

# THEORETICAL PHYSICS CURRICULUM

## Master in Physics

### 2026-27



Theory and Phenomenology  
of Fundamental Interactions

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UNIVERSITY AND INFN · BOLOGNA

# CURRICULUM DESCRIPTION

**First year**

<b>Compulsory courses</b>	Period
General Relativity 1	1
Quantum Field Theory 1	1
Symmetries and Path Integrals	1
Statistical Mechanics	1

# CURRICULUM DESCRIPTION

**First year**

<b>One elective course from Group 1</b>	Period
Statistical Field Theory	2
Quantum Field Theory 2	2

# CURRICULUM DESCRIPTION

**First year**

<b>Two Elective courses from Group 2</b>	Period
Theory of Black Holes	2
Quantum Cosmology	2
Theory of the Standard Model	2
Theoretical Astroparticle Physics	2
Quantum Information Theory	2
Introduction to Quantum Many-Body Systems	2
Group Theory for Physics	2
Advanced Mathematical Methods for Physics	1
Physics Education	1

# CURRICULUM DESCRIPTION

**First year**

<b>One Elective course from Group 3</b>	Period
Gravitational Wave Physics	1
Introduction to Particle Physics	1
Statistical Data Analysis for Nuclear and Subnuclear Physics	1
Astroparticle Physics	2
Dynamical & Ergodic Systems	1

# CURRICULUM DESCRIPTION

**First year**

<b>One Elective course from Group 4</b>	Period
Nuclear Physics	1
Theoretical and Numerical Aspects of Nuclear Physics	2
Quantum Sciences and Technologies	2
Interactions and Correlations in Condensed Matter	2

# CURRICULUM

**Second year**

<b>One Elective course from Group 5</b>	Period
Advanced Quantum Field Theory	1
Beyond the Standard Model	1
Introduction to String Theory	1
Quantum Computing	1
Quantum Chromodynamics	1
Supersymmetry	1
Theory of the Standard Model: Advanced Topics	1
Advanced Methods in Quantum Many Body Theory	1

**+ 2 Free choices**

# RESEARCH LINES & TEACHING PATHS

GRAVITATION &  
COSMOLOGY

PHENOMENOLOGY OF  
FUNDAMENTAL  
INTERACTIONS

ASTROPARTICLE  
THEORY

QUANTUM FIELD  
THEORY

STRING THEORY

QUANTUM MANY BODY  
THEORY & QUANTUM  
INFORMATION



# Suggested choice for **GRAVITATION & COSMOLOGY**

Group 1	Quantum Field Theory 2
Group 2 (2 choices)	Black Holes & Quantum Cosmology
Group 3	Gravitational Wave Physics
Group 4	student's choice
Group 5	Advanced Quantum Field Theory
Free choice 1	Advanced Mathematical Methods for Physics
Free choice 2	student's choice

# Suggested choice for **ASTROPARTICLE THEORY**

Group 1	Quantum Field Theory 2
Group 2 (2 choices)	Theory of the Standard Model & Theoretical Astroparticle Physics
Group 3	Gravitational Wave Physics <i>or</i> Astroparticle Physics
Group 4	student's choice
Group 5	Beyond the Standard Model
Free choice 1	Theory of the Standard Model: Advanced Topics <i>or</i> Supersymmetry <i>or</i> Quantum Cosmology
Free choice 2	student's choice

# Suggested choice for **FUNDAMENTAL INTERACTIONS**

Group 1	Quantum Field Theory 2
Group 2 (2 choices)	Standard Model & student's choice (Theoretical Astroparticle Physics)
Group 3	student's choice
Group 4	Nuclear Physics / Theoretical Nuclear Physics
Group 5	QCD <i>or</i> Standard Model: Advanced Topics <i>or</i> Beyond the Standard Model
Free choice 1	QCD <i>or</i> Standard Model: Advanced Topics <i>or</i> Beyond the Standard Model
Free choice 2	QCD <i>or</i> Standard Model: Advanced Topics <i>or</i> Beyond the Standard Model <i>or</i> Supersymmetry <i>or</i> Advanced Quantum Field Theory

# Suggested choice for QUANTUM FIELD THEORY

Group 1	Quantum Field Theory 2 <i>or</i> Statistical Field Theory
Group 2 (2 choices)	Advanced Mathematical Methods for Physics <i>or</i> Theory of the Standard Model <i>or</i> Group Theory
Group 3	student's choice
Group 4	student's choice
Group 5	Advanced Quantum Field Theory
Free choice 1	Quantum Field Theory 2 <i>or</i> Statistical Field Theory
Free choice 2	Supersymmetry <i>or</i> String Theory <i>or</i> Advanced Methods in Quantum Many-Body Theory

# Suggested choice for **STRING THEORY**

Group 1	Quantum Field Theory 2
Group 2 (2 choices)	Quantum Cosmology <i>or</i> Standard Model <i>or</i> Group Theory
Group 3	student's choice
Group 4	student's choice
Group 5	String Theory <i>or</i> Supersymmetry
Free choice 1	String theory <i>or</i> Supersymmetry
Free choice 2	student's choice

# Suggested choice for QUANTUM & MANY-BODY

Group 1	Statistical Field Theory
Group 2 (2 choices)	Theory of Quantum Information & Introduction to Quantum Many-Body Systems
Group 3	Dynamical Systems and Ergodic Theory
Group 4	Interactions and Correlations in Condensed Matter <i>or</i> Quantum Sciences and Technologies
Group 5	Quantum Computing <i>or</i> Advanced Methods in QMBT
Free choice 1	Quantum Computing <i>or</i> Advanced Methods in QMBT
Free choice 2	Advanced Mathematical Methods in Physics <i>or</i> Group Theory <i>or</i> Theoretical Nuclear Physics <i>or</i> any course on Quantum information