Operational Program European Social Fund - Regione Liguria 2014-2020
ASSE 3 "Education and training"

UNIVERSITÀ DEGLI STUDI
DI GENOVA

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EXCERPT OF INFORMATION SHEET **PHYSICS *** (current name of the course: **PHYSICS AND NANOSCIENCES**, the name has changed after approval of the grants by Regione Liguria, such changement does not involve the content of the approved projects)

GENERAL INFORMATION **STRUCTURE OF THE TRAINING PROJECT**	
DURATION AND ORGANIZATION OF THE COURSE	The course starts officially on 1 of November 2018 and lasts three years. 1. At the end of each year, doctoral students shall present the Teaching Body with a detailed written account of the activities carried out. The Teaching Body may ask for the account to be discussed according to procedures it has established. **Coordinator of the course:** Prof. Alessandro Petrolini; **E-mail address:** alessandro.petrolini@ge.infn.it **Department coordinating for research:** Dipartimento di Fisica (DIFI)
TRAINING PROJECT	The following 3 projects/scholarships are activated: **Curriculum PHYSICS (CODICE 7294):** **Project/scholarship 1: Marine mammals tracking using the acoustic positioning system of the underwater neutrino detectors.** *Months abroad*: 12 *In cooperation with*: - EDGELAB Spa - SITEP_TECNOMAR LIGURIA - CPPM-Marsiglia (FR) - Distretto Ligure delle Tecnologie Marine (DLTM) - Polo Energia Ambiente e Sviluppo Sostenibile (EASS) *Project/scholarship details*: The proposed PhD thesis will consider the development of marine technologies for the detection of acoustic signals. This work will improve the study of the behavior of marine mammals, of the systems to protect them from possible ship collisions, of the acoustic anthropic noise.

	In the first part of the project a collaboration with the local enterprises will focus on the development of technologies and software codes to detect acoustic waves on a marine environment. This activity will be very usefull to the appointed candidate both to familiarize with the requests of the ligurian enterprises and to improve his attitude to work with an industrial team. The second part of the activity will be done in collaboration with the Centre de Physique des particules in Marseille (CPPM) and with the Laboratori Nazionali del Sud of INFN (INFN-LNS). Both research Institutes manage the two blocks of the underwater high energy neutrino detectors where the positioning system consists of acoustic beacons and hydrophones. The same system will be used to test both the instruments and the software reconstruction packages developed by the student in collaboration with personnel of the Physics Department in Genoa and the local enterprises. This research activity will develop competences on various interdisciplinary fields like the Physics of the sound propagation in water, marine Biology, Data Acquisition Systems (DAQ)/ Data transmission. The project will be carried on in collaboration of the CPPM group in Marseille. This research centre maintains an underwater neutrino detector where acoustic signals are also detected. This detection system will be used as a bench test of the work done by the PhD student. Part of the activity will be done at Marseille under the supervision of the CPPM group (PhD thesis in 'co-tutela'). The ideal candidate shall have a good knowledge on elementary Physics, programming and good skill on laboratory activity. **Project/scholarship 2: Environmental and health effects of nano-particles and bio-aerosols in the atmosphere.** *Months abroad*: 3 *In cooperation with*: - C.P.G. LAB - PM_TEN - SIGE - TICASS - Distretto Ligure delle Tecnologie Marine (DLTM) - Polo Energia Ambiente e Sviluppo Sostenibile (EASS) *Project/scholarship details*: The industrial research project deals with the topic of atmospheric particulate matter with dimension <0.1 micron and of bioaerosol, in particular bacteria, and of its impact on air quality, health and climate. Given the growing development of nano-technologies and therefore the potential risk for health and environment, the knowledge on the concentration of nanoparticles and bioaerosol in the atmosphere, their effects and on the techniques to ensure reliable and economically sustainable monitoring are still rudimentary. The studies on nanoparticles and bioaerosol will be conducted in the controlled but realistic conditions of the atmospheric simulation chamber installed at UNIGE-DIFI (ChAMBRe) in collaboration with INFN. This structure consists of a cylindrical steel vessel with a volume of about 2.3 m3. Inside ChAMBRe, particular "atmospheres", both in terms of gaseous compounds and of aerosol concentration and composition, can be produced and maintained for times varying from a few hours to a few days. The simulation chamber is equipped with numerous ports for connecting different types of measuring and sampling instruments, including the sensors of the meteorological parameters. It will be possible to inject into ChAMBRe both aerosols made of artificial nanoparticles and samples collected on site and to measure any variation in the meteorological parameters (temperature, relative humidity, etc.) and air quality (i.e. concentrations of NOx and / or O3). As regards the bio-aerosol component, the focus will be on the behaviour of bacteria in the atmosphere, with the analysis of the possible correlation between meteorological parameters, air quality and their ability to survive and grow in the atmospheric environment. Objectives: To measure, through tests conducted inside the ChAMBRe atmospheric

	simulation chamber, the mechanism of interaction of the nanoparticles both with the electromagnetic radiation spectrum typical of the Sun and with the constituents of the atmosphere and other pollutants such as NOx and O3. To study the viability of gram-positive and gram-negative bacterial strains in the presence of different concentrations and mix of: SOx, CO, NOx, O3, temperature, U.R., spectrum and irradiance. Planned activities: - Execution of tests in the simulation chamber to measure the variation of the meteo-climatic parameters according to the concentration and type of nanoparticles introduced in the chamber itself. - Measurement of the reactivity and interaction of nanoparticles of different species with other polluting species, in particular NOx and O3. - Measurement of the influence of nanoparticles on the concentrations of bio-aerosols, in particular bacteria, present in the atmosphere. - Measurement of the influence of different atmospheric parameters / pollutants on the viability of selected bacterial strains. **Project/scholarship 3: Development of a HTS superconducting magnet for energy applications.** *Months abroad*: 6 *In cooperation with*: - CERN - CNR-SPIN - ASG Superconductors - INFN - Distretto Ligure delle Tecnologie Marine (DLTM) - Polo Energia Ambiente e Sviluppo Sostenibile (EASS) *Project/scholarship details*: The aim of the project is the study and development of a superconducting magnet suitable for applications in energy field (SMES, wind generators…). In particular, the project is based on exploiting innovative superconducting materials and an innovative dipole magnet design. Objectives: Regarding the superconducting conductor, the project will be focused on Bi-2212, a so-called high temperature superconductor (HTS) which shows high critical current density up to very high magnetic field (45 T) at low temperature (boiling helium, 4.2 K). It has the great advantage, with respect the other HTS superconductors such as YBCO or Bi-2223, to be processed as isotropic round wire. Regarding the magnet, the structure of the winding will be based on the so-called canted solenoid. It is basically composed of two concentric layers of solenoidal coils with opposite currents and having helical turns modulated to produce the desired transverse field, the solenoid field being canceled. Such a structure is of great interest in several fields and it can be considered the building-block for future superconducting magnets development. Activities: The work will be organized in two stages: in the first the development of the Bi-2212 wires at CNR-SPIN laboratory and the Rutherford cable at CERN laboratory. The second stage will be focused on the magnet design at INFN laboratory with a successive development of the magnet prototype at ASG Superconductors. Stage I: Bi2212 wires will be realized through the so-called Powder-In-Tube process in which a Silver sheath is filled by the superconducting powder and cold worked down to a wire. A critical aspect is the densification of the powder in the wire and it will be faced by an innovative approach based on groove-rolling. Deformation and heat treatment parameters will be optimized. Transport properties of the samples will be performed at DIFI. The wires realized at SPIN will be finally sent to CERN for the characterization at high magnetic field and for the development of Rutherford cables, the most suitable cable architecture for magnet winding.

	Stage II: the activities will be planned as follows: 1) magnet design; 2) mechanical design; 3) protection; 4) building design. The activities 1, 2 and 3 will be performed at INFN laboratories through the use of finite elements codes (COMSOL, Opera, ANSYS) for the magnetic, mechanical and thermal analysis. In this context, a stage at CERN is also foreseen. The activity 4 will be performed mainly at the ASG plant.
PhD FUNDING	The annual gross amount of the grant, including social security expenses to be paid by the recipient, is € 16,500.00. The amount of the doctoral grant shall be increased by 50% for an overall period of not more than 18 months, if the graduate student is authorized to by the teaching body to carry out research abroad. Starting from the first year, each graduate student will have, besides the grant, a budget for research activities in Italy and abroad which will not be less than 10% of the grant.
ADMISSION REQUIREMENTS	
COURSE ADMISSION	Admission is subject to the passing of the selection tests and is conditioned by the positive outcome of the medical examinations, where required, that are carried out in health facilities and aimed at ascertaining the suitability for the specific task in accordance with D. Lgs. No. 81/08.
REQUIRED QUALIFICATION	Degree which has been conferred according to the rules and regulations in force prior to the reform of didactic freedom in universities, or a specialist/II level degree or an equivalent foreign academic qualification.

SELECTION PROCESS	
SELECTION COMMITTEE	The committees are made up of at least 3 university professors for each course; they may be integrated by not more than 2 experts, who may also be foreign nationals, from public and private research institutions and structures.
ADMISSION TEST VENUE	Università degli Studi di Genova, Dipartimento di Fisica (DIFI), via Dodecaneso 33, Genova
TYPE OF ADMISSION TEST	• Comparative assessment of the qualifications/publications. • Written test (research project). • The interview consists in the discussion of the written test (research project) and the description of the candidate's research area of interest, also on the basis of previous activities stated in his/her scientific-professional curriculum The tests are focused on confirming the candidates' aptitude for scientific research.
METHODS FOR INVITING THE CANDIDATES AND COMMUNICATING THE OUTCOMES OF THE TESTS	The **examination schedule** is as follows: • Evaluation of qualifications, curriculum and written test (research project): **23.7.2018, 9.30 am** • Interview: **23.7.2018, 2.30 pm at** Dipartimento di Fisica (DIFI), room S824. **Candidates can use video conference mode; and, for identification purposes, the candidate must show the original document of which he has deposited a certified copy at the time of application.** The **list of those admitted to the interview** will be affixed at the Dipartimento di Fisica (DIFI). The **final lists** shall be announced on **10th August 2018**, and will appear solely on: • the noticeboard of the relevant research Departments/facilities for the

	research courses; • the noticeboard of the University; • on the Internet address https://unige.it/usg/it/dottorati-di-ricerca No information whatsoever shall be posted to candidates' domicile.
WRITTEN TEST	The research project (10 pages maximum) has to be attached to the online application form, and it must concern one or more research Projects/grants highlighted in the section "TRAINING PROJECT". The research project will be evaluated as practical test for the selection, together with the evaluation of the qualifications and the scientific-professional curriculum, in order to identify the candidate's aptitude for scientific research in terms of originality, feasibility, clarity in the definition of objectives, methods and expected results.
INTERVIEW	The interview consists in the discussion of the written test (research project) and the description of the candidate's research area of interest, also on the basis of previous activities stated in his/her scientific-professional curriculum During the interview, the candidate shall also prove his/her proficiency in the following foreign language: English. Non-Italian candidates will also have to prove knowledge of the Italian language.
PERCENTAGE VALUES OF TO EACH TEST	To each candidate can be assigned a maximum of 150 points, divided as follows: - comparative assessment of the qualifications/publications: max score 30/30, pass mark 20/30. - Written test (research project):max score 60/60, pass mark 40/60. - Interview: max score 60/60, pass mark 40/60. The final ranking will be drawn up by adding the scores assigned in comparative assessment, written test and interview. Candidates will be selected in compliance with the principles of equal opportunities.
ADDITIONAL CRITERIA FOR ADMISSION TO THE COURSE	In the case of equal grades, the evaluation of candidates' incomes prevails for the assignation of grants, as per D.P.C.M. 9 April 2001

PROJECT CO-FINANCED BY THE EUROPEAN UNION

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