

## TIMETABLE for the Master ERASMUS MUNDUS in NUCLEAR PHYSICS in Spain

### Academic year 2022-2023

The students have to follow the following topics in the first semester, all of them in Seville (except Nuclear Structure):

**Quantum Physics** (60 hours)

**Atomic and Plasma Physics** (60 hours)

**Basic Experimental Nuclear Physics** (45 hours = 30 h theory + 15 h lab (5 experiments x 3 h/exp))

**Computing and Numerics** (45 hours)

**Nuclear Structure** (30 h intensive during two weeks January 11-17, (on-line) and January 23-27 (in person), 2023) in Madrid (Trip to Caen January 18-21)

There will be an intensive Spanish course for beginners from October 4-21 in the mornings.

Students from paths 1 and 3 are expected to be in Sevilla until February 24<sup>th</sup>.

During last week of February students in **path 1 (Experiments)** and **path 3 (Applications)** have to move to Padova and Catania, respectively. They are expected to be there by March 1st, 2023.

Second semester (for the **theory path-2**)

**Introduction to Nuclear Reactions** (30 h intensive during two weeks February 6-17, 2023) in Sevilla

**Relativistic Quantum Theory: Nuclear Processes** (30 h intensive during the weeks February 27-March 3 (on-line) & March 6-10 (in person), 2023) in Sevilla

**Many-Body Theories in Nuclear Physics** (30 h intensive during the weeks March 20-24 (on-line) & March 27-31 (in person), 2023) in Madrid

**Elective, one of the following**

- **Hadron Physics** (30 h intensive during the weeks April 10-14 (on-line) & April 17-21 (in person), 2023) in Barcelona
- **Nuclear Astrophysics** (30 h intensive during the weeks April 17-21 (on-line) & 24-28 (in person), 2022) in Barcelona

**Weak Interactions** (30 h intensive during the weeks May 8-12 (on line) & May 15-19 (in-person), 2023) in Sevilla

Acronyms :

**QP = Quantum Physics**

**A&P = Atomic and Plasma Physics**

**BENP = Basic Experimental Nuclear Physics**

**C&N = Computing and Numerics**

**NS = Nuclear Structure: properties and models**

**MBT = Many-Body theories in Nuclear Physics**

**RQT = Relativistic Quantum Theory: Nuclear Processes**

**WI = Weak Interactions**

**HP= Hadron Physics\***

**NA = Nuclear Astrophysics\***

**NR = Nuclear Reactions**

**\*Each student has to choose one of these subjects**

**WEEKS**

|                               |                             |                              |                              |
|-------------------------------|-----------------------------|------------------------------|------------------------------|
| <b>40:</b><br>October 3-7     | <b>41:</b><br>October 10-14 | <b>42:</b><br>October 17-21  | <b>43:</b><br>October 24-28  |
| <b>44:</b><br>Oct.31-Novemb 4 | <b>45:</b><br>November 7-11 | <b>46:</b><br>November 14-18 | <b>47:</b><br>November 21-25 |
| <b>48:</b><br>Nov 28-Dec 2    | <b>49:</b><br>December 5-9  | <b>50:</b><br>December 12-16 | <b>51:</b><br>December 19-23 |

| Lectures                    | Monday                        | Tuesday                       | Wednesday                     | Thursday                      | Friday                        |
|-----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| 10:00-13:00                 | BENP<br>laboratory<br>GROUP 1 | BENP<br>laboratory<br>GROUP 2 | BENP<br>laboratory<br>GROUP 3 | BENP<br>laboratory<br>GROUP 4 | BENP<br>laboratory<br>GROUP 5 |
| Weeks 42, 43, 44, 45 and 46 |                               |                               |                               |                               |                               |

| Lectures            | Monday | Tuesday          | Wednesday        | Thursday | Friday |
|---------------------|--------|------------------|------------------|----------|--------|
| 15:00-17:00         | A&P    | QM               | A&P              | QM       | QM     |
| 17:00-17:30         |        |                  |                  |          |        |
| 17:30-19:00         | C&N    | BENP<br>(theory) | BENP<br>(theory) | A&P      | C&N    |
| 19:00-19:45         | C&N    |                  |                  | A&P      | C&N    |
| Weeks 40-48 & 50-51 |        |                  |                  |          |        |

### **QM and A&P (60 hours)**

**Starting date: October 3, 2022 (Week number 40) -**  
**Ending date: December 23, 2022 (week: 51) (6 hours/week)**  
**Exams period: 5-9 December 2022, January 9-10 & January 30-February 24 2023**

### **BENP (45 hours)**

**Starting date:**  
**THEORY (30 hours): October 3, 2022 (week number 40) -**  
**Ending date: December 23, 2022 (week: 51) (3 hours/week)**  
LAB Group 1 (15 hours): weeks 42-46, (normally) on monday  
LAB Group 2 (15 hours): weeks 42-46, on tuesday  
LAB Group 3 (15 hours): weeks 42-46, on wednesday  
LAB Group 4 (15 hours): weeks 42-46, on thursday  
LAB Group 5 (15 hours): weeks 42-46, on friday  
**Exams period: January 30-February 24, 2023**

### **C&N (45 hours)**

**Starting date:**  
**THEORY (45 hours): October 3, 2022 (week number 40) -**  
**Ending date: December 23, 2022 (week: 51) (4,5 hours/week)**  
**Exams period: January 30-February 24, 2023**

**Week 3: January 18-21, 2023 visit to CAEN (France)(?)**

### **NS**

**Teaching period:** weeks 2-4, January 11-17 (on-line) + January 23-27 (in person), 2023 in MADRID  
**Exam:** February 3, 2023 in Sevilla

### **SECOND SEMESTER**

#### **NR**

**Teaching period:** weeks 6-7, February 6-17 (in person) 2023 in SEVILLA  
**Exam:** February 24, 2023.

#### **RQT**

**Teaching period:** weeks 9-10, February 27- March 3 (on-line) & March 6-10 (in person) 2023 in SEVILLA  
**Exam:** March 17, 2023

#### **MBP**

**Teaching period:** weeks 12-13, March 20-24 (on-line) & March 27-31 (in person) 2023 in MADRID  
**Exam:** April 10, 2023

### **HP\***

**Teaching period:** weeks 15-16, April 10-14 2023 (on-line) & April 17-21 2023 (in person) in BARCELONA

**Exams period:** May 5, 2023

### **NA\***

**Teaching period:** weeks 16-17, April 17-21, 2023 (on-line) & April 24-28, 2023 (in-person) in BARCELONA

**Exam:** May 5, 2023

\* each student has to select one of these topics

### **WI**

**Teaching period:** weeks 19-20, May 8-12 (on-line) 2023 & May 15-19 (in-person) 2023, in SEVILLA

**Exam:** May 26, 2023

**In case of fail in one or more subjects, the student will have one extra opportunity in the period June 26 to July 21, 2023. The exact dates for this extra exam will be fixed with the lecturers. In addition, extra curriculum activities will be programmed in June and July, 2023.**

**For S3, the lectures at Caen (France) start in September 1<sup>st</sup>, 2023**

| Subject   | ECTs | Place     | Dates   | Character                     | EXAMS            |
|---|------|-----------|---|-------------------------------|------------------|
| Nuclear Structure: Properties and Models            | 6    | Madrid    | 11-17 January 2023 (on-line)<br>23-27 Jan 2023 (in person)    | Compulsory                    | 3 February 2023  |
| Introduction to Nuclear Reactions                   | 6    | Sevilla   | 6-17 February (in person) 2023                                | Compulsory for path2 students | 24 February 2023 |
| Relativistic Quantum Mechanics: Nuclear Processes** | 6    | Sevilla   | 27 Feb- 3 March 2023 (on-line)<br>6-10 March 2023 (in person) | Compulsory for path2 students | 17 March 2023    |
| Many-Body Theories in Nuclear Physics**             | 6    | Madrid    | 20-24 March 2023 (on-line)<br>27-31 March 2023 (in person)    | Compulsory for path2 students | 10 April 2023    |
| Hadron Physics**                                    | 6    | Barcelona | 10-14 April 2023 (on-line)<br>17-21 April 2023 (in-person)    | Elective for path2 students   | 5 May 2023       |

|                         |   |           |  |                               |             |
|-------------------------|---|-----------|--|-------------------------------|-------------|
| Nuclear Astrophysics ** | 6 | Barcelona | 17-21 April 2023 (on-line)<br>24-28 April 2023 (in person) | Elective for path2 students   | 5 May 2023  |
| Weak Interactions **    | 6 | Sevilla   | 8-12 May 2023 (on-line)<br>15-19 May 2023 (in person)      | Compulsory for path2 students | 26 May 2023 |

End evaluation for subjects in S1: February 24

End evaluation for subjects in S2: June 16

Period for exams for those who failed in subjects in S1 and/or S2: June 23 to July 21

C&N = Computing and Numerics ---- June 20

A&P = Atomic and Plasma Physics --- June 23

BENP = Basic Experimental Nuclear Physics --- June 27

QP = Quantum Physics ---- June 30

NS = Nuclear Structure: properties and models --- July 4

NR = Nuclear Reactions --- July 7

RQT = Relativistic Quantum Theory: Nuclear Processes --- July 11

MBT = Many-Body theories in Nuclear Physics --- July 14

HP = Hadron Physics --- July 18

NA = Nuclear Astrophysics--- July 18

WI = Weak Interactions ---- July 21