

# Master Math4Phys

International Master in Mathematical Physics

IMB - Dijon

# The IMB

Three research groups:

- Mathematical Physics
- Geometry, Algebra, Dynamics and Topology (GADT)
- Statistics, Probability, Optimization and Control (SPOC)

# The Master

- M2 active since 2016-17
- M1 active since 2018-19
- All courses in English

## Coordinators:

- § Guido Carlet (M1)
- § José Luis Jaramillo (M1)
- § Nikolai Kitanine (M2)

# About the Master

“The objective of the two-year program is to provide the students, within a mathematics curriculum, with a **knowledge of the advanced mathematical methods of modern theoretical physics**.

The program develops mathematical methods used in a wide range of topics in theoretical physics, such as **quantum field theory, statistical mechanics, general relativity, gauge theories, string theory**, etc.

The coursework will cover **different fields of mathematics (algebra, geometry, analysis)** and will highlight their applications to the problems of contemporary theoretical physics. “

# Statistics

Some recent statistics about the Master:

|                                                                | 2021-22 | 2022-23 | 2023-24 | 2024-25 | 2025-26 |
|----------------------------------------------------------------|---------|---------|---------|---------|---------|
| Number of applications to M1:                                  | 80      | 102     | 80      | 99      | 163     |
| Number of students admitted to M1:                             | 32      | 34      | 35      | 44      | 41      |
| Number of students registered to M1:                           | 14      | 14      | 12      | 14      | –       |
| Number of students registered to M2:                           | 14      | 14      | 14      | 13      | –       |
| Number of students who have completed M2:                      | 12      | 13      | 11      | –       | –       |
| Number of students who have started a PhD after completing M2: | 7       | 11      | 6       | –       | –       |

# Master 1

- S1 : 4 courses + FLE/English
- S2 : 4 courses out of 5
- Project (6 ECTS)

# Courses M1

|                                                 | CM+TD (hrs) | ECTS |
|-------------------------------------------------|-------------|------|
| Groups and representations                      | 22+22       | 7    |
| Differential geometry                           | 22+22       | 7    |
| Functional analysis                             | 22+22       | 7    |
| Differential equations in the complex domain    | 22+22       | 7    |
| FLE (or English)                                | 0+20        | 2    |
| Mathematical methods of classical mechanics*    | 22+22       | 6    |
| Quantum mechanics for mathematicians*           | 22+22       | 6    |
| Partial differential equations*                 | 22+22       | 6    |
| Computational methods in mathematical physics*  | 22+22       | 6    |
| Statistical mechanics and stochastic processes* | 22+22       | 6    |
| Dissertation                                    |             | 6    |

\* The students will have to choose 4 courses out of the 5 options available.

# Master 2

- S1 : 3 curricular courses + 1 thematic course + FLE/English
- S2 : 2 curricular courses + 2 thematic courses
- Project (10 ECTS)

# Courses M2

|                                                    | CM+TD (hrs) | ECTS |
|----------------------------------------------------|-------------|------|
| Lie groups and Lie algebras                        | 18+18       | 7    |
| Mathematical methods of quantum field theory       | 18+18       | 7    |
| Riemann surfaces and integrable systems            | 18+18       | 7    |
| Introduction to algebraic geometry*                | 15+15       | 7    |
| FLE (or English)                                   | 0+20        | 2    |
| Path integral approach in QFT                      | 15+15       | 5    |
| General relativity                                 | 15+15       | 5    |
| Cohomology of algebraic varieties*                 | 15+15       | 5    |
| Introduction to Hilbert schemes and moduli spaces* | 15+15       | 5    |
| Dissertation                                       |             | 10   |

\* Thematic courses.

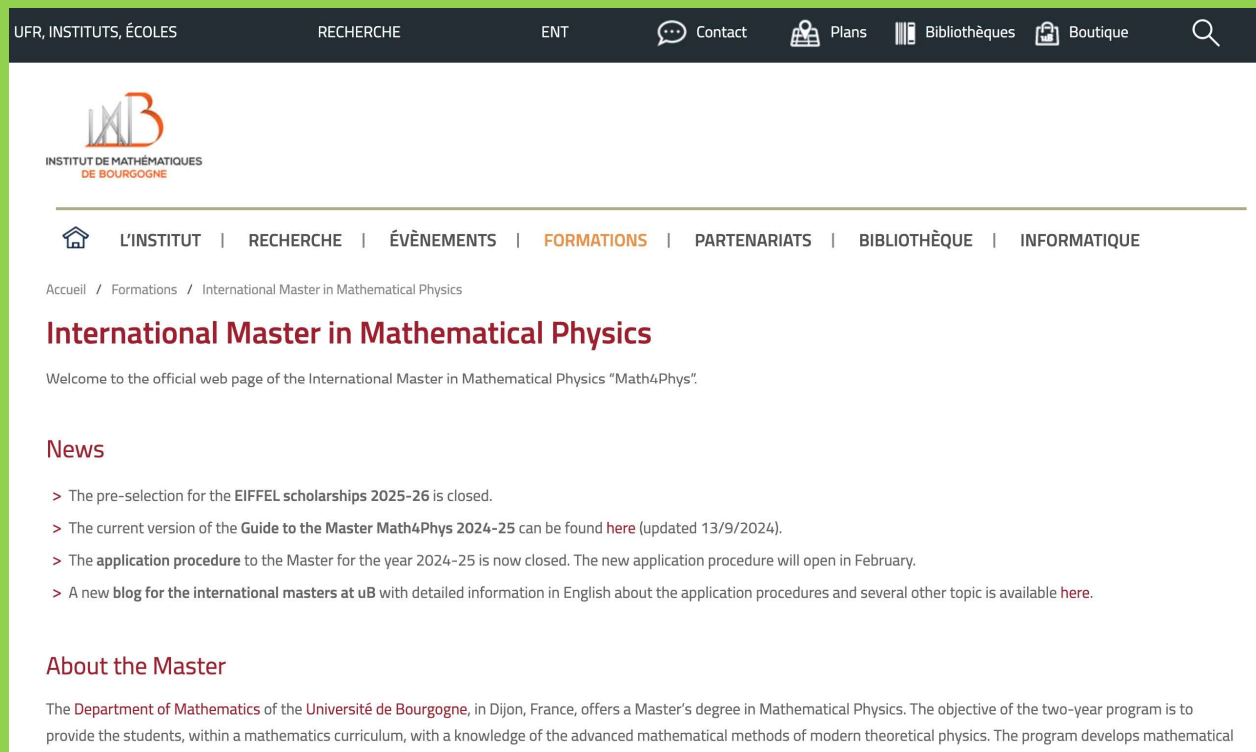
# Master 2 : Thematic courses

- 2025-26 : “Algebraic geometry”
  - Introduction to algebraic geometry
  - Cohomology of algebraic varieties
  - Introduction to Hilbert schemes and moduli spaces
- 2025-26 : “Probabilistic analysis in mathematical physics”
  - Stochastic processes
  - Random matrix theory and physics
  - Random walks on graphs

## More...

- Applications: Ecandidate (february – may)
- EIFFEL scholarships.
- Double diploma agreements:
  - Master in Mathematics at the University of Verona in Italy,
  - Master Mathematics International at the University of Kaiserslautern-Landau in Germany.

# Webpage of the Master



For further info see the  
website of the Master:  
[math.u-bourgogne.fr/  
math4phys](http://math.u-bourgogne.fr/math4phys)

# Guide to the Master

|                                                                 |   |
|-----------------------------------------------------------------|---|
| <b>International Master in Mathematical Physics – Math4Phys</b> |   |
| Guide 2022-23                                                   |   |
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| <b>1. PRESENTATION</b>                                                                                                                                                                                                                                      |  |
| The Master in Mathematical Physics “Math4Phys” is a master course of study of the Department of Mathematics of the <i>Université Bourgogne-Franche-Comté</i> (UBFC), which takes place at the <i>Institut de Mathématiques de Bourgogne</i> (IMB) in Dijon. |  |
| The main aim of the Master is to provide advanced lectures on the mathematical methods of modern theoretical physics in the framework of a mathematical curriculum.                                                                                         |  |
| Such an offer exists in France only in Dijon as the Mathematical Physics group of the IMB provides a unique environment for a program requiring a double competence in Mathematics and Physics.                                                             |  |
| The Mathematical Physics group of the IMB laboratory in Dijon is a unique research team in France with the ability to provide advanced lectures on the mathematical problems of modern physics.                                                             |  |
| <b>2. CONTACTS</b>                                                                                                                                                                                                                                          |  |
| Address:<br>Institut de Mathématiques de Bourgogne, UMR CNRS 5584,<br>9 avenue Alain Savary, BP 47870, 21078 Dijon Cedex, France                                                                                                                            |  |
| Official web page: <a href="http://math4phys.ubfc.fr">math4phys.ubfc.fr</a>                                                                                                                                                                                 |  |
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All info can be found in the Guide to the Master Math4Phys.

Available on:

[math.u-bourgogne.fr/  
math4phys](http://math.u-bourgogne.fr/math4phys)