IMPORTANT NOTICE

What is the Application Form?

The Application Form is the template for EU grants applications; it must be submitted via the EU Funding & Tenders Portal before the call deadline.

The Form consists of 2 parts:.

- Part A contains structured administrative information
- Part B is a narrative technical description of the project.

Part A is generated by the IT system. It is based on the information which you enter into the Portal Submission System screens.

Part B needs to be uploaded as PDF (+ annexes) in the Submission System. The templates to use are available there.

How to prepare and submit it?

The Application Form must be prepared by the consortium and submitted by a representative. Once submitted, you will receive a confirmation.

Character and **page limits**:

- page limit normally 40 pages for calls for low value grants (60 000 or below); 70 pages for all other calls (unless otherwise provided for in the Call document/Programme Guide)
- supporting documents can be provided as an annex and do not count towards the page limit
- minimum font size — Arial 9 points
- page size: A4
- margins (top, bottom, left and right): at least 15 mm (not including headers & footers).

Please abide by the formatting rules. They are NOT a target! Keep your text as concise as possible. Do not use hyperlinks to show information that is an essential part of your application.

If you attempt to upload an application that exceeds the specified limit, you will receive an automatic warning asking you to shorten and re-upload your application. For applications that are not shortened, the excess pages will be made invisible and thus disregarded by the evaluators.

Please do NOT delete any instructions in the document. The overall page limit has been raised to ensure equal treatment of all applicants.

This document is tagged. Be careful not to delete the tags; they are needed for the processing.

TECHNICAL DESCRIPTION (PART B)

COVER PAGE

Part B of the Application Form must be downloaded from the Portal Submission System, completed and then assembled and re-uploaded as PDF in the system. Page 1 with the grey IMPORTANT NOTICE box should be deleted before uploading.

***Note:** Please read carefully the conditions set out in the Call document/Programme Guide (for open calls: published on the Portal).Pay particular attention to the award criteria; they explain how the application will be evaluated.*

PROJECT	
Project name:	[European Master in Nuclear Physics]
Project acronym:	[NucPhys]
Coordinator contact:	[José Antonio LAY VALERA], [Universidad de Sevilla]

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#@APP-FORM-ERASMUSUNEMJM@#
#@PRJ-SUM-PS@# [This document is tagged. Do not delete the tags; they are needed for the processing.]

PROJECT SUMMARY

Project summary *(in English)*
See Abstract (Application Form Part A).

#§PRJ-SUM-PS§# #@REL-EVA-RE@# #@PRJ-OBJ-PO@#

1. RELEVANCE

1.1 BACKGROUND AND GENERAL OBJECTIVES

Background and general objectives

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

Nuclear Physics is a broad matter of relevance from both the fundamental knowledge of Nature and the multiple applications to different fields of strategic economical relevance. These include energy resources (based on fusion or fission), biomedical sciences, analysis and characterization of new materials, environmental studies (atmosphere, soil, waters), dating, art and archaeometry, airport and toll security, military applications, industrial automatization and control, fire surveillance, among others. There is a clear need to support the development of nuclear competences at the European level. **However, there was no international teaching programme in Europe at the Master level devoted specifically to Nuclear Physics before NucPhys**. In section 1.2 few programmes related to nuclear physics are included. Nevertheless, most of them are designed in combination with particle physics and/or nuclear technology and thus they do not provide the fundamental basis and a profound knowledge in nuclear physics.

The present project was born with the intention to educate Nuclear Physicists at the highest international level. Such a highly specialized curriculum, by definition can only be addressed to a very restricted number of students in few universities. For this reason, most European University centers include Nuclear Physics only as a specialization embedded in a larger and more generic curriculum including other branches of Physics. Thus, only relatively generic and interdisciplinary Master Courses called ÒPhysicsÓ, ÒScienceÓ, ÒNuclei, Atoms and CollisionsÓ, ÒParticles and Nuclear PhysicsÓ or ÒAdvanced PhysicsÓ are found in most European Universities. **This situation had clearly a detrimental effect on the visibility of Nuclear Physics as a well-defined branch of Physics with important theoretical, experimental and applied implications**. An exception was the case of Spain, where the University of Seville coordinates a specific joint Master Degree on Nuclear Physics, with the participation of other five Universities (Aut□noma de Madrid, Barcelona, Complutense de Madrid, Granada, and Salamanca). This Master Course has been running during the last decade with excellent results.

With this experience, **we created a new and stronger international consortium by adding University of Padova, University of Catania and University of Caen-Normandie**, who brought high-experienced researchers and top-level nuclear physics facilities. With these partners, **we now offer a complete programme including theory, experiments and applications, covering all different aspects of the nuclear field**. Hence, the consortium offers a highly specialized curriculum in the form of a joint European Master Course on Nuclear Physics (NucPhys).

This EMJMD consortium is strengthened with the participation, as associated partners, of most of the large facilities for nuclear physics worldwide, as well as hospital and companies. Initially, these associated centers were located in Europe. Once the consortium has been consolidated, it is being expanded with

the addition of new international partners from all the continents to be able to reach any interested student in nuclear physics all around the world. In the last years, the network of associated partners has been expanded through the addition of new collaborations with institutions from America, Asia and Africa.

The present proposal aims at continuing to develop a 120 ECTS long-lasting international joint study programme, Ò**European Master in Nuclear PhysicsÓ** (**NucPhys)**, to educate experts in the field of Nuclear Physics, in order to meet the needs of this sector.

NucPhys first edition started in 2017. In the first call for applications, more than 70 applications were received, while this number reached 121 in the second intake and 150 for the third intake. This attests the relevance of our programme and encourages us to continue developing NucPhys, taking corrective actions that will ensure its excellence and adapting to the needs of a sector that is fast evolving.

NucPhys Consortium was designed with a ÒjointnessÓ basis that ensures coordination in the programme implementation in all stages of the EMJMD:

A highly integrated consortium with partner organizations and associated members: Consortium and associated partners have cooperated in the programme design and in the implementation in all stages of EMJMD. These include designing the integrated programme (with compulsory mobility bringing added value to the EMJMD), and the development of joint and integrated management (the Academic Committee), and assessment (the Quality Committee) structures, where students are also included. In addition, our more than 30 associated partners offer to students a plethora of placements opportunities and collaborate in the supervision and assessment of internship and Master Thesis. To our knowledge, no other comparable project exists worldwide.

The **integrated programme of study** (see 2.1.1), within which the consortium members recognize fully all courses delivered by the partners. Though based on the specificities of the different partner universities, the EMJMD proposes a coherent, unified and progressive curriculum at the European level. It combines jointly developed academic provision and training with three specialization tracks and professional/research internships, visits to nuclear physics research facilities, distinguished visiting scholars, as well as a common high specialized course in a relevant topic selected by the Academic Committee in each intake. A specific effort is taken for the homogeneity of the training in the different institutions, allowing student mobility to each partner country.

The high specialized course (in Module 3) is a key element of the programme. This course used to be co-organized with the TALENT initiative (http://www.nucleartalent.org/), which is a consortium of European and Northern American institutions that aims to providing an advanced and comprehensive training to graduate students and young researchers in low-energy nuclear theory. To increase the academic quality of the course, the Academic Committee invites renowned scholars in the field of Nuclear Physics to give lectures or seminars. Important members of relevant companies are also invited to contribute with the industrial vision on several issues covered by the study programme.

Global objectives:

The integration of EMJMD students in the local environments. Although the Programme language is English, local language courses are offered for free to students. In addition, integration of local or other international students in selected modules promote ÒjointnessÓ between these and EMJMD students.

The harmonization and recognition of awarded degrees. At present, the Spanish Universities have an accredited joint degree (and joint Diploma Supplement), and the Italian and French Universities can issue their accredited degrees, together with the corresponding Diploma Supplements (multiple degree choice). The Consortium will offer a joint diploma supplement to all the EMJMD graduates following the European template. We will also make use of the European Approach Framework for Quality Assurance with the aim of having a powerful seed towards the implementation of the Joint Degree.

The shared knowledge and consistent teaching and management practices between Universities. These include the integration of all the information relevant for the students in a common ÒStudent's HandbookÓ, the common definition of learning outcomes, the establishment of shared teaching and examination methodology, the common approach for internship supervision (with a tutor from the academy, a tutor from the institution/industry, and a fully joint examination committee), the joint evaluation of Internships defenses, the introduction of cultural activities, the implementation of common quality control mechanisms, and the development of a joint and integrated management structure, among others. The consortium has already put in place a system to exchange academic and administrative information accessible by all the members to facilitate the management of the master course.

A **joint application and selection procedure** is also organized in collaboration between the NucPhys Secretariat and the Selection Committee composed by one member of each partner organizations and two associated partners, as well as a joint recognition mechanism of grades and credits. Students are also involved through the participation of their representatives in the Academic Committee meetings and implementation of monitoring and Quality Assurance activities.

Mobility plans are being carried out among administrative staff and lecturers among the universities of the consortium.

The shared knowledge and consistent student services between Universities. These include the organization, at the local level, of services and networking activities to incoming students. Local administrative staff at the International Offices of each partner universities works jointly (including mobility training periods) on all administrative and financial issues and exchanging students' documents for the monitoring of their academic performance in connection with the Academic Local Coordinator at each partner university.

Regular meetings to monitor and follow up the implementation of the project. At least once per year, all the consortium members (including academic and administrative coordinators) meet to discuss about the results obtained. In addition, as novelty in this proposal, a second meeting will be organized with the academic coordinators at the beginning of the academic course to define the calendar and the activities to be organized. Online meetings are also organized periodically to ensure a continuous monitoring.

A joint evaluation of the internship and Master Thesis. The evaluation of the internship (12 ECTS) is fully common, with a public defense and a jury composed of the academic representative of the Consortium universities.

On the other hand, although the master thesis is evaluated by a committee in each partner university, it will be composed by at least one academic representative of the Consortium universities and/or Associated members.

A joint end of course ceremony in which all successful students will receive their diplomas will be organized in one of the partner universities on a rotational basis.

1.2 NEEDS ANALYSIS AND SPECIFIC OBJECTIVES

Needs analysis and specific objectives *Please refer to the description of the award criteria in the Erasmus+ Programme Guide.*
It is extremely important to insure a high-level competence in both fundamental and applied nuclear science, at the EU, national, and regional levels because:

Nuclear science and technology has many applications. Nuclear fission is the splitting apart of the nucleus of an atom. By carefully controlling this process at an industrial scale, we can harness the large quantities of energy released to generate electricity for the benefit of society as a whole. In this way, for about three decades, civil nuclear power stations in a number of European countries have been responsible for producing approximately one-third of all the EU's electricity. Concerning the specific French context, nuclear power is its first source of electricity production. The politics of the country is to allow a controlled development of nuclear energy, develop new and safer reactors, and contribute to waste recycling, dismantling old nuclear plants in the deepest respect to strict security rules. Nuclear Physics has other applications apart from energy production. For example, radiation is used extensively in medical diagnostic and therapeutic practices, such as imaging (e.g. X-rays), cancer radiotherapy or radioactive tracers. Most radioisotopes and radio-pharmaceuticals are produced in small nuclear reactors, which also serve as research facilities.

The importance of nuclear research at the European level is testified by **the Nuclear Illustrative Programme** presented under Article 40 of the **Euratom Treaty** in May 2017 by the European Commission. It states that, retaining technological leadership in the nuclear field is possible only if interested Member States maintain diverse and sufficiently funded nuclear research capabilities, including **education and training aspects**. Continuing to pursue research and development is instrumental to maintain the EU at the forefront of nuclear technology and develop the highest standards of safety, security, waste management and non-proliferation. **This implies continued investment on research and training/education**, as well as on nuclear research infrastructure.

The EU-funded programme of research also contributes to these efforts. Key thematic areas of interest include safe long-term management of radioactive waste (including disposal as well as technologies to reduce and recycle hazardous material), nuclear installation safety, the design of more efficient and sustainable nuclear reactors, and the risks of low and protracted exposure to ionizing radiation. This will allow Europe to maintain world leadership in nuclear safety and waste management and to attain the highest level of protection from radiation. Among other applications, the Programme will be carrying out research in the medical uses of radiation, for the benefit for all European citizens.

In particular, the Euratom Research and Training Programme that complements Horizon 2020 in the field of **nuclear research and training,** puts a strong emphasis on developing nuclear skills and competence**. Its general objective is to support nuclear research and training activities. Specifically, point E of the** Euratom Work Programme 2016 – 2017 (European Commission Decision C (2015) 6744 of 13 October 2015) is devoted to: E - SUPPORT THE DEVELOPMENT OF NUCLEAR COMPETENCES AT EU LEVEL. **This action aims at addressing the difficulties encountered with maintaining and renewing an adequate number of well-educated and trained nuclear researchers and professionals**, especially in view of expected high retirement and low renewal rates in countries with a strong nuclear tradition and of the growing need for further specialized training in emerging nuclear energy countries.

Moreover, the importance of nuclear research at the European level is testified by several independent agencies. It is important to mention the position papers of the European Physical Society (EPS) ÒEnergy and EnvironmentÓ (https://cdn.ymaws.com/www.eps.org/resource/resmgr/policy/eps_pp_energy_env_2009.pdf) and ÒEnergy for the future: the Nuclear optionÓ(https://cdn.ymaws.com/sites/www.eps.org/resource/resmgr/policy/eps_pp_option_2007.pdf).

In addition to these industrial applications, fundamental nuclear science is a lively and active field.

On the other hand, NUPECC, which is one of the Expert Committees of the European Science Foundation, states in its latest Long Range Plan (http://www.nupecc.org/roadmaps/lrp2010_rec.pdf), ÒEurope should continue to be at the forefront of promoting one of the most vigorous and fascinating fields in basic science, Nuclear Physics. Nuclear Physics addresses the fundamental aspects of those particles that interact via the strong interaction. These hadrons constitute nearly 100% of the visible matter in the universe. With the renewed worldwide interest in nuclear technology (low-carbon energy:

nuclear fission and nuclear fusion power generation; nuclear medicine: imaging and tumor therapy, security, materials studies with nuclear probes, etc.), Europe needs to preserve, and even enhance, its nuclear physics knowledge and skills basis in the future. **A dedicated effort directed at the training of young people is mandatory**.Ó Thus, the formation of new generations of nuclear physicist is of fundamental importance for Europe to keep and improve its leadership in this critical field. **The importance for Europe to have a top-level community of Nuclear Physicists is clearly stated in this document.**

In agreement with the NUPECC recommendation, several large-scale rare ion beams facilities have been approved or are already under construction: SPIRAL2 in GANIL-Caen France, FAIR in Darmstadt Germany, SPES in Legnaro-Padova, Italy, ELI-NP in Romania (all of them associated partners of our consortium). Because of this extensive research activity at the European level, many employment offers at the PhD or post-doctoral level are presently available, which often do not find competent candidates to be filled. For this reason, the existence of a European Master programme in Nuclear Physics is strongly needed to ensure the proper education of the next generation of professionals on this field. To illustrate this point, let us mention that around 80% of our students obtain an employment in the first three months after finishing, mainly in PhD programmes worldwide.

Specific Objectives:

The main objective at the end of the EMJMD is that participants will have advanced knowledge with a first research/working experience in the Nuclear Physics field. This will directly enable them to successfully perform doctoral studies or to be inserted in research/working teams in Scientific Centers/Companies/Industries/Medical Centers/etc.

The learning outcomes at the end of the EMJMD, defined according to the Dublin Descriptors, are as follows:

- About knowledge and understanding, the participants should be able to:
  - describe, analyse and comparatively assess the most important parts in Nuclear Physics, their rationale and participation procedures, as best practices and as guidelines for future development and improvement of Nuclear Physics strategies
  - take part in an experiment in top experimental facilities using current techniques and new developments. It includes: understanding the basic setups, systems of data adquisition, basic electronic chains, main particle and radiation detectors, and the corresponding data analysis, knowledge of particle accelerator techniques, and safety measurements
- About applying knowledge and understanding, the participants should be able to:
  - describe and evaluate Nuclear Physics state-of-the-Art
  - apply knowledge, understanding and problem solving abilities in new or unfamiliar environments within broader (or multidisciplinary) contexts related to their master degree's field of study
  - participate in a team to apply knowledge and to develop new possible Nuclear Physics applications.
- About making judgements, the participants should be able to:
  - evaluate critically issues and discussions on Nuclear Physics
  - set and apply integrated and pluralistic evaluation methods in a specific Nuclear Physics context
  - identify most suitable planning tools for a particular problem either theoretical, experimental or applied.
- About communication skills, the participants should be able to:
  - use a standard format of writing professional reports
  - know the basic principles of writing a scientific publication
  - sustain an English scientific conversation on Nuclear Physics. They will have a high-level fluency and knowledge in technical English, in particular that associated with the Nuclear Physics field
  - organize and participate in a team work, while specifying his/her specific role in the team
  - communicate their conclusions (knowledge and rationale behind) to specialist and

non-specialist audiences clearly and unambiguously, as they would do in their professional life in Nuclear Physics
- communicate in as many national languages (Spanish, French, Italian) as they desire
- give short oral presentations in the field of nuclear physics in front of a specialized audience
- prepare scientific communication material such as posters presentations.

- About learning skills:
  - plan, design and manage information systems (data analysis and processing), with respect to specific decision support systems in Nuclear Physics
  - identify and describe suitable systems, technologies and tools to measure and monitor new Nuclear Physics advances
  - enrich personal experience by living in different European countries, immersion in their culture, and working with classmates from different countries all over the world
  - know the basic principles of preparing a proposal and managing a project
  - know the basic principles of the Intellectual Property Rights
  - know the basic principles of the entrepreneurship

With reference to the relevance of the aforementioned learning outcomes in view of the students´ future academic opportunities and employability it is important to highlight that Nuclear Physics constitutes a field of knowledge closely connected both to present research and to top industry.

Among the associated partners are several of the main Nuclear Physics facilities in Europe: CERN in Geneva, ELI-NP in Romania, GANIL in France, GSI in Germany, LNL, LNF, LNS and ECT* in Italy. These are National laboratories in which forefront Nuclear Physics is developed at fundamental and applied levels. In addition, LNS in Catania (Italy) is also a National Laboratory with important connections with industry and Medical Physics with the CATANA and ELIMED projects. Smaller facilities like CNA and CMAM in Spain are mainly devoted to applications included all mentioned above (Environment, Material analysis, Dating, Art and Archaeometry, etc.). The ARCHADE project in Caen has strong connections with industrial partners in the therapy domain. CIEMAT in Spain is involved in Energy studies and many other applications. The consortium has links also with Hospitals (Virgen del Rocio and Virgen Macarena (Seville), Baclesse (Caen), Azienda Spedaliero-Universitaria Policlinico (Catania) in the field of Medical Physics. Companies as CAEN Sys, CAEN Lab and Alter Technology will provide a professional environment to our students. Important laboratories in the forefront of research and applications in America (TRIUMF (Canada), RIBRAS (Brazil), TANDAR (Argentina), UNAM (Máxico)), Asia (RCNP-Osaka (Japan)) and Africa (CNESTEN (Marocco) and iThemba, (South Africa) are also supporting this master degree. The Academic Committee will continue looking for excellent new associated centers. We do believe that this large network of partners will bring important benefits to our students in terms of professional opportunities, promotion and sustainability of the master and internationalization.

Secondly, the associated members are companies and research institutions that will accept students for the internship period and also contribute in the additional activities by organizing visits to their corresponding factories. Research institutions will promote the development of research activities and will serve as a link between the academic institutions and companies working in the Nuclear Physics field. Their degree of commitment is certified by their corresponding endorsement letters. (See Annex II). All these different non-educational actors already have deep and longstanding links with the existing local Masters on which the EMJMD project is based on. These links will contribute to the sustainability of the project beyond the UE funding.

The companies CAEN Sys and CAEN Lab have already offered a summer two-week course on their main factory in Viareggio (Italy) to our students interested in instrumentation and detectors. We have the intention to maintain this short course and implement new ones in collaboration with other associate members.

Associated Partners are included in Academic and Quality committees created to manage the NucPhys EMJMD, they can be Tutor of Master Thesis and Internship, and will be consulted after course implementation so that they can contribute to improve the educational content and methodology, as well as any other aspect suitable of improvement as they have a realistic idea of what

is needed in the sector. In addition, they can contribute to the **promotion of our programme** and the dissemination of the results among their own contact networks. They will also play a key role in the **employability** of graduates, either to work as professionals, academics, or to embark on a research career by joining a PhD programme.

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1.3 COMPLEMENTARITY WITH OTHER ACTIONS AND INNOVATION — EUROPEAN ADDED VALUE

Complementarity with other actions and innovation

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

The proposal is strongly committed with excellence, innovation and internationalization in the higher education European space. While the general population is aware with the importance of fundamental Physics knowledge for the new generations, a smaller fraction of people knows the important impact of Nuclear Physics in society. This impact is long range for basic theory and experiments on fundamental Nuclear Physics that treat to understand the nuclear structure and its reaction mechanisms. However, there are many applications that are already running or start being implemented. Just to mention few applications, nuclear fission is the base of the already operating nuclear power plants, nuclear fusion is on the fundamentals of the new projected fusion projects, as ITER, that probably is the near future world solution for the energy. Coming to the more familiar medical issues, protontherapy and hadrotherapy are alternatives to the traditional photon and electron therapies that are already implemented with emerging technologies with the corresponding impact on our future lives. The technology developed for fore-front basic nuclear physics experiments (detector, electronics, data treatment and analysis, image processing, etc) are now-a-days being implemented in industry.

The proposed master degree includes all subjects needed for a solid background in basic Nuclear Physics (structure, reactions, computing, etc.) **and a selected specialization** on: i) experiments in large experimental facilities and instrumentation, ii) theoretical nuclear physics, or iii) applications of Nuclear Physics and smaller accelerator facilities. **For this purpose, three specialization paths have been designed taking advantage of the strongest points of each consortium member.** The complete programme description is given in 2.1.1. These will produce the following learning outcomes that fit perfectly with the detected European needs as mentioned in the EURATOM TREATY.

The NucPhys programme makes special emphasis on promoting experiential learning and offers students stimulating learning experiences which give them a continuous close contact with the world of work as well as the chance to see and reflect about the real nuclear physics activity, discover different ways of thinking and managing projects, and meet successful researchers, who might be potential future employers.

Comparison with related initiatives at the national, European and International level

As stated in 1.1. Nuclear science is taught at the Master level in different EU Universities, but most European University centers include Nuclear Physics only as a specialization embedded in a larger and more generic curriculum including other branches of Physics. Thus, **only relatively generic and interdisciplinary Master Courses called ÒPhysicsÓ, ÒScienceÓ, ÒNuclei, Atoms and CollisionsÓ, ÒParticle and Nuclear PhysicsÓ or ÒAdvanced PhysicsÓ are found in most European Universities**. Some particular examples related to nuclear physics at the national level are listed below:

University of Edinburgh (UK) - MSc in Particle & Nuclear Physics.

https://www.ph.ed.ac.uk/msc-particle-nuclear-physics

University of Glasgow (UK): MSc Physics: Nuclear Technology

https://www.gla.ac.uk/postgraduate/taught/physicsnucleartechnology/

University of Birmingham (UK) - Physics and Technology of Nuclear Reactors MSc

https://www.birmingham.ac.uk/postgraduate/courses/taught/physics/physics-technology-nuclear-

reactors.aspx#CourseDetailsTab

University of Surrey (UK) - Nuclear Science and Applications MSc

https://www.surrey.ac.uk/postgraduate/nuclear-science-and-applications-msc-2019

University of Manchester (UK): MSc by Research Nuclear Physics:

https://www.manchester.ac.uk/study/postgraduate-research/programmes/list/06699/msc-by-research-nuclear-physics/programme-details/#course-profile

http://www.nuclear.manchester.ac.uk/

University of Jyv□skyl□ (Finland) - Master's Degree Programme in Nuclear and Particle Physics

https://www.jyu.fi/ops/en/science/masters-degree-programme-in-nuclear-and-particle-physics

Uppsala University (Sweden) - Master of Science in Physics - Nuclear and Particle Physics

http://www.uu.se/en/admissions/master/selma/program/?pInr=KARN&pKod=TFY2M

The situation outside Europe is even worse, since there is not specialized education focused in Nuclear Physics. Only in North America, we can find some programmes related to Nuclear Engineering.

University of Ontario Institute of Technology (Canada) - Master of Applied Science in Nuclear Engineering

https://uoit.ca/programs/energy-systems-and-nuclear-science/nuclear-engineering-masters-program.php

University of Wisconsin – Madison (EEUU) - Master of Science, Nuclear Engineering and Engineering Physics

https://www.engr.wisc.edu/department/engineering-physics/academics/ms-nuclear-engineering/

Consequently, this proposal is extremely beneficial to Europe, improving the visibility of higher education in nuclear physics and help attracting the best students towards this field.

One important **added value** of this joint Master is the compulsory mobility among Universities and top level nuclear research centers and the possibility of three different specializations, that cover basically all Nuclear Physics: i) experiments, instrumentation and large accelerators, ii) theory of nuclear structure and reactions, and iii) applied nuclear physics and small accelerators. **This complete offer does not exist in any single University**. In addition, Master Thesis works are coordinated among different Universities/Research centers/Industries so as students will share the know-how/advise/facilities from two/three nuclear physics top level centers. **This is a unique opportunity for students to develop professional nuclear physics work in experimental, instrumental, theoretical or applied aspects.**

In order to illustrate this point, we would like to quote the external Quality report of previous project from Dr. Barbara Rega, AgroParisTech, FIPDes Managing director and Prof. Sandrine Courtin, IPHC Director, France, where the latter wrote: “this Master provides outstanding preparation for future Nuclear Physicists in academia as well as in Nuclear industry, providing them with essential knowledge of the field and its applications as well hands-on skills and the ability to develop novel approaches and to find autonomy in their work.” and that “This Master is, to my knowledge the most complete curriculum proposed in Europe for Nuclear Physics and takes advantage of the European expertise in the field.”

At the doctoral and post-doctoral level, there exists a recent action, TALENT, with similar aims as the theoretical path of the present EMJMD. **Our EMJMD is coordinated with it** in order to extend the training to the Master level and to the experimental and applied aspects of nuclear physics.

The TALENT initiative (**Training in Advanced Low Energy Nuclear Theory**, see http://www.nucleartalent.org/), aims at providing advanced and comprehensive in-depth training to graduate students and young researchers in low-energy nuclear theory. The initiative is a multinational network between several European and Northern American institutions and aims at developing a broad curriculum that will provide the platform for a cutting-edge theory for understanding nuclei and nuclear

reactions. These objectives are met by offering series of lectures, commissioned from experienced teachers in nuclear theory. This initiative is developed since 2012 mostly at the doctoral level and has shown to be a successful highly selective graduate program of excellence in low-energy nuclear theory. **This partnership with an internationally recognized high level training programme contributes to the excellence and international visibility of our partner universities**.

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2. QUALITY

2.1 PROJECT DESIGN AND IMPLEMENTATION

2.1.1 CONCEPT AND METHODOLOGY

Concept and methodology

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

Students of **NucPhys** are trained in nuclear technology, safety and radiation protection. The proposal addresses the integration of students in the industry and other institutions (i.e. hospitals), and seeks to bring young researchers into Euratom-supported research projects. The aim is to respond to the needs of the nuclear industry and the corresponding regulatory bodies. Also important are the so-called **nuclear activities of proximity, which include medical applications, the relevant non-nuclear industrial applications and the transport of radioactive materials.** In line with the strategy for EU international cooperation in research and innovation (COM(2012)497), **international cooperation is fundamental** and is the base of this proposal.

The creation of the Nucphys consortium specially designed to integrate the best expertise (needed to create an assembled, well-based and complete programme) was a necessary step forward to achieve these objectives, because none of the mentioned institutes could alone offer a complete study career that covers all aspects of this multi-faceted field. A renewal of this programme which is further improved in this submission will be essential to continue to attract excellent non-European students in the field of Nuclear Physics.

It is important to note that we propose three specialization paths (see below for details) so as to cover all branches of Nuclear Physics. In path 1, (**experiments and instrumentation in large accelerators**) students are in contact with forefront nuclear physics experiments and with the companies working in the field (electronics, vacuum, electromagnetism, new materials, etc.). In path 2 (**theoretica**l), students will learn more academic topics related to fundamental interactions and components of matter. In path 3 (**applications and small accelerators**), students will learn about many applications of nuclear physics, in particular: material analysis, therapy (including the new hadrontherapy), archaeometry, medical imaging, etc. They will be also in contact with companies developing instrumentation for applications. These three lines cover both, academic and professional important aspects for the future of the nuclear physics young generations.

DESIGN AND STRUCTURE OF THE PROJECT

The design and structure of the project has been done by all partners in the consortium in order to produce a top level master degree from the academic point of view and to favor the networking among both institutions and students from the beginning.

Our proposal is a 120 ECTS Master Course of 24 months' duration. The Master is structured for all students in 5 modules and divided into 4 terms (semesters). A common basis of fundamental knowledge is given to all students during the first semester. A progressive specialization is then acquired through the choice of one out of three different paths. The academic content of the different courses and the progressiveness of the specialization are further optimized by this renewed proposal, by the fact that the entrance university is the same for all students, and therefore the basic courses are common to all. This insures a completely even background and further increases the links among students of a given intake. Moreover, the course on advanced computing insures to all students the compulsory background for a

successful completion of their internship in S3 and employability after the graduation.

The NucPhys Master program will start with an **orientation week** in the entrance university, Seville. During this week a **welcome ceremony** will be organised that will gather together new students, professors from all the consortium partners, alumni and some representatives from associated partners. Besides coordinators of each Consortium university will welcome students and introduce the NucPhys program, **associated partners and alumni will be invited to give a presentation of their current professional situation** to motivate our students about their career opportunities once the master is ended and to have a better idea of how the nuclear physics sector is working. In addition, students from the previous intake will be connected via a video-conference for a joint session for the new students to ask questions and getting some advice. This first step of networking among students provides the opportunity to exchange views, experiences, and plans with each other at a very early stage.

Initial knowledge of students will be checked during the orientation week through a ÒPilot TestÓ and online dedicated resources will be available for bridging possible gaps in order to assure the same starting point to all students. Our students arrive from very different academic environments focused on different backgrounds and skills, thus generating serious difficulties to foreign students both on tackling the different contents but also with understanding the evaluation system of each University. This has been our main risk and source of failure among the students. In this new edition we expect to overcome this issue by establishing a network of tutorships. Those students finding difficulties will be assigned a tutor (second-year students of the master or professors). Potential tutors will be encouraged to enroll and to have periodic discussions with students on which skills are expected to be evaluated and how, evaluation systems, bureaucratic proceduresÉ With this we expect to help specially foreign students to overcome the initial disadvantage of starting a programme in a different academic environment.

The Master is structured in 4 semesters and three different paths or specializations. Below the characteristics of each path are briefly explained:

PATH 1 – EXPERIMENTAL AND LARGE ACCELERATORS

The aim of this path is the advanced education in experimental Nuclear Physics using large accelerators. Most of the largest accelerators in the world are associated partners of this Master and students could have the opportunity of visiting these facilities.

The path includes master-level courses in Quantum Mechanics, Structure and Reactions in Nuclear Physics, Experimental Techniques at basic and advanced level, and different applications of Nuclear Physics, etc. Additional extra-curriculum courses will be offered as computing and numerical calculations, plasma physics and fusion with the participation of external experts.

Thanks to high-level education on general aspects in subatomic physics and to specific experimental and technical acquired competences, students can be projected towards different career opportunities both in the academic sector (fundamental research in physics) and in the R&D department of industries in all the technology sectors dealing with ion beams, data acquisition and instrumentation. A continuation in PhD is also foreseen.

PATH 2: THEORETICAL NUCLEAR PHYSICS

The specific objectives of the theoretical path can be identified with providing the students with a solid preparation in several features of nuclear structure, nuclear dynamics, nuclear astrophysics and in various other aspects of theory of fundamental interactions.

The students will have the opportunity to interact with major experts in the various fields at the international level. Besides this, this path aims at the training on the use of particle detectors, and of other experimental instrumentation for the study of Physics of Fundamental Interactions, Matter and Astrophysics. The students will also learn recent technics for data taking and analysis.

The theoretical path has as natural development an academic career and/or an activity in research in fundamental nuclear and particle physics and astrophysics. Furthermore, the skills acquired and the high level of scientific preparation will be able to provide these students with job opportunities in all the different fields needing modelling, data storage and analysis, software package development and related areas. A continuation in PhD is foreseen.

PATH 3 - APPLICATIONS AND SMALL ACCELERATORS

The aim of this path is the advanced education of young students to different applications (medicine, environment, archeaometry, accelerators, etc.) in the field of Nuclear Physics.

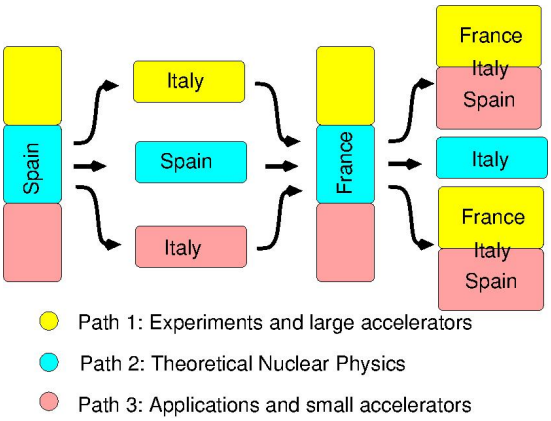
The path includes master-level courses in Quantum Mechanics, Statistical Mechanics, Nuclear Physics and Nuclear Astrophysics. Furthermore, advanced courses in nuclear physics applications will be held also with the participation of external experts. Both in the regular courses and in extra activities, students will be approached to experimental techniques, detectors, accelerators and analysis procedures. Different activities are programmed, including a visit to the Laboratory Nazionali del Sud, including the two accelerators, the experimental halls and the Radioactivity Laboratory.

The high-level education on general aspects in subatomic physics and the specific experimental and technical competences acquired in this path concerning the different nuclear physics applications of social interest will allow students to access executive positions in companies or laboratories dealing with radiation protection, waste management, proton and hadrontherapy, radioisotopes for medicine, archeaometry, accelerators, etc. A continuation in PhD is also possible.

The mobility in the three specialization paths:

PATH 1: Experiments and Instrumentation in large accelerators. Students following this path will start in Seville for S1, next go to Padova for S2, then to France for S3 and, finally, to any of the three countries for the Master Thesis in S4.

PATH 2: Theoretical nuclear physics. Students within this path will start in Seville for S1 & S2, then go to France for S3 and finally will go to Italy for the Master Thesis in S4.



PATH 3: Applications and small accelerators. Students within this path will start in Seville for S1, next go to Catania for S2, then to France for S3 and, finally to any of the three countries for the Master Thesis in S4.

The general scheme ECTs distribution of the Course is presented in the following table, giving the number of credits associated to each module (see below) according to the mobility and specialization path:

PATH 1 - EXP: Large accelerators (~1/3 of the students*)

PATH 2 - THEO: Theoretical Nuclear Physics (~1/3 of the students*)

PATH 3 - APP: Small accelerators (~1/3 of the students*)

	MOD1	MOD2			MOD3	MOD4	MOD5
		EXP	THEO	APP			

PATH 1	30	24	12	6	6	12	30
PATH 2	30	0	42	0	6	12	30
PATH 3	30	6	12	24	6	12	30
Total	30	42			6	12	30

***) The selection committee will consider keeping a certain balance amount paths.**

Concerning contents, the academic programme is structured in 5 modules:

Module 1: Basics nuclear physics and tools (30 ECTs in S1)

Module 1 (BAS) will be devoted to the basic knowledge required on general Physics, and Complementary/Interdisciplinary courses adapted to the chosen path (notably numerical methods and computing). These courses will be concentrated in the first year, in S1, and include topics as Advanced Quantum Mechanics, Basic Nuclear Physics: theory and laboratory, Computing and Numerical Methods, and Atomic and Plasma Physics

Module 2: Advanced nuclear physics (42 ECTs in S2 and S3), with three specialties (experimental, theory, applications)

Module 2 allows students to follow 3 paths: Experimental/large accelerators (path 1), Theoretical (path 2), or Applied/small accelerators (path 3). This module will give the specialized focus of the Master curriculum towards fundamental or applied nuclear physics. Fundamental physics includes either an experimental or a theoretical focus. Applied physics is especially focused on biomedical applications, but also includes fundamentals in accelerators technology, archaeometry, monitoring of nuclear waste, and nuclear fusion plasma physics. The specialization is progressive, starting already in the first year (S2), then continuing in S3 with courses and specific internships, to finalize in S4 with the master thesis. Academic topics in S2 and S3 include Nuclear Structure and Reactions, Nuclear Astrophysics, Weak and Strong Interactions, Collision Physics, Many Body Theory, Nuclear Physics Applications: Art, Materials, Nuclear Physics Applications: Radioprotection and Therapy, Metrology and Data Analysis, Experimental Nuclear Physics, Advanced Nuclear and Subnuclear Laboratory, Accelerator Physics, and Advanced Instrumentation. Specially in this module, we will continue encouraging lectures from Universities in the consortium to be invited to teach by a different University on subjects where they can contribute with their expertise, thus improving mobility and enhancing the quality of the programme.

Module 3: Common advanced course (S3 course, 6 ECTs)

Module 3 (ADV) is devoted to a highly specialized topic that will be selected for each intake among the hot topics in Nuclear Physics. During two weeks at the end of S3 this special topic will be presented by invited scholars in Caen, France. The choice of period and location is done to optimize the mobility scheme of the students (see below). Topics and lecturers used to be selected in previous project every year for the next course in a co-organization with TALENT (6 ECTS). At present, we have decided to continue the previous programme on “Data Analysis and Machine Learning”, in principle provided by Prof. Morten Hjorst-Jensen (see 2.1.3).

Module 4: Internship (12 ECTs)

Module 4 (INTERNSHIP) will be done in the third semester (S3). It is dedicated to student individual internship (experimental, theoretical or applied topics are accepted), which will take place in different institutional or industrial research centers in Caen (France) according to the chosen path and desired specialization. Students will be supported by internal (Consortium) and external (Associated Members) tutoring and will be fully integrated in the research centers within appropriate signed agreements during the whole semester (from September to December), where they will perform their internship project part-time. The internships are programmed by the University in advance, so as to provide a real working experience, valuable for future job placement. A “Practice Oriented Day” is organized at the beginning of the third term in Caen, so as to present the Internships programs, to share the discussion on the work topics, aims and methods with students, and to consolidate the Consortium network. The evaluation of

this module is fully common, with a public defense and a jury composed of the academic representative of the Consortium universities. This common evaluation is an extra jointness feature of our programme.

Module 5: Master Thesis (30 ECTs)

Module 5: (THESIS) will include the initial steps to write a short project of Master Thesis which has to be approved by the Master Academic Committee and the conduction of a research work in theoretical, experimental or applied Nuclear Physics with the direction of one or more advisors from one or more Universities (works with coordinate tutors from two partner Universities, or from one University and one associated industrial/host institution, will be encouraged). This module includes the writing of the Master Thesis and the public defense of the achieved results. The student will present and defend the Master Thesis in the University of enrollment during S4 and will follow the rules of that University concerning formats, regulations, deadlines, and composition of the Defense Committee. The present project will recommend to include in this committee academics of the other Consortium Universities, experts from the associated members and/or other external experts). In case of failure, an extra opportunity will be given to the student in his/her S4 enrollment University following the local rules for Master Thesis defense. In this case, the inclusion in the "Defense Committee" of an external member from other internal (Consortium) and external (Associated Members) institution is highly recommended.

COURSE DISTRIBUTION

In the following table we list the courses offered in each University for semesters one, two and three each year. This list is made using part of the structures and courses already offered in local Masters with the appropriate selection of matters. Concerning semester 3, only 12 ECTS have to be obtained in regular courses, since 12 ECTS correspond to the internship and 6 ECTS are assigned to a common course (module 3, see below) which is compulsory for all students. Semester 4 is devoted to the preparation of the Master thesis in a host University, research center or company (MOD 5).

MODULE 1 – basic nuclear physics and tools	MODULE 2 - advanced nuclear physics (EXP)	MODULE 2 - advanced nuclear physics (THEO)	MODULE 2 - advanced nuclear physics (APP)	MODULE 3- Common Specilized Course	MODULE 4 – Internship	MODULE 5 – Master Thesis

PATH 1: Experiments, instrumentation and large accelerators (approx. 1/3 of the students)

S1: Spain	**Computing and Numerical Methods (6)**	**Quantum Mechanics (6)**	**Basic Experimental and Applied Laboratory (6)**	**Basic Nuclear Physics (6)**	**Atomic & Plasma Physics (6)**
S2: Padova (Italy)	**Radioactivity and Nuclear Measurements**	**Nuclear Astrophysics**	**SubNuclear Physics**	**Introduction to Radiation Detectors**	**Advanced Laboratory (6)/ Introduction to Radiation Detectors (6)/Astroparticle Physics (6) /Subnuclear Physics (6)**

S3: Caen (France)	**Research Internship (12)**	**Common Advanced Course (6)**	**Metrology and Data Analysis (6)**	**Exp.Nucl.Phys. +Accelerators (6)**
S4: Spain, France or Italy	**Master thesis on experimental nuclear physics, instrumentation large accelerators (30)**			

PATH 2: Theoretical nuclear physics (approx. 1/3 of the students)

S1: Spain	**Computing and Numerical Methods (6)**	**Quantum Mechanics (6)**	**Basic Experimental and Applied Laboratory (6)**	**Basic Nuclear Physics (6)**	**Atomic & Plasma Physics (6)**
S2: Spain	**Nuclear Reactions (6)**	**Relativistic Quantum Mechanics (6)**	**Hadronic Physics (6) or Nuclear Astrophysics (6)**	**Weak Interactions (6)**	**Many-Body Theories in Nuclear Physics (6)**
S3: Caen (France)	**Research Internship (12)**		**Common Advanced course (6)**	**Theoretical nuclear, atomic and collision physics (12)**	
S4: Italy	**Master thesis on theoretical nuclear physics (30)**				

PATH 3: Applications and small accelerators (approx. 1/3 of the students)

S1: Spain	**Computing and Numerical Methods (6)**	**Quantum Mechanics (6)**	**Basic Experimental and Applied Laboratory (6)**	**Basic Nuclear Physics (6)**	**Atomic & Plasma Physics (6)**
S2: Catania (Italy)	**Nuclear Reaction Theory (6)**	**Accelerator Physics and applications (6) / Nuclear and subnuclear Physics Laboratory (6)**	**Medical Physics (6) / Archaeometry (6)**	**Advanced Nuclear Techniques applied to Medicine (6) / Environmental Radioactivity (6)**	**Nuclear Astrophysics (6)**
S3: Caen (France)	**Research Internship (12)**		**Common Advanced course (6)**	**Applications for therapy (12)**	
S4: Spain,	**Master thesis on applications and small accelerators (30)**				

France or Italy	

Courses will be taught in English. Students will be provided with the appropriate academic material in English.

It is important to note that **in addition to the participant Universities, the associated Labs and Companies can be the hosts for internship and Master Thesis development**.

Apart from the mobility of lectures, we have recently started to encourage mobility of administrative staff. Such visits and also the presence of administrative staff together at the internship defense have definitely helped to the management and effectiveness of the progamme.

In coordination with some of our associated partners the master program will offer **extra-curriculum activities**. For instance, in the running master a two-week internship was offered on nuclear physics instrumentation at the main facilities of the company CAEN Sys and CAEN Lab. at Viareggio (Italy), a one-week internship was offered to work on application to therapy at the Hospital HVM in Seville (Spain) and a four-week internship was offered to work within the nuclear fusion group at CNA in Sevilla (Spain). We continue working with our associated partners to open more possibilities of extra-curriculum internships for our students.

Finally, it is worth mentioning that regular opportunities (meetings of the Academic Committee and Quality Committee) will be scheduled to critically and constructively identify where the content and the coherence of the study programme, the learning outcomes, or any other aspect of the EMJMD, can be improved. The inclusion of students and industry/research facilities associated partners in the Quality Committee will facilitate to accommodate the EMJMD to new academic/industry needs, if necessary.

Student application, selection, participation in the course, and student scholarship allocation.

All applications for admission will be submitted on-line, through the official application system of the NucPhys Master program (http://www.emm-nucphys.eu/) for their processing. The following documents must be attached (translated into English if necessary):

- Copy of a valid ID document (passport, identity card, etc).
- Photo.
- Copy of the official transcript of academic records from HEI awarding Bachelor Degree.
- Whenever possible, students will be required to present officially certified copies and translations of the student's diplomas and grades and an official certificate of the ECTs content of the subjects and of their position within their corresponding cohort.
- A complete and updated curriculum vitae (the Europass CV is recommended).
- Motivation letter from the student explaining why she/he has selected the Master and describing purposes and interests.
- Commitment Letter to full-time study for the two years of the Masters Course.
- Recommendation letters from two referees, of which at least one academic.
- Proof of English level (the accepted certificates are TOEFL, IELTS, University of Cambridge Certificates, etc).
- Any other documents characterizing applicant's credentials, like research memories, mathematical competitions diplomas, etc.

Candidates for the NucPhys EMJMD must hold:

- A university qualification corresponding to bachelor in Physics, Chemistry or Engineering (Materials, Mechanical, Structural, Civil, Aeronautical, Naval) according to the Bologna framework. Any other kind of scientist or engineer with a background related to the objective of the NucPhys EMJMD is also welcome.
- Language skills: English, candidates from countries where English is not one of the official languages, must demonstrate their knowledge of English by proving that they have received their education in English or with a certified language level equivalent to B2 using the CEF (Common European Framework of Reference for Languages).
- Commitment in writing to full-time study for the two-year period of the Masters Course.

Selection Process

After closing the deadline for applications, the consortium's Selection Committee will evaluate them. The admission policy is intended to ensure equal opportunity of access to higher education for qualified European and Third-country students. In the first instance the Selection Committee selects those students who meet the Admission Requirements and afterwards establishes a ranking considering merits (according to the list of Additional Merits listed above). Each applicant will be evaluated on the listed merits a)-g) independently by three different members of the Selection Committee in order to avoid individual bias. According to this evaluation the best 50 applicants will be selected for the second evaluation round that will be a personal interview with a member of the selection committee. In this interview the basic Physics and Mathematical background of the applicant and his/her English level will be evaluated. Finally, the Committee formulates a proposal for candidates who should be accepted into the Master, the list top ranked candidate deserving the award of the Erasmus + EMJMDs scholarship, according to Erasmus Mundus rules, as well as a reserve list. As soon as the list is approved, students will be informed, by fax or e-mail. They will also be notified by an official letter expressly confirming the student's admission to the Master programme. The letter will be accompanied by a brief description of the Masters Course, with express reference to its forming part of the European Commission Erasmus + Programme - EMJMD, its organization by officially recognised educational entities in the three countries, and any other information that may help to complete the paperwork necessary to obtain visas, official permits, etc.

Additional Merits: Those candidates for the Master who meet the Admission Requirements will be ranked with a maximum score of 100 according to:

- (up to 30) Academic excellence.
- (up to 3) Relevant work experience related to the field of the Master Course.
- (up to 5) Student motivation to undertake the Master and relevance to her/his professional development.
- (up to 10) Recommendation from the references.
- (up to 2) Others.
- (up to 50) Individual interview on-line, including language skills and relevance of the student's background to the field of the Master Course.

There will be a two-step selection. In a first round, items a-e will be scored (up to 60 points) for each applicant by the selection committee. Then, the best 50 applications will be selected for the second round of evaluation that is item f above (personal interview) to check level of English, basic Physics and Mathematics knowledge, and actual motivation.

Besides, as one of the NucPhys EMJMD missions is to attract the best students from all over the world interested in Nuclear Physics, the final selection will encourage a possible spread of the number of places considering the applicant nationalities. No more than two-scholarships will be allocated to students of the same nationality.

In order to ensure the clearness and transparency of the selection process, every applicant will have the right to know their final position according to the following scheme:

-Group I: Applications of very good quality (score higher than 75 points out of 100).

-Group II: Applications of good quality (score between 60 and 75 points out of 100).

-Group III: Applications of weak quality (score less than 60 points out of 100).

Enrollment:

All students will be enrolled in the first year for S1 in University of Seville where they will follow the courses of S1. For the next semesters, students will enroll in the university where they courses take place, (for S2 students in path 1 will be enrolled in University of Padova, students in path 2 in University of Seville, and students in path 3 in University of Catania and in S3 all of them should enroll at University of Caen). During S4, path 1 and path 3 students will be enrolled in any of the consortium Universities, the one the student selects to develop and present his/her Master Thesis work. Students in path 2 need to be enrolled for S4 in one of the Italian Universities so as to spend at least one semester in each of the countries involved in this proposal (Spain, France and Italy). Consequently, during all the Master period students will be officially enrolled in one of the consortium Universities and as such, they will benefit from the standard support and **services offered** and insured to all students for visa procedure, accommodation, insurance, language training, disability needs and administrative formalities. Let us remind that, as commented in other parts of this document, to this services we will offer language courses, a tutorship programme, help with accommodation, and support for asking extra funding for mobility to self-funded students like other actions of Erasmus+.

During the mobility periods the University of Seville, as coordinating institution, will take care of communicating all student data to the other University/Center/Company so as to ensure that all of them benefit of services like student rooms, canteen, library, language courses, etc. All students during the Master period will have health insurance, according to the minimum requirements for EM programme, and administrative help. Non EU students will receive special support jointly by the Coordinator and the other host Institutions in order to facilitate and speed up the visa procedure.

Concerning performance assessment, during S1, S2 and, partially, S3 students will be evaluated following the rules of the enrolment University. The consortium already checked that the main assessment rules are qualitatively equivalent in all involved Universities. The consortium has already approved a equivalence table for the different grades so as to translate in a common way the marks in France, Italy and Spain to the general European system. This equivalence is included in the Consortium Agreement. Anyway, every year situation is commented in the consortium meetings so as taking corrective measurements if needed. For the evaluation of the Internship there will be a common ceremony in which the evaluation committee has members of different nodes in the consortium including the associate members. This defence is done at the end of S3 taking advance of the development of the common specialized course for which all students and many academics for the consortium will be in Caen. The Master Thesis defence is done locally at the S4 student enrolment University and is strongly recommended the participation in the evaluation committee of external members from other consortium Universities and/or associated members.

Participation in the course:

Besides the normal evolution of the courses, internships and thesis, students are asked to elect a representative and a deputy per course. The representative is part of the Academic Committee that organize the course, so that students can be represented in those decisions that affect them. The deputy will be directly involved in the Internal Quality assessment of the programme. This is in addition to the participation of all students in the Quality assessment through anonymous surveys, but also through periodic meetings to express their complaints and suggestions for improving the programme.

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2.1.2 PROJECT MANAGEMENT, QUALITY ASSURANCE AND MONITORING AND EVALUATION STRATEGY

Project management, quality assurance and monitoring and evaluation strategy

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

Please ensure coherence with the information on degrees and accreditation provided in other parts of the application.

NucPhys Consortium is perfectly aware of the importance of the Standards and Guidelines for Quality Assurance in the European Higher Education Area and therefore, we are willing to use the ESG as a reference for our internal and external quality assurance system. Thus, all the quality assurance standards and procedures have been set based on the ESG as NucPhys Master aims to implement the European Approach for Quality Assurance of Joint Programmes once this tool is consolidated.

Following the *Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG). (2015). Brussels, Belgium* document, the consortium has implemented the harmonization of high quality assurance standards during several meetings and discussions .This includes:

- **Policy for quality assurance**: Our policy for quality assurance will form part of our strategic management. The Quality committee will work in close cooperation to the Academic Committee to ensure that this policy is developed and implemented by the consortium through appropriated structures and processes.

- **Student-centered learning and teaching**: Careful consideration of the design and delivery of study programmes and the assessment of outcomes will be provided. It will respect and attend to the diversity of students and their needs, enabling flexible learning paths; flexibly use a variety of pedagogical methods; regularly evaluate and adjusts the modes of delivery and pedagogical methods; encourage a sense of autonomy in the learner, while ensuring adequate guidance and support from the teacher; promote mutual respect within the learner-teacher relationship and have appropriate procedures for dealing with students' complaints.

- **Student admission, progression, recognition and certification:** The regulations and administrative procedures covering all the aspects of the student Òlife cycleÓ are pre-defined and communicated to the student and also published in NucPhys website.

- **Teaching staff:** NucPhys consortium fully assures the competence of our lecturers, who are highly motivated researches in the field of Nuclear Physics with a wide experience in teaching and researching. In addition, the consortium encourages scholarly activities to strengthen the link between education and research and the innovation in teaching methods and the use of new technologies.

- **Learning resources and student support:** The consortium put at the disposal of our students all the resources available at each institution to ensure the best higher education experience, including both physical resources and human support. A tutor is assigned to each student to advise them during the course and provide guidance when required.

- **Information management:** Permanent contact with students, lecturers and other stakeholders is taken in order to collect continuous feedback about all the aspects of the master course. The information is collected and shared among the different committees to analyse it and put in place all the needed actions to apply corrective measures.

- **Public information:** A communication plan is being implemented to ensure the dissemination of all the results and activities organised. The website is constantly updated with all the information about the master programme, including the main objectives of our programme, the admission and selection criteria, the intended learning outcomes, the career opportunities and employment information, etc.

- **On-going monitoring and periodic review of the master programme:** Regular monitoring, review and revision of NucPhys Master is permanently done to ensure it is up-to-date to guarantee that NucPhys content is in the light of the latest research in the field of Nuclear Physics. In addition, the student's workload, progression and completion, students' expectation, needs and satisfaction and the learning environment and support services are also assessed in a regular basis to set corrective measures when necessary.

- **Cyclical external quality assurance:**

NucPhys consortium considers that external evaluation is an essential point for the maintenance of its level of excellence. Thus, the objectives of this evaluation will be:

1. To verify whether the Masters Programme has met the objectives for which it was set up and to analyse the extent to which it has done so.

2. To analyse the degree of satisfaction among the NucPhys students.
3. To identify possible strengths and weaknesses in the Masters Programme.
4. To diagnose the strengths and weaknesses of the teachers participating in the Masters Programme.
5. To evaluate the content, methodology and strategies used, and to assess their efficiency.
6. To evaluate the application of the grading scale, together with the conversion of the grade obtained to the comparative listing and the degree of satisfaction expressed by students assessed in this way.
7. To evaluate the success of trained students and alumni of NucPhys E+JMD.

Quality control will be carried out by an external international committee, composed by three independent and external experts both in Nuclear Physics and EMJMD's. This evaluation will be performed at the end of each edition. All the results obtained by the internal evaluation will be available for the external international committee. Full reports by the experts will be published, clear and accessible to all the stakeholders and will be among the deliverables of the project.

As mentioned above, NucPhys Consortium has implemented a Quality Committee composed by a representative of each partner university, a representative of an associated partner and two students. It is in charge of: internal day to day quality assurance, the evaluation of the programme and its implementation, control of all the internal procedures for recruitment and management, the student mobility performance (number of ECTS acquired, number of degree awarded and integration into the labour market), a day to day monitoring of the situation of the labour market and job opportunities from students and the analysis of the specific strengths, weaknesses, opportunities and threats of the programme in all the higher education institutions.

The Quality Committee will organise the internal evaluation of NucPhys Master. Internal evaluation will consist of two complementary ways:

- A first one following an integrated approach agreed by all partner institutions fully designed by the consortium, taking place at the end of each teaching period and at the end of the internship - Master thesis period. This evaluation will cover the following areas: contents, students (both from Europe and Third-countries), teachers (both those belonging to the Masters Programme and those visiting), coordinator/head of studies, work carried out by students in order to successfully complete the Masters Programme, methodology and strategies used, infrastructures/facilities – means used, areas of research, joint recognition mechanisms, students' application and enrolment procedures, feedbacks from scholarship holders, etc. The tools used to gather information will vary, and will include:
  - Semi-structured interviews with the Consortium Academic Committee.
  - Interviews with personnel in charge of technical resources.
  - Questionnaire for teachers and Tutors of the associated institutions/companies (internships, Master Thesis).
  - Questionnaire for students.
  - Alumni Survey (important to measure employability).
  - Specialists' opinion.

The consortium has already prepared a draft of questionnaires for NucPhys students: a first one about the "Teaching quality" which will be administered to the students in order to evaluate each teacher, a second one aiming to evaluate the mobility paths and a third one designed to measure the general assessment once the E+JMD ends (on process). The questionnaires have been completed for the first year of the first intake students, and are presently being analyzed by the Quality Committee.

- The second one is organised by the partner institutions themselves and is included within

their regular quality plans for Master Course assessments. These evaluations will take place at the end of the teaching periods. In the particular case of the coordinating institution the Higher Education Law 6/2001, December 21st and the reformed document, Law 4/2007, April 12th in the article 31 for the Quality Assurance gathers the necessity of establishing quality assurance criteria that provides the evaluation, accreditation and certification in the MCs. This article considers the quality assurance as an essential purpose of the higher education. Likewise, the new organization of the higher education teaching, proposed by the Ministry of Education and Science (MEC) in the document dated 26 September 2006, includes the quality assurance as a basic element of the training programme. University de Seville with the aim of promoting the continuous improvement of the degrees and assuring a quality level to facilitate the verification, has approved the Quality Assurance System of Master Degrees in the Plenary Session on 30/09/2008. The actions and procedures included in this system are in accordance with the criteria and legislation of the European Higher Education Area«s quality assurance elaborated by the European Quality Assurance Agency in Higher Education (ENQA). This evaluation is performed by Centro Andaluz de Prospectiva (Andalusian Center of Prospective Analyses) and focuses on teaching quality by means of questionnaires prepared for the students. The other Universities of the Consortium follow similar procedures for all their degrees, including NucPhys.

The information collected in the forms will be reported by each university to the Quality Committee. This committee will use this information not only for the improvement of the MC quality from one edition to the next one but also for the implementation of immediate measures when necessary. Teachers and students will be directly involved in this exercise due to the composition of the Quality Committee. Additionally, the treatment of personal data and results of each teacher's individual evaluation will be an important issue and it will be treated confidentially. This information will only be available for the Quality Committee and the teacher herself/himself.

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2.1.3 PROJECT TEAMS, STAFF AND EXPERTS

Project teams and staff

Describe the project teams and how they will work together to implement the project.

List the staff included in the project by function/profile (e.g. project manager, senior expert/advisor/researcher, junior expert/advisor/researcher, trainers/teachers, technical personnel, administrative personnel etc. and describe shortly their tasks.

Name and function	Organisation	Role/tasks	Professional profile and expertise
Prof. José Antonio Lay, coordinator.	Univ. Sevilla	General coordination of the programme and Local organization at Univ. of Seville, WP1, T1.1, T1.3, and T1.5. He will coordinate the Academic Committee.	Present coordinator of the Erasmus Mundus Master on Nuclear Physics. Associate Professor of Atomic, Molecular and Nuclear Physics in the University of Seville with a relevant expertise on Nuclear Direct Reaction Theory. He was previously Juan de la Cierva Fellow at Universtiy of Univ. of Seville and Marie Sklodowska Curie – Piscopia (cofund) fellow at Univ. of Padova. Supervisor of a PhD in joint supervision between U. of Seville and U. of Catania and another one in progress. Member of Ganil User Elected Committee. Organizer of the International School on Nuclear Physics "La Rábida". According to WoS 70 articles published

			with 750 quotations (h-index 15).
Project manager, administrative personel to be hired at Univ. of Seville.	Univ. Sevilla	NucPhys secretariat and administrative role in the Academic Committee. To coordinate the different administrations and, also, the different committees and Tasks. Responsible of the Communication Plan.	Expertise on administration and social-media management. High level of English. Availability to travel to visit the different consortium partners. Knowledge of other official languages of the countries of the consortium will be appreciated.
Prof. Joaquin Gómez Camacho, senior expert and lecturer.	Univ. Sevilla	Organization of the selection committee, WP2 and T2.1. He will report the results to the coordinator.	Full professor of the University of Seville since 2007. ORCID 0000-0003-0925-5037. 173 publications, 2927 citations, h-factor 31. 62 publications In Q1, 25 in Q2. Director of 7 PhD theses (I. Martel, A. Moro, M.Carvajal, A. Sanchez, G. Potel, M. Rodriguez, A. Garzon). Tutor of other 2 PhD thesis (A. Lopez y J.P. Fern□ndez). Responsible of the contracts of other 2 PhD researchers (B. Fernandez, M. Macias). IP of the university of Seville of 3 ITN training networks funded by the EU (DITANET, OPAC and OMA), which trained 7 early-stage researchers. Coordinator of the interuniversity doctoral program ÒEscuela de doctorado de F□sica NuclearÓ 2002-2007. Coordinator of the PhD program of the University of Seville on Physics Science and technology 2018-now. Evaluator of research projects by agencies in Spain, Belgium, Argentina, EEUU, EU and Technical collaborator of the Andalusian evaluation agency (DEVA). Representative of Spain in the expert committee NuPECC since 2018
Prof. José M. Arias, senior expert and lecturer.	Univ. Sevilla	Courses at Univ. of Seville. T1.3, T1.5, T2.2, and T2.3.	Full Professor at US. Former Director of the Department of Atomic, Molecular and Nuclear Physics at University of Seville since 2009-2017. Former NucPhys Master coordinator (2017-2022) and also former national coordinator of the Spanish inter-university master's degree on Nuclear Physics (2011-2020). Prof. Arias is expertise on theoretical nuclear structure and reactions. He is an expert in applications of algebraic techniques in

			Nuclear Physics and other many-body systems. He has also worked in the study of quantum phase transitions and in the interplay of nuclear structure and reaction mechanisms applied to weakly bound nuclei. He has some 170 publications registered in WoS with 2901 citations and an h index of 33. He has directed 9 PhD Theses and has been awarded by the University of Seville as excellent scholar in 2001-2002. He was selected by the Physics students as the best lecturer in 2016. He has organized 7 summer schools on Nuclear Physics and 7 workshops on Quantum Phase Transitions and has been responsible of several national and European projects.
Prof. Àngels Ramos Gómez, local organizer.	Univ. Barcelona	Local organization at Univ. of Barcelona and responsible of courses given there. T1.3, T1.5 and T2.3. She will be member of the Academic Committee and will also communicate with people responsible of T2.2 (supervision and assistance).	PhD in Physics from the University of Barcelona in 1988. Full Professor at the University of Barcelona since 2008. Theory expert on strangeness nuclear physics and hadron interactions in vacuum and in hot and dense media. Over 300 publications, of which 160 correspond to conferences. Two publications with more than 500 citations and 20 publications with more than 100 citations. h-index=50. Supervisor of 7 PhD theses, 13 Master theses and several Bachelor theses. Co-opted member of the Nuclear Physics Board of the European Physical Society (1999 – 2001). Member of the Scientific Committee of the Laboratorio Nazionale di Frascati (2015–2021). Member of the External Advisory Committee of IDPASC-Portugal Doctoral Program in Particle Physics, Astrophysics and Cosmology (2016–2018). Associate Editor of Nuclear Physics A (2010–). Co-editor of Eur. Phys. J. A (2010–2016).
Prof. Assumpta Parreño, lecturer.	Univ. Barcelona	Courses at Univ. of Barcelona, T1.3, and T1.5.	Associate Professor at the University of Barcelona. Advanced research accreditation from the Agency for the Quality of the Catalan University System. Deputy Director of the Institute of

			Cosmos Sciences. President of the Academic Doctorate Commission of the Physics Doctorate Program of the UB. Chair of the Diversity, Equity, and Inclusion Commission of the ICCUB. PI of the projects FIS2008-01661/FIS and PID2020-118758GB-I00. 4 research and 3 teaching accredited periods. More than 25 years of research (hadronic and nuclear phyiscs) and teaching experience. Advisor of 4 Ph.D. thesis, 6 master thesis, and 13 graduate projects. 84 publications (57 as regular articles). 2959 cites, H-index = 31 (Scopus) 35 invited talks, co-organizer of 10 international conferences. Outreach:youtu.be/F-OQndizWs0 youtu.be/IQTPQQEpunM www.youtube.com/v=I2HP2C2D_ss&t=5s
PhD. Arnau Rios, lecturer.	Univ. Barcelona	Courses at Univ. of Barcelona, T1.3, and T1.5.	Ramon y Cajal Fellow at the University of Barcelona since September 2020. Formerly, Senior Lecturer at the University of Surrey. I have 20 years of research expertise on nuclear theory (44 publications, 1700+ citations, h-index 27). PI of 3 individual fellowships (Marie Curie, STFC Rutherford & Ramn y Cajal). Teaching experience in under- and post-graduate physics courses, including modules like ÒExplosive Stellar PhenomenaÓ and ÒNuclear AstrophysicsÓ. Supervisor of 5 PhD students and of 20+ Bachelor and Master's thesis. Member of the STFC Nuclear Physics Advisory Panel (UK, 2020-2022). Associate Editor in the European Journal of Physics A. Participate regularly in outreach activities, and recently coordinated the first Nuclear Physics Masterclass in Spain (November 2022, shorturl.at/efgj2).
PhD Raúl González, local organizer.	Univ. Complutense de Madrid	Local organization at Univ. Complutense de Madrid, member of the Academic Committee and responsible of courses given there. T1.3, T1.5 and T2.2. He will be responsible of T2.2 and will be	Assistant professor at Complutense University of Madrid. PhD in Seville (2014). Ghent University from 2015 to 2018. Taught about 500 hours at Master's and Bachelor's degrees, both in Spanish and

		in contact with local organizers and responsible of courses, internships, and Master theses.	English. Supervision of 5 master theses, 6 final degree projects and co-advisor of two ongoing PhD theses. His main research line is the study of neutrino-nucleus interactions. He has around 50 publications and 620 cites (Scopus), and given around 25 talks at international events. He is PI of two projects funded with approx. 55kÛ each.
Prof. Tomás Rodriguez, lecturer	Univ. Complutense de Madrid	Courses at Univ. Complutense de Madrid, T1.3, T1.5 and T2.2.	Expert in Theoretical Nuclear Physics, particularly, in methods to solve the nuclear many-body problem and their applications to describe experimental data. He has published 90 research articles in peer-reviewed journals with around 2750 citations (h-index: 27), participated in 12 competitive research projects (4 as PI) and given more than 80 talks in international conferences, workshops and seminars. He has more than 15 years of experience in teaching Nuclear Physics and other areas in Bachelor and Master Programs, and has supervised more than 10 Master's Theses and three PhD Theses students. He acted as the Local Coordinator (UAM) of the Spanish Interuniversity Master in Nuclear Physics (2014-2022) and EMJMD-NucPhys (2017-2022).
Prof. José Manuel Udías, lecturer.	Univ. Complutense de Madrid	Courses at Univ. Complutense de Madrid, T1.3, and T1.5.	Researcher ID A-7523-2010. ORCID: 0000-0003-3714-764X; Scopus: 6701483306; Google Scholar: kO59NtcAAAAJ/HSnw8rcAAAAJ Former Marie Curie Postdoctoral fellowship in The Netherlands, joined UCM in 1997. Research area: Applications of Nuclear Physics in Medicine: PET and radiotherapy. Nuclear reactions. Relativistic nuclear structure. Nuclear detectors. 252 papers in peer-reviewed journals (h-index 35). Teaching experience in Nuclear Physics, Applied Nuclear Physics, Computational Physics, Quantum Physics, at undergraduate, graduate and doctorate level. Advisor of 16 PhD theses. Principal

			investigator of 18 projects in basic and applied research, at the national and international level. Responsible of 12 knowledge transfer contracts to companies.
Prof. Stefano Romano, local organizer.	Univ. of Catania	Responsible for local organization of activities at Univ. of Catania, T1.3, and main responsible of Master thesis organization (T1.5). He will be member of the Academic Committee and will also communicate with people responsible of T2.2 (supervision and assistance). Member of the selection committee (T2.1).	Full Professor of Nuclear and Subnuclear Physics - University of Catania - 2007-2016: National Coordinator of the INFN-ASFIN project on Nuclear Astrophysics - 2012-2016: Academic Coordinator of the International PhD in Nuclear and Particle Astrophysics, University of Catania - 2012-2015: Deputy of the INFN-LNS Director - 2015 – 2020: National Coordinator of the INFN Transnational Access within the EC Grant Agreement ÒEuropean Nuclear Science and Applications Research-2Ó (ENSAR2); - 2016- 2020: Scientific Coordinator of the User Selection Panel for the INFN Transnational Access; - 2016 – 2020: Head of the LNS Research Division - 2018-2020: member of the Academic Senate, University of Catania - 2021-present: member of the Administrative Board, University of Catania Scientific Activity: Experimental Nuclear Astrophysics - Study of heavy ions nuclear reactions - Alpha and gamma spectrometry - Environmental Radioactivity monitoring - Indoor e outdoor Radon measurements. Bibliometric indicators: publications: >500 WoS-Core Collection: articles 255 h-index: 39 citations: 3454

Prof. Vincenzo Greco, lecturer.	Univ. of Catania	Contact person for courses and study plans Univ. of Catania T1.3, and T1.5.	- 2016 Full Professor in Theoretical Physics, University of Catania. - 2016, Elected Member of the Academia Europaea - 2018, Member of the “College of Expert Reviewers” - European Science Foundation (ESF) - 2011-2016, Principal Investigator of a Starting Grant (Consolidator) of the European Research Council (ERC) - 2017-23, National Coordinator of the INFN project on “Strongly Interacting Matter at High Density and Energy - SIM” - 2012-2020, Member of the National Scientific Committee of the Istituto Nazionale di Fisica Nucleare (INFN) - Currently Deputy of INFN-LNS and Vice-Coordinator of the PhD in Physics at the University di Catania. SCIENTIFIC ACTIVITY: Equation of state (EOS) and dynamics of isospin asymmetric nuclear matter and its study through heavy-ion collisions at intermediate energy (30 AMeV – 1 AGeV) - Formation and properties of the quark gluon plasma (QGP) and its hadronization. BIBLIOMETRY: About 200 publications, 7200 citations, h-index=42.
Prof. Anna M. Gueli, lecturer.	Univ. of Catania	Contact person for courses and study plans Univ. of Catania T1.3, and T1.5.	Associate Professor of Applied Physics (SSD FIS/07) at Catania University and Head of PH3DRA (Physics for Dating, Diagnostic Dosimetry Research and Applications) labs of the INFN-CHNet network at the Department of Physics and Astronomy “Ettore Majorana” of the University of Catania. Erasmus Higher Education grant at University of Bordeaux 3; graduated and PhD in Physics at the Catania University; DESS (Diplôme d’Etudes Supérieures Spécialisées) in Physical

			Methods for Archaeology and Museography, University of Bordeaux I. Professor Gueli is the Catania's University Delegate in the Scientific Coordinator of the Permanent Thematic Working Group of the Regional Strategy of the Innovation for the Intelligent Specialization in the area of "Tourism, cultural heritage, culture". Research activities Authenticity tests and dating of archaeomaterials by ThermoLuminescence (TL) and Optically Stimulated Luminescence (OSL). Analytical Techniques in Art Conservation - Raman Spectrometry. Colorimetry. Multispectral imaging. Microclimate monitoring for preventive conservation. Radiation dosimetry: TLD and radiochromic films. Clinical Imaging: Optimization of Dose to Patient and of image quality in Diagnostic Radiology. Bibliometric indicators (source Scopus 26th January 2023) H-index : 15 Documents number: 91 Citations numbers : 753
Prof. Giovanna Montagnoli, local organizer.	Univ. of Padova	Responsible for local organization of activities at Univ. of Padova, T1.3 and T1.5, and main responsible Course preparations and implementation (T1.3). She will be member of the Academic Committee and will also communicate with people responsible of T2.2 (supervision and assistance).	Graduated in Physics PhD degree at the Padua Univ. One-year fellowship at the Technische Universitaet Munich, Germany. INFN contract at the Laboratori Nazionali di Legnaro researcher of the Padua Univ., since 2005 associate professor of physics Univ. of Padua Research activities: -Experimental studies of heavy-ion nuclear reactions

			-Development of particle detection techniques -Studies of structure of neutron-rich nuclei, populated by means of binary reactions Since 2012: national responsible of the “PRISMA-FIDES” experiment, funded by INFN Teaching and tutorial activities: - responsible for 4 fellows and supervisor of 5 PhD theses and several bachelor theses holder of the Nuclear Physics, course for the master degree in Physics 299 publications from ISI Web of Science with 6200 citations, h-index = 46
Prof. Daniele Mengoni, senior expert and lecturer.	Univ. of Padua	Member of the Selection Committee (T2.2) and Courses at Univ. of Padua T1.3, and T1.5.	Professor at the Dept of Physics and Astronomy, University of Padova, coordinator of the INFN nuclear physics group and member of the INFN nuclear physics scientific committee. Research subject: Experimental Nuclear Physics. My research activity has been so far deployed in the field of the experimental nuclear physics, with a special interest in the development of particle and gamma-ray tracking detectors and on the investigation of the exotic structure in the atomic nuclei. Coauthor of about 250 publications and proponent of several projects at national and international level. Invited to more than 50 International Conferences/Workshops and member of the organizing committee of more than 20 International Conferences/Workshops. Proponent of several nuclear physics experiments at the major worldwide facilities.
Prof. Antonio Caciolli, lecturer.	Univ. of Padua	Courses at Univ. of Padua T1.3, and T1.5.	Associate Professor at the University of Padua. His main research activity is related to experimental Nuclear Astrophysics. In LUNA he is local responsible of the Padua

			group, involving other three staff researcher one post doc, one PhD student and two master student at the moment. Antonio Caciolli is teaching Nuclear Astrophysics in the Master degree in physics. This is a 48 h course (about 25 students per year). During the last five years he acted as supervisor of 8 master, one bachelor and one PhD student. He was also involved in management committee of the EU COST ACTION CHeTEC and in the project ChETEC-INFRA (no. 101008324) as UniPD coordinator.
Prof. Francesca Gulminelli, local organizer.	Univ. de Caen - Normandie	Responsible for local organization of activities at Univ. de Caen Basse – Normandie, including internships, T1.2, T1.3, and T1.5. She will be member of the Academic Committee and will also communicate with people responsible of T2.2 (supervision and assistance).	Full professor of the University of Caen since 2006. ORCID 0000-0003-4354-2849. 194 publications, 4302 citations, 52 invited seminars in international conferences, h-factor 31. (Co)organizer of 20 conferences. (Co) director of 15 PhD theses. PI of the bilateral agreement CAPES/COFECUB Ph-315 2015-2018, and CEFIPRA no.5804-F (2017-2021). Co-Editor of EPJA (2014-2019). Awards: member of Institut Universitaire de France 2003-2008, “Outstanding reviewer” of the American Physical Society (APS) and of the Institute of Physics (IoP); Joiliot-Curie award of the Société Francaise de Physique 2008, « Dragomir Hurmuzescu » award of the academy of Roumania 2014. Head of the Master programme in physics of the University of Caen and of the Graduate School Normandy Nuclear Physics. Evaluator of research projects by agencies in France, Italy, Belgium, USA and for ERC.
Prof. Julien Gibelin, senior expert.	Univ. de Caen - Normandie	Responsible for Internal Quality assessment, T1.2, and member of the Academic Committee	Associate prof. at Université de Caen Normandie, Researcher at LPC CAEN. https://inspirehep.net/author/profile/J.Gibelin.1 Research fields: experimental nuclear physics, in particular structure of light nuclei at the neutron drip line. Supervisor of 9 PhD plus one in progress. International adviser for the Faculty of Sciences of the

			University of Caen. Chairman of the Erasmus Mundus "NuPhys" Master's Quality Committee. French director of the Associated International Laboratory France/Japan "NuPIC".
Prof. David Boilley, senior expert and lecturer.	Univ. de Caen - Normandie	Member of the Academic Committee (T1.1) and selection committee (T2.1). Courses at Univ. de Caen – Normandie, T1.3, T1.4, and T1.5.	Associate prof. at Université de Caen Normandie, researcher at GANIL. ORCID: 0000-0001-9079-2766 Research fields: theoretical description of nuclear reactions - Bayesian analysis Supervisor of 4 PhD plus one in progress. In charge of training through research at GANIL Elected member of the research commission of the university

Outside resources (subcontracting, seconded staff, etc)

If you do not have all skills/resources in-house, describe how you intend to get them (contributions of members, partner organisations, subcontracting, etc).

Our intention to improve Quality is to have an External Quality Assurance. An external committee composed of renowned experts in Nuclear Physics will be paid for a mid-term and final report.

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2.1.4 COST EFFECTIVENESS AND FINANCIAL MANAGEMENT

Cost effectiveness and financial management

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

The participation costs requested from all students for the full Master course (2 years=120 ECTs) will be 18.000 EUR.

Students' participation costs have been calculated for 25 students and based on the implementation costs, that take into account the needs and means of the partners for the development of the Master Course. It should be noted that in all country members the amount requested to the students is smaller since the corresponding Ministry covers part of the actual expenses.

With this new proposal, the programme includes a high number of field trips and visits related with the different teaching modules, allowing the students to learn and analyse in place the different application of the nuclear physics field. Participation costs have been increased in order to allow us to organize more activities that represent an added value for our students. In addition, more funds will be allocated to organize common meetings that will enhance the jointness in the consortium.

The items considered for calculating the student participation costs are:

- Tuition fees: The average cost of the ECTS credit between the member universities of

the consortium has been considered.

- Additional language courses: The student could attend in all periods of study during the Master the language courses organized at the Language Centre of any of the universities members of the consortium. Costs of these courses have been considered.
- Student insurance according to EACEA rules.
- NucPhys project manager. It is essential to have a person managing administratively the project full time, who will be supported by the administrative coordinator of each partner university.
- Invited scholars: In order to ensure NucPhys is constant updated with the last state-of-art in the field, 10 weeks of invited scholars are foreseen per intake.
- Academics and invited experts' mobility: Mobility of academics belonging to the consortium and external to teach at different Universities or the common course in different periods to those associated to their university is foreseen in the curriculum. Costs associated to traveling expenses are considered.
- Administrative assistants and office supplies.
- NucPhys Consortium Committee meetings: Though contact between members of different committees will be continuous through phone or e-mail, at least 2 meeting per Master edition will need to be organized. Costs associated to travelling expenses are considered.
- External Quality Assurance. An external committee will be invited to assess the implementation and the results obtained at the end of each two intakes.
- Internship defenses: A joint committee composed by an academic member from each partner institution will evaluate the internship defense in S3. Students from the next intake would be invited to the event. Travel costs will be borne by the Consortium.
- End of course ceremony. Alumni and associated partners will be invited and sponsored to attend the event.
- Website improvement and maintenance.
- Report of the NucPhys edition.
- Additional activities: Visits to laboratories/companies will be organized within the framework of the Master Course. Expenses associated to traveling for internship defense, internship, common course, final conference and other possible joint academic activities have been considered.
- New laboratory equipment. The equipment is provided by each partner university, however some lecturers pointed out that some new experiments requires special equipment.
- Publicity and promotional material, including the production of promotional material such as posters, brochures and leaflets.

The former list of items cannot, undoubtedly, be covered just with the students' participation costs but other income sources must be considered, like funds provided by Companies and eventually by some associated partners. Details of these financial sources are given in an annex where implementation cost are presented plus an example of budget per edition. It is worth noting that each University provides some indirect funding via the acquisition of special equipment for laboratories to be used by the students, some fee waivers for selected self-financed students, partially support the language courses offered to the students, etc. For the student mobility implied within Spain in S2 for path 2 students, University of Seville will provide with local mobility grants to cover travel and accommodation expenses.

The distribution of funds among partner universities will be calculated based on the number of students enrolled in each partner institution multiplied by the number of ECTs. The coordinator will keep an amount per ECTs to cover general expenses such as the insurance, the organization of the welcome week or the contract for the project manager. Each unit will be responsible to manage the funds according to the needs to cover the tuition fees and other administrative fees and to organize the activities correspondent to each module. The Univ. of Seville, as coordinating institution will distribute the funds upon reception of the proof of enrolment at the hosting partner university and a request of payment document.

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2.1.5 RISK MANAGEMENT

Critical risks and risk management strategy

Describe critical risks, uncertainties or difficulties related to the implementation of your project, and your measures/strategy for addressing them.

Indicate for each risk (in the description) the impact and the likelihood that the risk will materialise (high, medium, low), even after taking into account the mitigating measures.

***Note:** Uncertainties and unexpected events occur in all organisations, even if very well-run. The risk analysis will help you to predict issues that could delay or hinder project activities. A good risk management strategy is essential for good project management.*

Risk No	Description	Work package No	Proposed risk-mitigation measures
1	Students with difficulties due to background and cultural impact – small impact for the project – high likelihood	WP1	We have proposed a reinforcement of the traditional tutorship with second-year students to help them undergo the issues that they themselves should have experience. Task 2.2 will also monitorize the process.
2	Hiring of project manager lack of candidates – large impact - low likelihood	WP1	While we reoffer the position and keep on looking for candidates, the role of the project manager will be split between the coordinator, the members of the Academic committee and different administrative staff of the members.

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2.2 PARTNERSHIP AND COOPERATION ARRANGEMENTS

2.2.1 CONSORTIUM SET-UP

Consortium set-up

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

All the participants in the consortium have well known research groups in different and complementary aspects of Nuclear Physics and, in addition, teaching experience at the level of under- and post-graduate studies. In each consortium node, more than 10 scholars are permanent staff members of the local universities and internationally recognized experts in the field. Together with the scientists working in the different research labs associated to the consortium, they naturally guarantee the excellence of the teaching and tutoring. As mentioned in preceding sections, the origin of this project is the previous Erasmus Mundus Master Degree in Nuclear Physics that is already running from 2017. All Spanish Universities/Centers involved have important active groups in Nuclear Physics at theory (Seville, Complutense de Madrid, and Barcelona), experiment (Complutense de Madrid, Seville, CIEMAT, CSIC Madrid and Valencia) and applications (Complutense de Madrid, CIEMAT, Seville and Barcelona). What clearly lack are large scale Nuclear Physics facilities at european level. Thus, the consortium is completed with three important European Universities with active Nuclear Physics research groups in experiments, theory and applications and with strong links to key Nuclear Physics laboratories:

University of Caen-Normandie (UNICAEN), founded in the XVth century, hosts nowadays 30 000

students in different branches. Its key feature in the context of the present project is twofold. First, its close links with **GANIL**. GANIL, including the high intensity rare ion facility SPIRAL2 under construction, is one of the four largest laboratories in the world dedicated to research using ion beams. SPIRAL2 is complemented by two equipment of excellence (EQUIPEX), the next-generation spectrometer S3 and the experimental room for physics at low energy DESIR, both selected and financed by the National Agency of Research (ANR), led by the French Ministry of Higher Education and Research. Since the very beginning, GANIL has actively participated in European projects in which it cooperates with many laboratories from the European Union and beyond. (http://www.ganil-spiral2.eu/). In addition, Caen University is also strongly linked to the project ARCHADE (resource and research center in hadrontherapy) open in 2019. This center will have two independent superconductor cyclotrons: a protontherapy cyclotron for treatment, and a C400 cyclotron for ion acceleration up to Carbon for research purposes in hadrontherapy (physics, radiobiology and clinic aspects). The physicists implied in the Consortium are responsible of the research programs in physics at ARCHADE as well as in the interdisciplinary programs for radiotherapy treatments.

University of Padova has a long and well established history in Nuclear Physics research which is strongly related to the **Laboratori Nazionali di Legnaro (LNL)** that is one of the four national labs of the Italian Institute of Nuclear Physics (INFN). The mission is to perform basic research in nuclear physics and nuclear-astrophysics, together with applications of nuclear technologies. More than 800 scientists from all over the world are involved in the ongoing research programs. Every day about 250 people work at LNL, half of them being INFN employees (physicists, engineers, technicians....) the remaining half coming from universities and research institutions in Italy and abroad. The laboratory budget is nearly 20 Million Euro per year, half for handling and research, and half for personnel. Strength points are the development of particle accelerators and of nuclear radiation detectors. LNL have been recognized at European level as a Research Infrastructure with Transnational Access. (http://www.lnl.infn.it/). In addition, the Nuclear Research groups of Padova University have expertise on nuclear structure at the limits of spin and isospin, nuclear reaction dynamics at low, intermediate and ultra-relativistic energies, nuclear astrophysics and civil security applications of nuclear physics. Padova is a 800 year old institution with a long standing tradition for scientific excellence and a commitment to freedom and diversity.

University of Catania is one of the first Universities in Italy, founded in 1433. It is closely related to the **Laboratori Nazionali del Sud (LNS)**. LNS is one of the four national laboratories of INFN. Founded in 1976 it currently employs about 130 people (researcher and technicians) and associates about 130 people among professors, researcher, PhD and Diploma students from the University. It is an advanced development center for technology and instrumentation. The laboratory budget is about 12 Million Euro per year for direct research, personnel budget excluded. The research activity is mainly devoted to the study of structure and reaction of atomic nuclei bu mean of both a Tandem and a Supeconducting Cyclotron, in collaboration with more than 700 researchers coming from Italy as well as several European and non-European countries. A Tandem accelerator allows an intense activity in Nuclear Astrophysics measuring the cross section of interest for fusion nuclear energy and stellar nucleosynthesis (ASFIN2 project). Among the new projects in fundamental research it is also worth mentioning the construction and operation of a submarine cubic kilometer telescope (KM3NeT) installed at 3500 m depth offshore from Catania, with a long and complex R&D activity in which the LNS have been deeply involved inside the KM3NeT project (https://www.lns.infn.it/en/research/astroparticle-physics.html). UniCT and LNS beyond the experiments at the frontier of the Nuclear Physics are strongly active in several aspects of Applied Nuclear Physics such as accelerators technology, cultural heritage and Archaeometry with non – destructive techniques (LANDIS and PH3DRA labs), monitoring of Nuclear Waste, Laser Physics for Nuclear Fusion plasma and above all in Nuclear Medicine with a center for eye-melanoma therapy and the projects CATANA, ELIMED, SCENT (see Form A.1.4). The students of EMJMD will be allowed to profit also from an on-going agreement between LNS and Azienda Ospedaliero Universitaria Policlinico di Catania to have a direct experience of applied nuclear medicine.

In the Spanish part of the consortium:

University of Seville: will act as coordinating institution and has experience on these issues since is already coordinating the running Erasmus Mundus Master Degree and also the Spanish inter-university Master Degree. It provides, in addition to the coordination, scholars experts on theoretical nuclear reactions, applications Nuclear Physics to Environment, Medicine, Art and Archeometry, and analysis and characterization of Materials.

Facilities: **CNA** with three ion accelerators: Tandem Van de Graaff 3MV, Cyclotron with protons up to 18 MeV and deuterons up to 9 MeV and a Tandem Cockcroft-Walton of 1 MV used as mass spectrometer. In

addition, there is a scanner PET/CT for humans, a dedicated accelerator for 14C dating MiCaDaS, and a 60Co irradiator. (http://acdc.sav.us.es/cna/index.php/en).

University of Barcelona: Scholars experts on many-body problems, theoretical astrophysics and hadronic physics.

Facilities: ALBA is a facility co-financed by the Spanish government and the Catalan government. It is a new generation of synchrotron. ALBA is a circular-shaped machine, called a synchrotron that uses arrays of magnets, called insertion devices to generate bright beams of synchrotron light. There are research lines on: Accelerator Computing, Engineering, Experiments on material science mainly. (https://www.cells.es/)

University Complutense of Madrid: Scholars experts on theoretical nuclear structure, experimental nuclear physics, applications of nuclear physics to medicine and energy sources.

Facilities: close connections to **CIEMAT** (Centro de Investigaciones Energ□ticas, Medioambientales y Tecnol□gicas) which is a public research body assigned to the Ministry of Economy and Competitiveness focusing on energy and environment and the technologies related to them. Of particular interest for our EMJMD is the Thermonuclear Fusion Device TJ-II which is a heliac-type stellarator, which produces magnetically-confined fusion plasmas. (http://www.ciemat.es/).

In the previous proposal, the Spanish part of the consortium was also composed by Universidad Autónoma de Madrid. However, the Nuclear Physics research group in that University has become very small and they have preferred not to be involved in this new project. This have a positive impact in the consortium since the contribution from Universidad Autónoma de Madrid can be easily covered by the rest of Spanish Universities and it will simplify the administrative management.

It is worth noting that **all institutions are already collaborating in the development of the running Erasmus Mundus Master in Nuclear Physics**. The collaboration is excellent from both academic and administrative points of view. In addition, the lecturers/researchers have previous research links: Seville-Caen-Complutense are already together in the project EURO-LABS that is the integrating activity for European nuclear scientists who are performing research in three of the major subfields defined by NuPECC: Nuclear Structure and Dynamics, Nuclear Astrophysics and Nuclear Physics Tools and Applications. Common projects between Barcelona-Catania (equation of state), Seville-Padova-Catania (nuclear structure and reactions and lately double-beta decay) have been active for many years. These links have been strengthened with the running Erasmus Mundus Master that has allow to sign mobility Erasmus Agreements at the level of Bachelor and postgraduate studies (Seville-Catania, Seville-Padova, Caen-Padova, Caen-Catania, Seville-Caen) that are presently active.

The EMJMD project will fully benefit of the complementary specializations of the partners. Padova, close linked to Laboratory Nazionali di Legnaro, a large nuclear physics facility, have the academics/researchers and the experimental facilities to provide the appropriate background on experimental nuclear physics to students in path 1. Catania, closely linked to Laboratori Nazionali del Sud, an important facility for nuclear physics applications, will guarantee students in path 3 the appropriate specialization. The presence of the two national labs LNL and LNS make Padova and Catania ideal sites for the accomplishment of the Master thesis in experimental nuclear physics and the associated instrumentation. Spanish expertise in theoretical physics will provide with excellent teaching for the path 2 students. In addition, there are in Spain medium size facilities that will guarantee the appropriate development of nuclear physics applications oriented master thesis projects. The academic completeness of the curriculum for each specialization will be guaranteed by the Caen partner. Indeed, the triple connection to GANIL, ARCHADE and TALENT makes Caen the ideal site for the third semester of the Master programme, dedicated to the specialization either in fundamental (theory and experiments) or in applied physics. With the present scheme Caen will be able to host Master Thesis in large facilities (GANIL), but also in theory and applications.

Finally, it is important to stress that an important, though not unique, issue to the Master degree will be the preparation of a PhD. All the labs associated to the EMJMD in France, Italy and Spain are attached to doctoral schools for the preparation of PhD and will provide a natural job opportunity for our students.

In addition, the **associate member** HGS-HIRe is a common graduate school of the universities Frankfurt, Darmstadt, Giessen, Heidelberg and Mainz together with GSI and with many ongoing programs on Nuclear Physics. **GSI** operates a worldwide unique large-scale accelerator facility for heavy ions and currently employs about 1.100 people. In addition approximately 1.000 researchers from universities and other research institutes around the world use the facility for their experiments. In the coming years the new international accelerator facility FAIR, one of the largest research projects worldwide, will be built at GSI. (https://www.gsi.de/en/). **CERN, TRIUMF, ELI-NP, RIBRAS, TANDAR, iThemba LABS** and many other facilities are associated members of the consortium that are helping us with master thesis proposals and extra-curriculum internships.

The curriculum has been designed coordinately by all members in the consortium taking into account the expertise of the different nodes. Also, the previous experience has convinced the consortium of the convenience of having a common first semester (S1) with general matters so as to bring all students to an initial even level of knowledge. This S1 semester will be lectured in Seville as coordinating institution. This will allow doing all administrative tasks relative to inscriptions, visas, etc., in a centralized way from the beginning. Then in S2 starts the specialization: path 1 in Padova taking advantage of LNL and the academics and facilities related to large accelerators, path 2 in Spain using the strong theory groups in Madrid, Barcelona and Seville, and path 3 in Catania taking advantage of LNS and the AOUP (Azienda Ospedaliero-Universitaria Policlinico di Catania) with academics and facilities related to many Nuclear Physics applications. In S3 all students move to Caen, in which there are large scale nuclear physics facilities, GANIL, but also an important theory group and many industries/laboratories around that are associated members of this Master and guarantee the appropriate internships in S3. In addition, in S3 is programmed the highly specialized common course, organised every year in collaboration with TALENT and freely hosted by our associated partner GANIL. The topic is selected each year among the hot topics in Nuclear Physics. For this common meeting on a specific relevant topic, selected scholars will be invited and they are essential for the development of the course. Since the topics will be diverse the invited scholars provide an extra added-value to the Master allowing us to have as lecturers the best specialists in the selected topic every edition. TALENT will help us to select the best scholars in each academic course and this will allow students to be introduced in a hot nuclear physics topic by the world experts on it.

2.2.2 CONSORTIUM MANAGEMENT AND DECISION-MAKING

Consortium management and decision-making (if applicable)
Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

Role of the partners in the Erasmus + implementation

Financial tasks will be mainly managed by the University of Seville as coordinating partner. For the rest of the tasks, four committees have been created in order to resolve the different issues related to the EMJMD. every full partner takes part in these committees and there is representation of the associated partners, The committees are:

- **Academic Committee**: it is responsible for the correct implementation of the EMJMD and the general management. It will be formed by one local academic of each full partner (universities), two representatives of the associated members and one student. In addition, it is in charge of examination methods and the organisation of the Master Thesis work. It is also responsible for the contents of the NucPhys EMJMD. This committee will have 3 sub-committees (one at each country). Each sub-committee will be presided by the academic that is part of the Academic committee plus two academics that belong to their own universities. The aim of the sub-committees will be to solve all the academic issues within their own university.

The Academic Committee will also be in charge of obtaining the necessary number of internships for the training period in a company for all the students participating in the NucPhys EMJMD. The academic committee will also be responsible for the final assignment the internships among all the students according to the grading obtained by the students in the lecturing period, their preferences and the advice of the local coordinator in contact with students. Another important aim of this committee is to develop a joint and well-structured curriculum for the EMJMD that takes into account the best expertise of every full partner and the present needs of companies related to Nuclear Physics.

- **Selection Committee:** it is in charge of the issues related to the admission criteria, selection procedure and awarding of Erasmus + scholarships to the best students. It will be formed by one academic from each full partner (universities) as well as one person representing the associated partners. This committee will have regular meetings (mainly on-line) before the beginning of each EMJMD edition to manage all applications received and to apply the admission criteria for the student selection process as well as for the award of the JMD scholarships, according to Erasmus + rules.

- **Quality committee:** it is needed to ensure the internal EMJMD quality and to design improvement strategies. This committee is formed by one academic of each full partner (universities), two representatives of the associated partners, and two students of the present NucPhys EMJMD edition. This committee will implement all the internal evaluation strategies and mechanisms. It will also be in charge of coordinating with the external organisms/institutions/agencies responsible for the external quality assurance of the NucPhys EMJMD, as detailed in Section 2.1.2

- **NucPhys Secretariat**: it is the executive board, in charge of executive management, communication with EACEA, administrative and financial management. It is located at the coordinating institution and is composed by the Consortium coordinator, one project manager, one administrative assistant and supported by the International Office at USEV. It is in contact with local administrative staff at partner institutions and supervises exchange of student documents among partners. The Secretariat ensures update of the website and application system.

It should be mentioned, that in order to have a continuous coordination within the committees, most of the meetings will be held by means of electronic communication systems and internet. Nevertheless, the Academic Committee will have at least two meeting per year. The first one will be at the beginning of the year with the occasion of the welcome ceremony. The other one will be celebrated during the common specialized course coinciding with the internship defenses that will be done jointly with a internship defense committee composed by members of different consortium members. Further meetings if needed, will be held in any of the 3 countries.

The committees make the proposals for improving the Master Programme and management of the Master and the Universities in the consortium are the responsible for the specific implementation. Form the academic point of view, Seville University is responsible for the organization of S1, the University of Padova University is responsible for the implementation of S2 in path 1, the Spanish Universities are responsible for S2 in path 2 and University of Catania is responsible for the implementation of courses in S2 for path 3. University of Caen is the responsible for the academic organization of S3, this includes the organization of the common specialised. The Academic Committee is responsible of offering Master Thesis topics appropriate in number and matters for all students in an intake. For this task, the proposals from all members in the consortium and associated centers are crucial.

All partners undertake to develop all promotion and marketing measures.

The consortium abides by the terms and principles of the proposal for a European Quality Charter for Mobility, following its recommendations to provide the best service as Host Institutions, as detailed in 2.1

Students involvement in the EMJMD coordination:

Students will be involved in the course coordination and implementation tasks as part of the feedback obtained from the evaluation questionnaires administered to students to evaluate the different modules. In this way a constant improving of the EMJMD is obtained. Specifically, one students' representative will be elected to take part in the Quality Committee and two in the Master Academic Committee. Additionally, a delegate will be elected among students for every course edition to represent them in daily issues.

#§CON-SOR-CS§# #§QUA-LIT-QL§# #@IMP-ACT-IA@#

3. IMPACT

3.1 IMPACT AND AMBITION

Impact and ambition

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

The partner Universities included in this proposal have already set up an Internationalization Plan, in which this proposal is considered of **strategic importance**:

- First, in order to accommodate the needs of the multicultural students, and to harmonize administration, teaching, evaluation and management methods, **administrative and academic staff will adopt a more international approach**, embracing shared and innovative methodology. NucPhys Master is having a strong impact in the internationalization of all the universities of the Consortium. International units focused in Erasmus Mundus projects are being created. In addition, from the academic point of view, Nucphys Master has been very important in the decision of the Department in University of Padova, University of Catania and University of Caen to give all courses in English. In Spain, all the courses that are shared with local students are also given in English. Local students enrolled in lectures with Erasmus Mundus students benefit a lot from this international approach. Learning and exchanging in English is also beneficial.

- Second, the European character of the proposed EMJMD will enhance its visibility and attract third-country and European nationals. It will foster mobility and international cooperation. The master is born and designed by all partners as a top-level specialization course that intends to enhance the common internationalization strategy of the consortium attracting the best students to the European area. Remarkably, **there is no international teaching programme in Europe at the Master level devoted specifically to Nuclear Physics**. This joint Master will bring to partner Universities new opportunities for strengthening research ties through enrolling graduates in PhD Thesis. This **will enhance the international component of the involved partner Universities in a strategic field of common interest.** Thus, this EMJMD will contribute to attract the best students interested in Nuclear Physics all over the world to the European region. Thus, it will help to increase the European's stock of human capital in this scientific and technological critical area of knowledge.

- Third, it is of fundamental importance to notice that the proposed EMJMD **will enhance the technological base in the European region.** Industries located in Europe will receive a unique transfer of knowledge from the institution's research efforts for providing the best training to the best students. This will increase future productivity and therefore incomes and economic activity. To the extent that this activity occurs locally, future economic impact is created. In this sense the proposed EMJMD will produce up to 25 nuclear physics specialists per year to work in academic and research institutions but also in industries, energy companies, companies of analysis and characterization of materials using nuclear probes, art and archaeometry, dating, nuclear medicine (traditional therapy, but also hadrontherapy), etc. The fundamental nuclear physics knowledge and the skills worked out by the EMJMD will improve the students' employability.

As it can be seen from the list of associated partners, the consortium already contacted companies, hospitals, nuclear research facilities **worldwide** that participate in the implementation and assessment of the EMJMD. It is the intention of the consortium to promote contacts with more non-educational companies/industries potentially interested in our graduates.

The most relevant Nuclear Physics experiments for the next decade are programmed in the associated centres. For instance, CERN with the experiments ISOLDE and n_TOF, GSI with the project FAIR including the experiments: PANDA which uses antiprotons to study the structure and spectroscopy of hadrons, NuSTAR which is a radioactive beam facility to produce nuclei far from stability and investigate their structure, CBM to measure the properties of dense baryonic matter, and an extensive program in applied nuclear physics called APPA. At GSI, too, a new Superconducting Linac for the provision of high-intensity stable beams to search e.g. for superheavy elements, is being constructed. GANIL in Caen in which SPIRAL2 is being developed, including high intensity stable beams which will allow the study of unstable nuclei at the S3 spectrometer, and ISOL radioactive beams of very neutron-rich fission products and studied, for example, at the DESIR facility. The new research and treatment hadrontherapy center ARCHADE in Caen clearly requires a new generation of nuclear physicists at the interface with radiobiology and medicine.

More generally, France is one of the most advanced countries in the world concerning nuclear science and its applications. Normandy has a longstanding tradition in this respect and concentrates an important know-how in the domain. The different industrial applications of nuclear physics in Normandy, from energy to health, from material science to archeometry, are coordinated by Nucleopolis, which is an associate partner of our EMJMD. INFN-LNL in Legnaro-Padova is involved in the construction of the SPES facility including its radioactive beam. The experimental set-up AGATA which is a gamma-ray

spectrometer consisting of semiconductor detectors will be used at the facilities mentioned above. INFN-LNS has a large project in collaboration with local hospitals about Nuclear Medicine especially by mean of hadron therapy. CATANA (Centro di AdroTerapia e Applicazioni Nucleari Avanzate) is the first and only center of hadrontherapy in the Mediterrean area. Furthermore, there are ongoing projects like ELIMED which constitutes the future of hadron theraphy with laser-ion acceleration and continue working on the *hadrontherapy* development for the treatment of tumours and benign malformations placed close to high-risk organs and/or for particularly radioresistent tumour treatments. A Tandem accelerator allows an intense activity in Nuclear Astrophysics measuring the cross section of interest for fusion nuclear energy and stellar nucleosynthesis (ASFIN). The LANDIS laboratory of non-destructive analyses is an internationally recognized activity in nuclear archeometry that recently has also provided new datation of the Dead Sea Scrolls of 100-200 B.C. Currently, the LNS has been indicated by the Italian Ministry as one of the strategic Research Infrastructures for the European Community.

All listed experiments are forefront Science and all countries involved in this EMJMD will benefit of the training of their young scientists in the best world facilities within the most relevant experiments in international collaborations. The **students will have the unique opportunity of being already a part of such a network, as main actors of new collaborations and exchange of knowledge in these advanced projects in nuclear physics**. Students will have the opportunity of developing transverse and cross-disciplinary competences and skills that will help them in their professional career, including languages such as Italian, Spanish and French or scientific programming. They will also visit the premises of different institutions on the field on Nuclear Physics to learn about the different applications and how the scientific research works

Being nuclear physics and its applications a matter of relevant actuality, **NucPhys objectives and its socio-economic benefits will be disseminated** by using the Master web page, but also through social media tools (Twitter, Facebook, LinkedIn), as well as traditional communication channels conferences and debates, magazines, etc. This will enhance its impact within and outside the academic world. In order to measure this impact, the Quality Committee will perform periodic surveys and reports through questionnaires, fora, and by Facebook and/or Twitter. Employers and Alumni will be among the questioned. After each edition of the Master a periodic report will be publically available. After the last edition of the Master, the Quality Committee will publish a final report on the impact of NucPhys outside academia.

#§IMP-ACT-IA§# #@COM-DIS-VIS-CDV@#

3.2 COMMUNICATION, DISSEMINATION AND VISIBILITY

Communication, dissemination and visibility of funding

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

The consortium has already implemented several mechanisms to promote and disseminate research results. All the actions are included in a Communication Plan (CP) which includes targets, objectives and corresponding measures.

Our main target is potential students graduated in Physics or other related areas such as Chemistry, Engineering, Applied Mathematics or similar or any other kind of scientist with interest in Nuclear Physics. In addition, universities with physics departments, international associations in the field of nuclear physics, research centers, laboratories, public and private institutions, companies, scholars and interest groups are also key players that are targeted in our CP.

The aim of the CP is to promote as much as possible the NucPhys master course so to reach a number of potential candidates, but also to disseminate the results obtained under the programme to become a reference in the field of Nuclear Physics education.

The NucPhys web page has been designed as a potent attraction tool for students. It contains links to each partner organization, associated partners, EMA, Facebook and twitter. LinkedIn is being included

to follow up the career plan of all our students. Newsletters are sent to all the stakeholders so they can follow on-going students and consortium activities. The assessment of the impact of this measure will be monitored by using visitors (via Google Analytics o similar), in order to record unique visitor numbers and adjust the promotion strategy accordingly, ensuring a balanced attraction of students and scholars from several geographical origin. Additionally, this website includes information about Erasmus + programme and direct links to EACEA and EMA (Erasmus + Students and Alumni Association) websites. In order to get a bigger impact and dissemination of the Nucphys Master, each partner university has created direct links from their home pages. The webmaster will undertake the measures to place the domain of the Master in the best positions on various search engines

NucPhys website will constitute a platform as reference of the nuclear physics community. A biannual newsletter will be sent to NucPhys stakeholders.

Social networks: A communication plan is being developed to assure high quality content in the social networks to use them, not only as a promotion tool, but also as a source of information about the Nuclear Physics sector. It includes the following actions:

- Facebook:

a) A private group per intake is created to be linked with the Facebook page. It is a useful mechanism to enhance the relations among students before the start of the master course since it is a platform where they can share information. In addition, these groups are useful to contact students once they have finished the master course.

b) Publication of at least one post with own content once per week:

   - News about the activities which are organized during the master course: field visits, seminars, conferences, cultural acts, invited lecturers etc.
   - A space for students with testimonials.
   - Information related to the master course (linked to our website): different paths, partners and associated partners, opening of application period, etc.
   - Information related to professors, including main achievements, publications, investigations and research etc.

c) Enhancing dissemination of content through partners and associated partners:

   - Following all our partners and associated partners« Facebook pages.
   - Sharing relevant posts published by our partners and associated partners twice per week.
   - Mentioning our partners and associated partners in our pages, to facilitate interactions.

d) Sharing job offers from partners and associated partners. We enhance the employability of students informing them about the working opportunities.

- Twitter: It counts with more than 310 million of users and it is a very effective tool to reach a big audience and to receive feedback. We use our Twitter account to make important announcements and share any news that our students ought to know.

a) Link the twitter account with the Facebook page to inform about the new posts which have been added in Facebook

b) Following partners and associated partners.

c) Follow prestigious international institutions in the field of nuclear physics.

d) Follow prestigious physicists in the field of nuclear physics that are making research that can be interesting for our master.

- LinkedIn

a) A profile will be generated for the Master

b) Connect to members and associated partners

c) Connect to former students

Developing information materials: The consortium has created not only the website but also other information tools such as brochures, leaflets, posters, roll-ups, etc. which are sent to the Third-countries and European universities on request and handed out at international congresses, meetings, etc. In line with this action, the consortium has developed a visual identity that can be used in all the publications. Harmonizing the visual identity of our master course will ensure that the content we share is easily identifiable as ours. This visual identify should overcome the graphic line of the universities of the consortium.

Associated Members will also be in charge to distribute NucPhys brochure to their contacts, with specific attention to professionals associations and public Bodies. Moreover, the network of worldwide nuclear physics will be contacted so to promote the master course among their partners.

Networking: A strong action of networking should be at the base of the NucPhys promotion. The networking would be implemented according to the following measures:

- Each Consortium Partner is invited to circulate the NucPhys brochure and link to its own contacts, in its own Country and abroad. Moreover, each Consortium partner should publish on its website the information on NucPhys.

- Dissemination of the NucPhys master results through participating at newsletters of Associations or networks on Nuclear Physics topics.

- A number of core groups of magazines and journals, will be selected and contacted so to publish a short description on NucPhys master course. The aim is to involve and to reach scholars and professionals working on nuclear physics issues, so to communicate and to enlarge the Consortium.

- Contacts with universities: NucPhys Secretariat will be in charge of the international relations with the universities all over the world through mass mailing. In addition, every university will take advantage of the relations of their Òinfluence areasÓ.

The International offices of European and Third-countries universities will receive up-to-date information about the calls for participation, deadlines for submission of documents and general information of the programme. Through these contacts, the Masters consortium will advertise the selection process of both students and scholars. Even if contact with Third-country universities will be mainly made through the NucPhys Secretariat, each consortium member will directly invite departments from relevant universities to apply for scholar grants. The contact process consists in:

• Mass emailing introducing the Master: General information and electronic brochures are sent out.

• Keeping contact with the universities which had expressed interest in the programme: Giving further and updated information as well as advertising materials.

• Contact with the Departments of Physics and Faculties that are considered especially interesting for the consortium.

- With respect to Third Country visibility and attractiveness, a mailing list of Universities and Research Centres working in the nuclear physics field will be put in place, so to send NucPhys brochure and information. For this purpose, a strong involvement should be granted by Third Country potential collaborators all around the world, especially in Asia and North and Latin America.

Moreover some funds will be destined so to promote the participation of NucPhys Consortium representatives (proposed by the Academic Committee, and nominated by the Consortium Coordinator) to the future Nuclear Physics events

3.3 SUSTAINABILITY AND CONTINUATION

Sustainability and continuation

Please refer to the description of the award criteria in the Erasmus+ Programme Guide.

NucPhys EMJMD is designed to continue beyond the period of EU funding. It is based on the structure that was built by the consortium members who already offer their own programmes in Nuclear Physics. Hence, all the professors, installations and technical resources are already put in place. Each university is perfectly equipped with high level technology and it counts with prestigious lecturers in the field of the nuclear physics that ensures the excellence of the programme. Attracting the best partners, students and employers is essential for the sustainability strategy and in order to entice them, NucPhys EMJMD assures innovative content based on the market needs, strategic partnerships and an effective dissemination strategy. For this reason, we count with a wide network of associated partners which provide us with a real vision to improve knowledge of the trends, needs, obstacles and limitations of the Nuclear Physics sector, being the potential employers of our graduates.

Nevertheless, attracting the best students is our main goal, as they are the reason and the only ones who can guarantee the continuity of NucPhys EMJMD. The consortium foresees that once at least 20 students per intake are ensured and around 10 external fellowships are maintained, the program will be ready to run without EU funding. Our programme is now in the second project and sixth intake. In these six intakes, we have grown in number of self-funded students up to an average of 5 students, a number that we expect to continue increasing.

The strategies and mechanisms designed to fulfill these objectives are:

Academic excellence

NucPhys Master is committed to provide all the students with an excellent background in Nuclear Physics (theory, experiments and applications) so as to educate experts in the field to meet the needs and challenges of the sector and foster their future career in this field. At the same time, NucPhys students carry out their master studies in at least 3 countries, in a stimulating and scientifically excellent international environment. In this sense, academic excellence including updated contents in connection with industrial needs will be pursued in all editions.

Financial support to students:

Consortium members are aware of the importance of supporting students with scholarships or grants. For this reason, members of the consortium will mobilize their own resources to offer scholarships and grants and will inform all the students about any funding available.

Recently, we have obtained different grants and fellowships similar to those offer by the Erasmus Mundus to those self-funded students. University of Caen offers consistently around 5 fellowships per year that are intended to cover the second year of selected self-funded students. The INFN (Italy) funds full two-year grants, we have enjoyed 3 in the last two academic years, and we expect to have another 3 next academic year. These opportunities were not possible in the first project of our Master as they are product of the dissemination of our success and the renowned excellence that our students are gaining with our train but also with their own motivation and work. We expect to continue increasing these external fellowships

All students enrolled at University of Seville that are not awarded with the Erasmus Mundus scholarship, can apply for the Erasmus Plus HE-SMS-P grant. In the framework of the project K103. In addition, the University of Seville is offering grants from the "*Plan Propio de Docencia de la Universidad de Sevilla"* to support the travel and accommodation costs during the mobility foreseen among Spanish universities.

Moreover, all the universities in the consortium have signed mobility agreements to offer students regular Erasmus grants. In addition, the consortium will research and collect information on all the possible funding sources and scholarships available across the world and keep this information updated and uploaded to the website. One of the tasks of NucPhys Secretariat will be to search scholarships opportunities and communicate them to self-funded students.

Students studying in Italy can apply for Italian Government Scholarship, although this scholarship would not cover any study periods spent in other EU or international universities as part of the EMJMD. In

addition, students studying in Padova can also apply for a regional scholarship.

University of Caen has agreed with CROUS to give access to our students to the accommodation at university halls granted by the government with special low prices.

The NucPhys Consortium continually strives to provide other funding options for self-funded students. Financial aid for self-funded candidates willing to join the master programme will find a list of possible funding in our website.

Wide network of associated partners

In addition, our associated partners also contribute with their own resources to our programme, organising activities, visits and seminars that are completely funded by them. In particular, the GANIL associated partner has agreed to host and partially support the advanced common course, and also to offer room at the laboratory guest-house at a reduced price for the Nucphys students. For this reason, building a strong network of associated partners is one of the mechanisms designed to ensure the sustainability of the master program:

- Having prestigious institutions as associated partners will increase our visibility and credibility. Students can be more interested in Nucphys EMJMD if they see that institutions from their region are involved in the organization of the master course.
- The consortium uses them as important communication channels to ensure the promotion of NucPhys and the dissemination of the results. Research centres, laboratories, nuclear physics associations, companies of the industry and public institutions may have contact with local universities, so they can easily promote NucPhys among local students.
- These associated partners may be interested in funding our programme, providing scholarship to students from their own country / region. Nuclear physics students are the future labour market in the industry and the associated partners may be very much interested on contributing to training of professionals in this area.

Employability of graduates:

The employability of graduates is one of the most important goals of the Bologna Process. The 2012 Bucharest Communiqu highlights the importance of 'cooperation between employers, students and higher education institutions', to ensure that students are equipped with a combination of transversal skills and up-to-date subject-specific knowledge, enabling them to 'contribute to the wider needs of society and the labour market'. In line with this objective, NucPhys Consortium is working in the implementation of actions designed to promote and foster the entry into employment.

- NucPhys curriculum includes an internship period, which presents two advantages: First of all, the fact of having an internship attract much more students as the master will give them the opportunity to gain access to the labour market. Secondly, students will develop some skills that are only acquired when they face real life situations.
- Organization of activities that clearly reinforce the connection with the world of work such as summer schools set by associated partners, extracurricular internships, organization of seminars etc.
- Collaboration with external institutions for those students who may be interested in preparing their master thesis to have a first experience at the labour market and to increase the possibilities of getting a job once they have finished their studies. Associated partners collaborate proposing topics and offering their facilities to perform research and master theses.

It is interesting to remark that among the first four promotions of NucPhys, 80% of students are employed very soon after finishing, mainly on PhD positions with some of them getting jobs and enterprises. Some of the remaining 20% decides to continue their formation in different masters.

As previously mentioned, NucPhys consortium is very motivated to keep on running the course after the funding period, as we consider that represents the best Master course to form the next generation of

nuclear scientists. The teaching units in themselves belong to the pedagogical offer of the host universities; therefore, the structure and logistics will be maintained. However, the sustainability of the programme essentially depends on the availability of the students. We have increased consistently the number of self-funded students and external funding, but nowadays the absence of EU funding will put at risk the continuity of the programme. In this respect, the consortium expects that the reputation of the course, which is increasing since its start in 2017, will make progressively increase the number of self-funded students to finally continue without EU funding.

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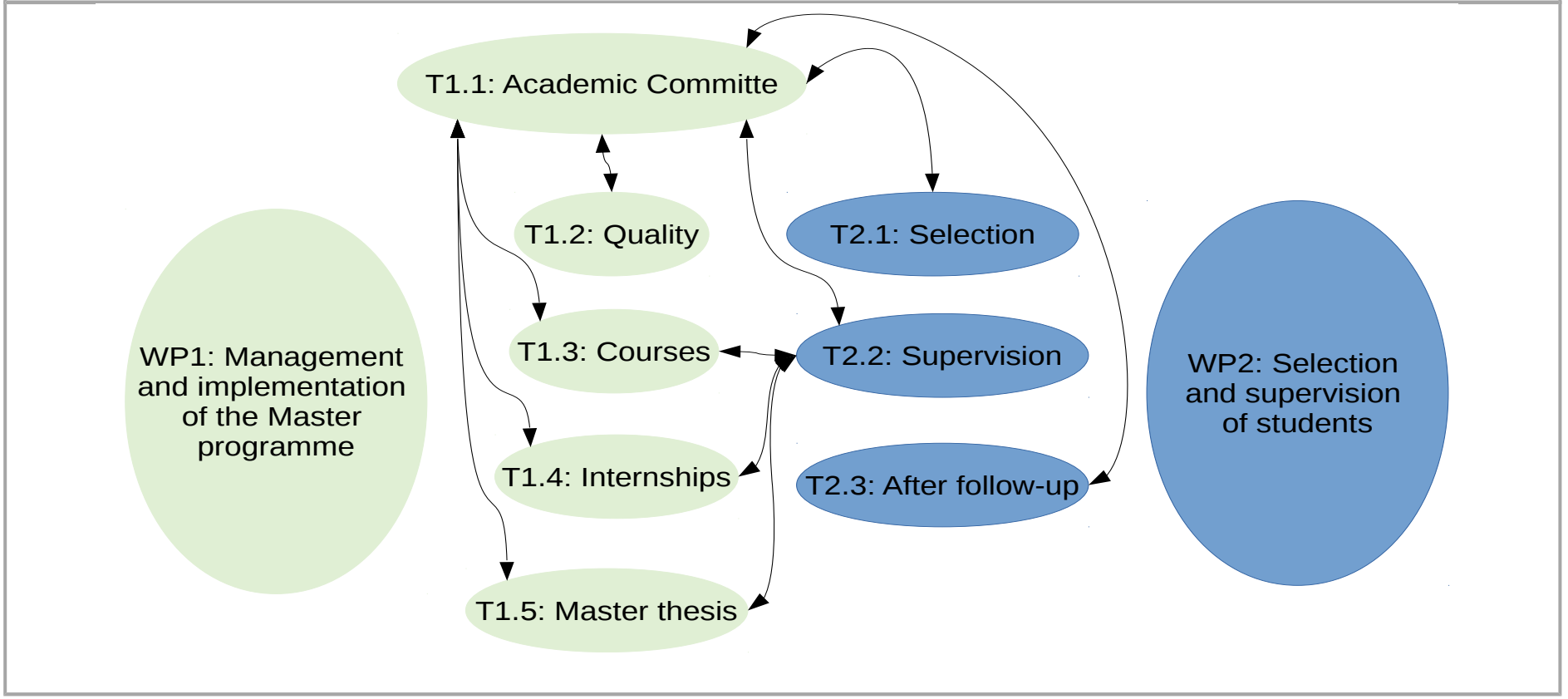
4. WORK PLAN, WORK PACKAGES, ACTIVITIES, RESOURCES AND TIMING

4.1 WORK PLAN

Work plan

Provide a brief description of the overall structure of the work plan (list of work packages or graphical presentation (Pert chart or similar)).



4.2 WORK PACKAGES, ACTIVITIES, RESOURCES AND TIMING

WORK PACKAGES

Work packages

This section concerns a detailed description of the project activities.

*Group your activities into work packages. **A work package means a major sub-division of the project**. For each work package, enter an objective (expected outcome) and list the activities, milestones and deliverables that belong to it. The grouping should be logical and guided by identifiable outputs.*

Projects should have 2 fixed work packages:

- *WP1 – 'Management and implementation of the Master programme' (management and coordination activities (meetings, coordination, project monitoring and evaluation, financial management, progress reports, etc), curriculum implementation, promotion of the master programme and impact, sustainability and dissemination of results)*
- *WP2 – Selection and supervision of students*

⚠ *Enter each activity/milestone/output/outcome/deliverable only once (under one work package).*

⚠ *Ensure consistence with the detailed budget table/calculator (if applicable).*

Objectives

List the specific objectives to which the work package is linked.

Activities and division of work (WP description)

Provide a concise overview of the work (planned tasks). Be specific and give a short name and number for each task.

*Show who is participating in each task: Coordinator (COO), Beneficiaries (BEN), Affiliated Entities (AE), Associated Partners (AP) and others, indicating **in bold** the task leader.*

Milestones and deliverables (outputs/outcomes)

***Milestones** are control points in the project that help to chart progress (e.g. completion of a key deliverable allowing the next phase of the work to begin). Use them only for major outputs in complex projects, otherwise leave the section empty. Please limit the number of milestones by work package.*

Means of verification are how you intend to prove that a milestone has been reached. If appropriate, you can also refer to indicators.

***Deliverables** are project outputs which are submitted to show project progress (any format). Refer only to major outputs. Do not include minor sub-items, internal working papers, meeting minutes, etc. Limit the number of deliverables to max 10-15 for the entire project. You may be asked to further reduce the number during grant preparation.*

For deliverables such as meetings, events, seminars, trainings, workshops, webinars, conferences, etc., enter each deliverable separately and provide the following in the 'Description' field: invitation, agenda, signed presence list, target group, number of estimated participants, duration of the event, report of the event, training material package, presentations, evaluation report, feedback questionnaire.

For deliverables such as manuals, toolkits, guides, reports, leaflets, brochures, training materials etc., add in the 'Description' field: format (electronic or printed), language(s), approximate number of pages and estimated number of copies of publications (if any).

For each deliverable you will have to indicate a due month by when you commit to upload it in the Portal. The due month of the deliverable cannot be outside the duration of the work package and must be in line with the timeline provided below. Month 1 marks the start of the project and all deadlines should be related to this starting date.

The labels used mean:

Public — fully open (automatically posted online on the Project Results platforms)

Sensitive — limited under the conditions of the Grant Agreement

EU classified — RESTREINT-UE/EU-RESTRICTED, CONFIDENTIEL-UE/EU-CONFIDENTIAL, SECRET-UE/EU-SECRET under Decision 2015/444. For items classified under other rules (e.g. national or international organisation), please select the equivalent EU classification level.

WORK PACKAGE 1

Work Package 1: [Name, e.g. Management and implementation of the Master programme]			
Duration:	M1 - M74	**Lead Beneficiary:**	1-Univ. Sevilla

Objectives

List the specific objectives to which this work package is linked.

- Coordination of the programme
- Quality evaluation
- Course preparations and implementation
- Proposals, implementation and defence of Internships and master's thesis projects

Activities and division of work (WP description)

Task No (continuous numbering linked to WP)	Task Name	Description	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T1.1	Academic Committee	Organization of two meetings per year of the Academic Committee with representatives of all beneficiaries and students. Overall coordination	**Seville**	COO	n/a

		and supervision of the different tasks.			
			(all others)	BEN	
T1.2	Internal Quality assessment	Interviews among students regarding the implementation of the program and suggestion of possible improvements	**Caen**	BEN	n/a
			(all others)	BEN	n/a
T1.3	Course preparations and implementation	Global coordination and implementation. Each beneficiary will be responsible of the implementation of the subjects performed at its University according to the program described in Sec. 2.1	**Padova**	BEN	
			(all others)	COO,BEN	
T1.4	Internships organization	Global coordination and implementation. Gathering of proposals, implementation and defence of Internships.	**Caen**	BEN	
			(all others)	COO,BEN	
T1.5	Master thesis organization	Global coordination and implementation. Each beneficiary will be responsible of gathering of proposals, implementation and defence of Master thesis performed at its University according to the program described in Sec. 2.1.	**Catania**	COO,BEN	
			(all others)	COO,BEN	

Milestones and deliverables (outputs/outcomes)

Milestone No (continuous numbering not linked to WP)	Milestone Name	Work Package No	Lead Beneficiary	Description	Due Date (month number)	Means of Verification

MS1		1					
MS2		1					
Deliverable No (continuous numbering linked to WP)	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month number)	Description (including format and language)
D1.1	Mid-term Internal Quality Report	1	**Caen**	*[*R — Document, report*]*	*[*PU — Public*]*	40	Electronic. English. 10 pages.
D1.2	Final Internal Quality Report	1	**Caen**	*[*R — Document, report*]*	*[*PU — Public*]*	74	Electronic. English. 10 pages.

Estimated budget — Resources
For Unit Grants, see detailed budget table/calculator (annex 1 to Part B; *see Portal Reference Documents*).

WORK PACKAGE 2

Work Package 2: *Selection and supervision of students*			
Duration:	M1 - M74	**Lead Beneficiary:**	1- University of Seville
Objectives *List the specific objectives to which this work package is linked.*			
■ Selection of applications			

- Supervision of students
- Follow-up of students after the programme

Activities and division of work (WP description)

Task No (continuous numbering linked to WP)	Task Name	Description	Participants		In-kind Contributions and Subcontracting (Yes/No and which)
			Name	Role (COO, BEN, AE, AP, OTHER)	
T2.1	Selection of students	A committee with representation of all beneficiaries will review applications and interview applicants in order to decide the distribution of grants and admission into the program.	**Seville**	COO	n/a
			(all others)	BEN	
T2.2	Supervision and assistance	Supervision of academic performance of students. Different actions to help students with possible academic difficulties.	**Complutense**	BEN	
			(all others)	COO,BEN	
T2.3	After-programme follow-up	Graduated students in the programme will be requested to inform on how the programme impacted their employability and personal growth. This information will be reported to the Academic Committee to decide actions or adjustments to be made to the programme.	**Barcelona**		n/a
			(all others)	COO,BEN	n/a

Milestones and deliverables (outputs/outcomes)

Milestone No	Milestone Name	Work Package	Lead Beneficiary	Description	Due Date	Means of Verification

(continuous numbering not linked to WP)		No				(month number)	
MS1		1					
MS2		1					
Deliverable No (continuous numbering linked to WP)	Deliverable Name	Work Package No	Lead Beneficiary	Type	Dissemination Level	Due Date (month number)	Description (including format and language)
D1.1		1		*[*R — Document, report*]* *[*DEM — Demonstrator, pilot, prototype*]* *[*DEC —Websites, patent filings, videos, etc*]* *[*DATA — **data sets, microdata, etc***]* *[*DMP — Data Management Plan*]* *[*ETHICS*]* *[*SECURITY*]* *[*OTHER*]*	*[*PU — Public*]* *[*SEN — Sensitive*]* *[*R-UE/EU-R — EU Classified*]* *[*C-UE/EU-C — EU Classified*]* *[*S-UE/EU-S — EU Classified*]*		
D1.2		1		*[*R — Document, report*]* *[*DEM — Demonstrator, pilot, prototype*]* *[*DEC —Websites, patent filings, videos, etc*]* *[*DATA — **data sets, microdata, etc***]* *[*DMP — Data Management Plan*]* *[*ETHICS*]* *[*SECURITY*]* *[*OTHER*]*	*[*PU — Public*]* *[*SEN — Sensitive*]* *[*R-UE/EU-R — EU Classified*]* *[*C-UE/EU-C — EU Classified*]* *[*S-UE/EU-S — EU Classified*]*		

EVENTS AND TRAININGS

Events and trainings

This table is to be completed for events that have been mentioned as part of the activities in the work packages above
Give more details on the type, location, number of persons attending, etc.

Event No (continuous numbering linked to WP)	Participant	Description					Attendees
		Name	Type	Area	Location	Duration (days)	Number
E1.1	[Univ. Caen]	[Internship defense]	[event, one per intake]	[Common ceremony where besides the evaluation of Internships,first year students are invited to learn the process of internships and strengthen relations with second-year students]	[Caen, Framce]	[3]	[50]

TIMETABLE

Timetable (projects of more than 2 years)

Fill in cells in beige to show the duration of activities. Repeat lines/columns as necessary.
Note: *Use actual calendar years and quarters. In the timeline you should indicate the timing of each activity per WP. You may add additional columns if your project is longer than 6 years.*

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6

ACTIVITY	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4	Q 1	Q 2	Q 3	Q 4
Task 1.1 – 1.3																												
Task 1.4 – 1.5																												
Task 2.1																												
Task 2.2																												
Task 2.3																												

#§WRK-PLA-WP§#

#@ETH-ICS-EI@#

5. OTHER

5.1 ETHICS

Ethics (if applicable) *If the Call document/Programme Guide contains a section on ethics, describe ethics issues that may arise during the project implementation and the measures you intend to take to solve/avoid them.* *Describe how you will ensure gender mainstreaming and children's rights in the project activities.*
Not applicable

#§ETH-ICS-EI§# #@SEC-URI-SU@#

5.2 SECURITY

Security
Not applicable.

#§SEC-URI-SU§# #@DEC-LAR-DL@#

6. DECLARATIONS

Double funding	
Information concerning other EU grants for this project ⚠ *Please note that there is a strict prohibition of double funding from the EU budget (except under EU Synergies actions).*	**YES/NO**
We confirm that to our best knowledge neither the project as a whole nor any parts of it have benefitted from any other EU grant *(including EU funding managed by authorities in EU Member States or other funding bodies, e.g. Erasmus, EU Regional Funds, EU Agricultural Funds, etc)*. If NO, explain and provide details.	YES
We confirm that to our best knowledge neither the project as a whole nor any parts of it are (nor will be) submitted for any other EU grant *(including EU funding managed by authorities in EU Member States or other funding bodies, e.g. Erasmus, EU Regional Funds, EU Agricultural Funds, etc)*. If NO, explain and provide details.	YES

Financial support to third parties (if applicable)
Not applicable.

Seal of Excellence (if applicable)	
0 *If provided in the Call document, proposals that pass the evaluation but are below the budget threshold (i.e. pass the minimum thresholds but are not ranked high enough to receive funding) will be awarded a Seal of Excellence.* 1 *In this context we may share information about your proposal with other EU or national funding bodies through the Erasmus+ National Agencies.*	
Do you agree that your proposal (including proposal data and documentation) is shared with other EU and national funding bodies to find funding under other schemes?	*[*YES*] [*NO*]*

#§DEC-LAR-DL§#

ANNEXES

LIST OF ANNEXES

Standard

Detailed budget table/Calculator (annex 1 to Part B) — *mandatory for Unit Grants (see Portal Reference Documents)*
CVs (annex 2 to Part B) — *not applicable*
Annual activity reports (annex 3 to Part B) — *not applicable*
List of previous projects (annex 4 to Part B) — *mandatory*

Special

Proof of accreditation — *mandatory*
Draft Partnership Agreement — *mandatory*
Draft model of Diploma Supplement — *optional*
Draft Student Agreement — *optional*
Blank copies of the proposed master degree diplomas — *optional*

LIST OF PREVIOUS PROJECTS

List of previous projects *Please provide a list of your previous projects for the last 4 years.*					
Participant	Project Reference No and Title, Funding programme	Period (start and end date)	Role (COO, BEN, AE, OTHER)	Amount (EUR)	Website (if any)
[name]					
[name]					

HISTORY OF CHANGES		
VERSION	PUBLICATION DATE	CHANGE
1.0	25.02.2021	Initial version (new MFF).
2.0	15.12.2021 01.06.2022	Update for calls 2022. Consolidation, formatting and layout changes. Tags added.