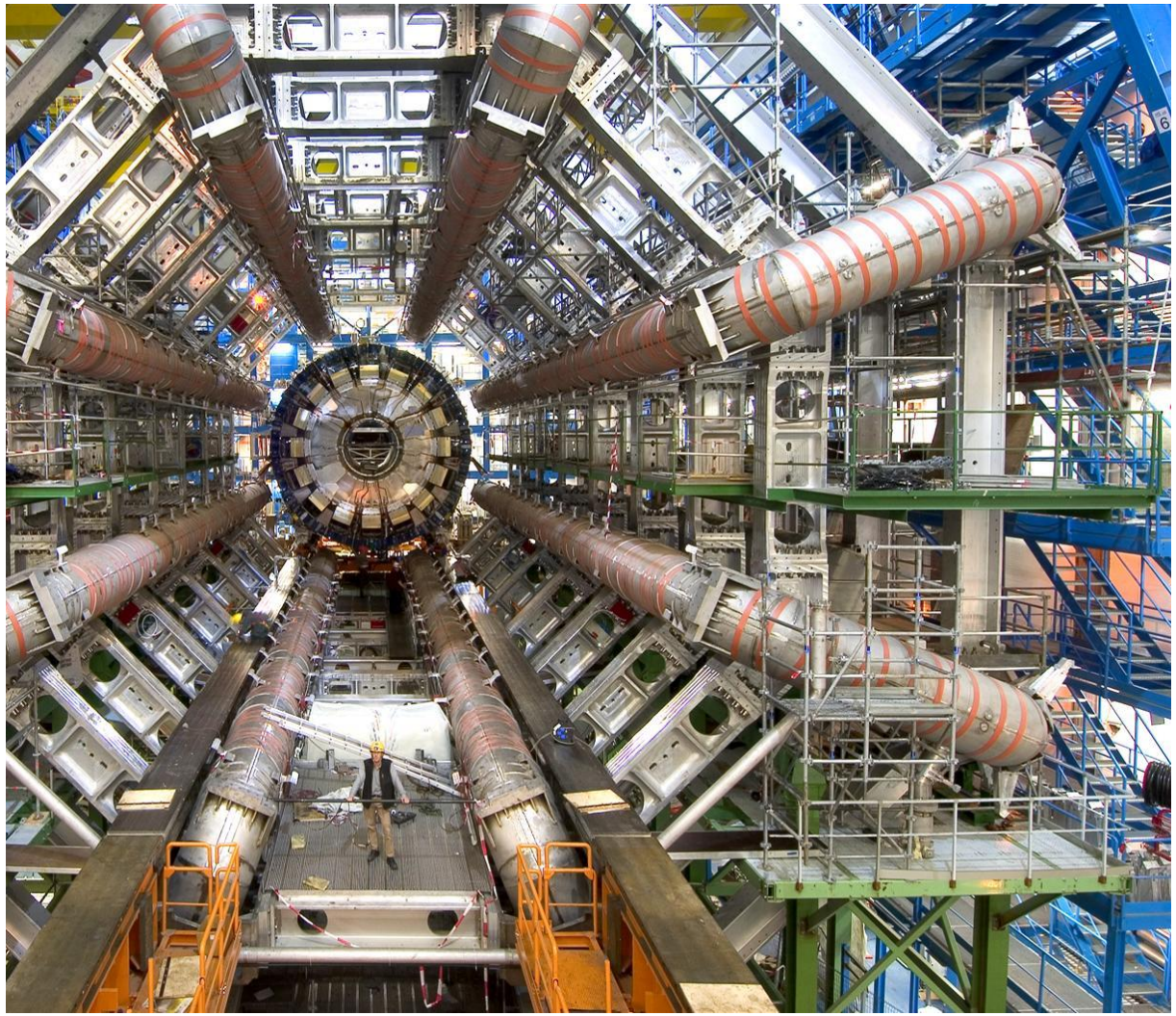
Erasmus Mundus Joint Master of Advanced Methods in Particle Physics (IMAPP)

Kevin Kröninger, Department of Physics, TU Dortmund University

www. imapp.eu

Particle Physics

- Experimental particle physics: research at international laboratories, e.g. CERN, Fermilab, DESY, etc.
- Research in large international collaboration (ATLAS: 42 countries, 181 institutions, 3000 members), starting from PhD
- Networking on an international scale, e.g. joint effort in building experiments, working on projects, etc.
- Networking on a national scale (KET, ATLAS-D, LHCb-D, Helmholtz Alliance, NFDI consortium, …)
- **No real international network on teaching aspects**

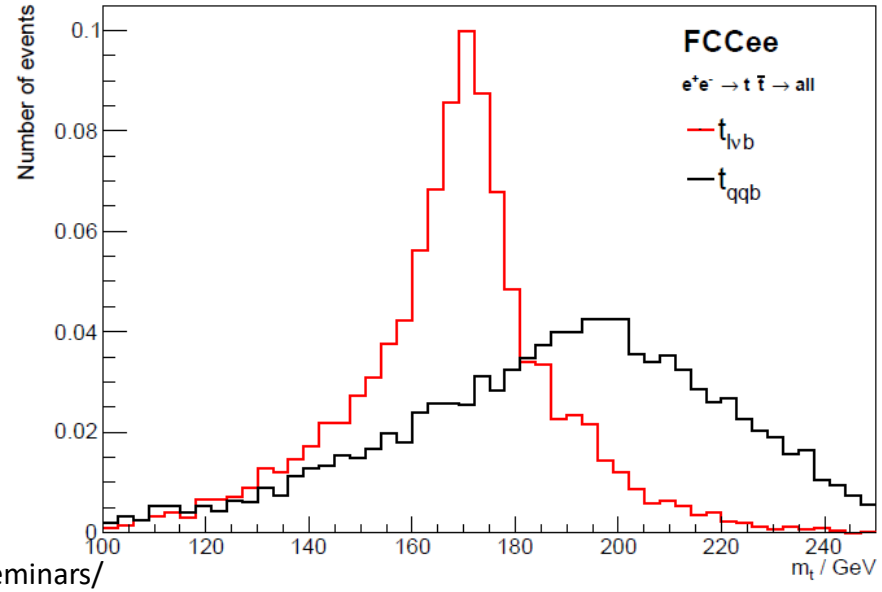


Photograph: Maximilien Brice: https://cds.cern.ch/record/910381

Our network

Université franco-allemande Deutsch-Französische Hochschule

Photograph: https://www.universita.corsica/en/research/major-seminars/



Deutsche Forschungsgemeinschaft

Université franco-allemande Deutsch-Französische Hochschule

heinrichhertzstiftung

iTHEPHY Educating The Future

Tandem Project

Erasmus+

Photograph: Andreas Jung

Summer term 2022 DAAD

Prof. Dr. Andreas Jung, Purdue University

- Development of the silicon inner detector of the CMS experiment
- Analysis of data collected by the CMS experiment.

2015 — 2022

Summer schools

University courses

Strategic partnership

Student exchange

Joint PhD projects

Joint Master degree

Guest chair

International character

Universities:

- TU Dortmund University
- University of Bologna
- University of Clermont Auvergne

Associated partners:

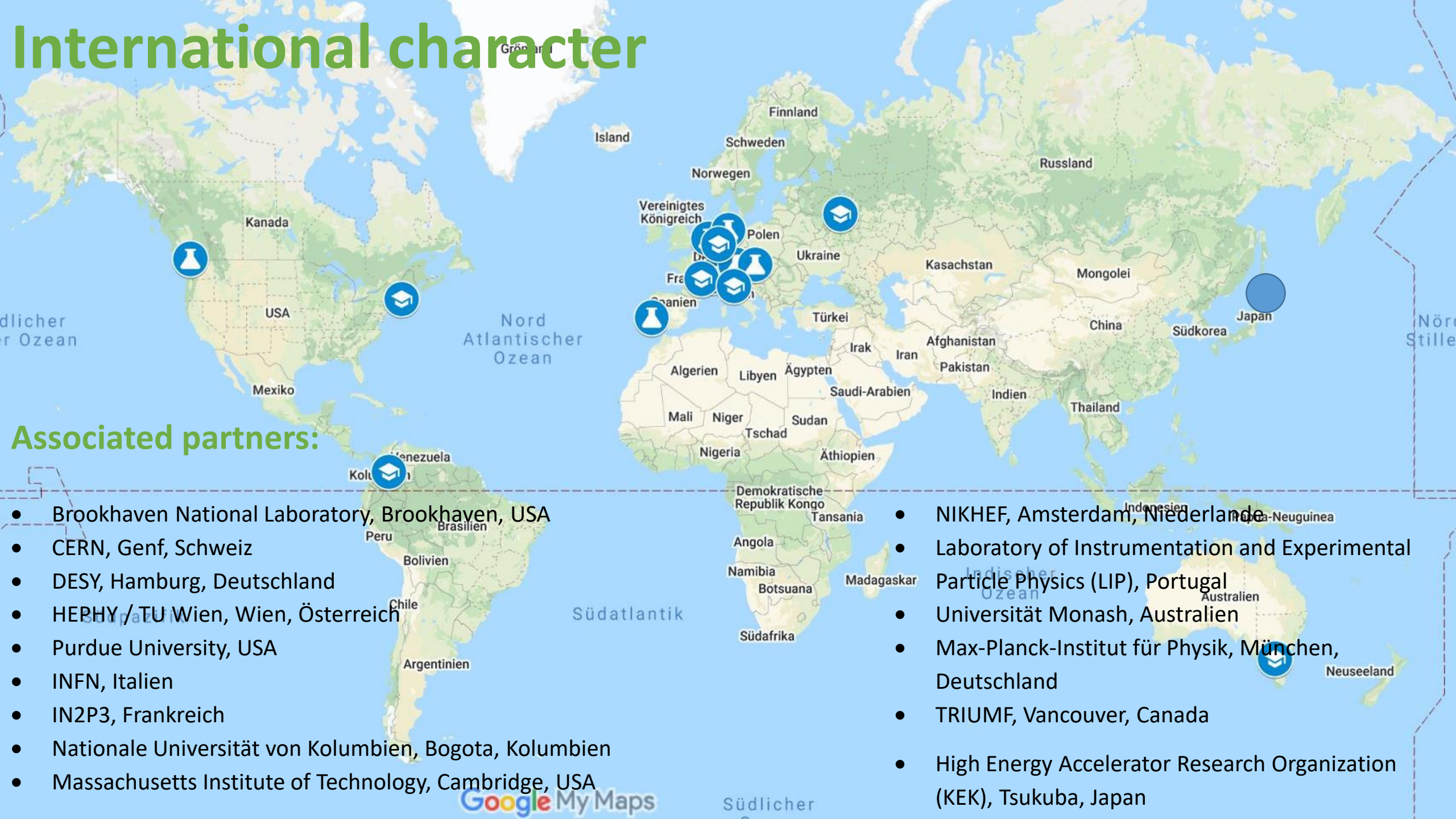
- International research laboratories
- Research networks
- Universities around the world
- Companies

technische universität dortmund

ALMA MATER STUDIORUM UNIVERSITÀ DI BOLOGNA

UNIVERSITÉ Clermont Auvergne

International character



Associated partners:

- Brookhaven National Laboratory, Brookhaven, USA
- CERN, Genf, Schweiz
- DESY, Hamburg, Deutschland
- HEPHY / TU Wien, Wien, Österreich
- Purdue University, USA
- INFN, Italien
- IN2P3, Frankreich
- Nationale Universität von Kolumbien, Bogota, Kolumbien
- Massachusetts Institute of Technology, Cambridge, USA
- NIKHEF, Amsterdam, Niederlande
- Laboratory of Instrumentation and Experimental Particle Physics (LIP), Portugal
- Universität Monash, Australien
- Max-Planck-Institut für Physik, München, Deutschland
- TRIUMF, Vancouver, Canada
- High Energy Accelerator Research Organization (KEK), Tsukuba, Japan

Master program

Education:

- Physics: Experimental and theoretical particle physics — Scientific case
- Methods:
  - Instrumentation and detector physics
  - Large-scale scientific computing and programming
  - Statistical data analysis and machine learning

} Technical aspects, relevant for employability

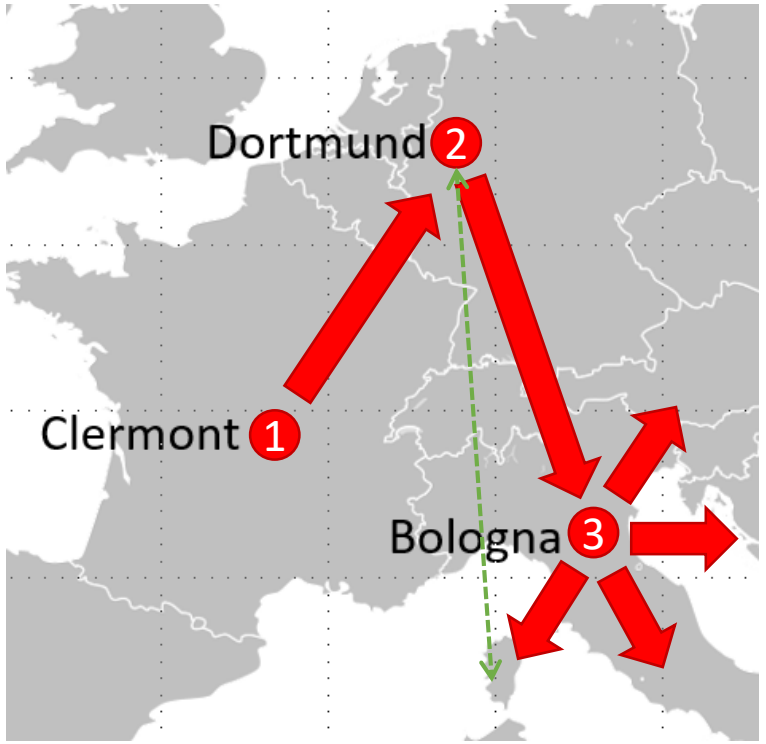
Courses:

- Mandatory courses from the realm of theoretical and experimental particle physics
- Mandatory courses on the technical aspects
- Specialization possible by choosing compulsory courses
- Extracurricular (free) language courses

Issued degree:

- Joint degree signed by all three universities
- Acknowledged as Master degree in physics (with/without specialization) in each country

Mobility



Schedule:

Sem.	Location	Academic focus	Events
1 (WS)	Clermont	Particle physics and statistics	Orientation week
2 (SS)	Dortmund	Particle physics and detectors	Spring school
3 (WS)	Bologna	Particle physics and computing, introduction Master thesis	Trade fair for Master theses
4 (SS)	Any	Master thesis	Spring school, virtual industry day

Prerequisites and organization

Prerequisites:

- First cycle degree qualification or equivalent in physics (Bachelor degree)
- Qualifying degree has to be passed with a grade higher or equal to “B” (“good”) (corresponds to best 35% of students) → thresholds: 2.8 (German system), 84/110 (Italian system), 14 (French system)
- Command of the English language, i.e. either native speaker or at least level B2 (certificate)
- If applicable, visa/residence permit

Organization:

- Students will be enrolled in Dortmund and registered in Bologna and Clermont
- Full access to all university facilities in Bologna, Clermont and Dortmund
- All grades will be collected in Dortmund
- There are tuition fees about 950 Euro / semester (German part corresponds to “Semesterbeitrag”)

Status and plans

Status

- Fully accredited in France, Germany and Italy according to a European approach
- Program was installed in the academic year 21/22 – Late/small time window for application
- Composition of intakes:
  - First intake: 7 students (6 IT/1 FR)
  - Second intake: 10 students (4 IT/3 FR/2 DE/1 ES)
- Program is running smoothly so far

FAQ

- We try to provide help in finding accommodation where possible (working on a deal with the Studierendenwerk in Dortmund)
- You can start the program prior to enrolling (e.g. if you are late with you Bachelor degree)
- Further information: www.imapp.eu

Support by university

During planning

- No experience in setting up international Master degrees
- Included discussions at all levels (Department and rectorate, international office and science support center, legal department and student services, …)
- Very supportive in most cases, some more difficult problems (tuition fees, enrollment)
- Great support from Bologna on the EMJM application (they have a lot of experience)!

During installation

- Very supportive
- Great acknowledgement of international Master by university → matches the new internationalization strategy
- Great acknowledgement of EMJM by university → unique in Dortmund

Key elements

For setting up and running an international Master

- Have a reliable consortium of partners – you will need their full support
- Have good relations with your administration
- Get support by the rectorate
- Be patient and persistent – some problems are difficult to solve and/or take time

For writing an EMJM application

- Make sure the program fits into the EU strategy
- Set up and run the Master first – then you know all aspects and you are ready to run when the funding comes
- Share the work, but streamline the document
- Try again if it does not work the first or second time – carefully identify the problems raised by the reviewers

Good luck!

Backup

Study plan

Semester 1: Clermont

Module	ECTS	Comments
Compulsory modules		
Introduction to quantum field theory and gauge theories	6	Graded
Introduction to particle physics and the experimental foundations of the Standard Model	9	Graded
Programming and data analysis	6	Graded
Statistics and artificial intelligence	6	Graded
Elective modules		
Guest lecture on various topics	3	e.g. on cosmology, graded
UCA particle physics seminar	3	video broadcasted to all three universities, not graded

Study plan

Semester 2: Dortmund

Module	ECTS	Comments
Compulsory modules		
Model building in particle physics	6	Graded
Practical aspects of particle physics measurements	6	Graded
Detector systems in particle and medical physics	9	Graded
Spring/summer school	3	Summer school in Cargese / Corsika; not graded
Elective modules		
Electronics lab course	6	Graded
Modern particle physics	6	Graded
Astroparticle physics	6	Graded
Guest lecture on instrumentation	3	Graded
TUDO seminar on particle physics	3	video broadcasted to all three universities; not graded

Study plan

Semester 3: Bologna

Module	ECTS	Comments
Compulsory modules		
Advanced standard model	6	Graded
Phenomenology and experimental flavor physics	6	Graded
Computer science for high energy physcs	12	Graded
Preparation for scientific research and internship orientation	6	Preparation of Master thesis, graded

Study plan

Semester 4: Any of the three universities or a partner institution

Module	ECTS	Comments
Compulsory modules		
Final examination	12	Will take place in Dortmund
Master thesis	18	Can be done anywhere

Notes on the Master thesis:

- The project for the Master thesis can be conducted at any of the three universities or any of the associated partners (in academia or industry)
- There is a 6 CP course for the preparation of the Master thesis. This can be viewed as the start of the Master project.
- There is extra time between semesters that can be used to prolong the preparation phase.
- The final is basically a presentation of the results of the Master thesis and will take place in Dortmund (or via ZOOM)

Financial support

Erasmus Mundus

- Large EU project that aims at getting the best students from all over the world
- 18 full stipends per intake: 1.400 Euro/month, no tuition fees, insurance coverage
- National quota: about 1.8 students from one country per intake

French German University

- Program with a focus on French-German relationship and cultural exchange
- Mobility support for all interested students: 300 Euro/month for up to 10 month a year when abroad (note details)

University of Clermont Auvergne

- Program to support best students
- Stipend of 4000 Euro in total