

**Oferta Becas Máster Instituto de Física Corpuscular (IFIC, CSIC-UV). Curso 2022-2023**

Cód. Plan de formación Investigador	Investigador/a responsable	Proyecto	Descripción	Modalidad
JAE Intro ICU-2022-IFIC-01	Enrique Nácher Enrique.Nacher@ific.uv.es	Nuclear Instrumentation for proton-therapy quality control	This work will consist on an experiment of proton irradiation of artificial bone tissue loaded with iodine at Centro de Microanálisis de Materiales (CMAM, Madrid), and the corresponding data analysis, with the aim of assessing iodine contrasts and pure LaCl <sub>3</sub> scintillator crystals for proton-range verification.	AFNP
JAE Intro ICU-2022-IFIC-02	Luis Caballero Luis.Caballero@ific.uv.es	Hybrid detector of gamma-rays and ultrasound for biopsy guidance in breast cancer	The selected person will work on the assembly and experimental characterization of a novel Compton-type gamma-ray detector, as well as on different reconstruction algorithms of the gamma image obtained and its real-time correlation with the images provided by an ultrasound scanner, as part of the MAGAS project to develop a guided biopsy system for breast cancer.	AFNP

JAE Intro ICU-2022-IFIC-03	Gabriela Llosá Gabriela.Llosa@ific.uv.es	Development of a Compton camera for medical applications	The IRIS group ( <a href="http://ific.uv.es/iris">http://ific.uv.es/iris</a> ) develops instrumentation, simulations and image reconstruction algorithms for medical physics applications. We propose to participate in the development of a Compton camera for the visualization of radiopharmaceuticals (in collaboration with La Fe hospital) or for hadron therapy treatment monitoring.	AFNP
JAE Intro ICU-2022-IFIC-04	Enrique Nácher Enrique.Nacher@ific.uv.es	Development of nuclear instrumentation for studies of climate change effects on marine ecosystems	This work will consist on testing/optimizing a system based on photomultiplier tubes coupled to scintillating fibers and/or liquids, to detect low-energy electrons. The result will be applied to the detection of the $^{45}\text{Ca}$ radiotracer in controlled coral and mollusk ecosystems at the Oceanogràfic, for its environmental relevance.	AFNP
JAE Intro ICU-2022-IFIC-05	Alejandro Algora Alejandro.Algora@ific.uv.es	Study of the shape of beta spectra for the prediction of the antineutrino spectrum in reactors	Recently, we have measured the beta spectra of some decays relevant for the prediction of the antineutrino spectrum for reactors at the IGISOL facility (Univ. of Jyväskylä, Finland). We propose to explore deconvolution methods to extract the shape of the original spectra.	FNPE
JAE Intro ICU-2022-IFIC-06	Alejandro Algora Alejandro.Algora@ific.uv.es	Search for isomeric states in the vicinity of $^{100}\text{Sn}$	We propose to look for isomeric states in nuclei located in the vicinity of the double magic $^{100}\text{Sn}$ nucleus that were produced in the fragmentation of a $^{124}\text{Xe}$ beam at RIKEN (Japan). The work will require the development of tools for the identification and determination of the half-lives of the isomeric states.	FNPE

JAE Intro ICU-2022-IFIC-07	Ana Isabel Morales Ana.Morales@ific.uv.es	Structure of exotic nuclei produced in new-generation fragmentation facilities	The student will have the possibility to investigate aspects related to the production, identification and/or radioactive decay of exotic heavy nuclei, of interest in the formation of the third abundance peak of the rapid neutron-capture process of nucleosynthesis and the subsequent production of the nuclear cosmochronometers of U and Th in the universe.	FNPE
JAE Intro ICU-2022-IFIC-08	Carlos Lacasta Carlos.Lacasta@ific.uv.es	Construction of the ATLAS Inner Tracker for the HL-LHC	The work would consist in the characterization of the radiation resistance of the silicon micro-strip sensors to be used in the new ATLAS tracker for the HL-LHC as well as the readout electronics.	FNPE
JAE Intro ICU-2022-IFIC-09	José Luis Taín Jose.Luis.Tain@ific.uv.es	Fast neutron detector characterization using AI techniques	Commissioning and characterization of liquid scintillation detectors for a time-of-flight spectrometer for nuclear astrophysics experiments using digital electronics, in particular the gamma/neutron discrimination power using machine learning techniques	FNPE
JAE Intro ICU-2022-IFIC-10	Javier Balibrea, Jorge Lerendegui Javier.Balibrea@ific.uv.es Jorge.Lerendegui@ific.uv.es	Development of gamma-ray imaging systems and Machine-Learning based algorithms for nuclear astrophysics experiments at CERN n_TOF	This project focuses on experimental developments and Machine-Learning based algorithms for the optimization i-TED, a gamma-ray imaging system intended for enhancing detection sensitivity in neutron-capture experiments of astrophysical interest at CERN n_TOF. +info at <a href="https://hymnserc.ific.uv.es">https://hymnserc.ific.uv.es</a>	FNPE

JAE Intro ICU-2022-IFIC-11	Luca Fiorini Luca.Fiorini@ific.uv.es	Higgs boson measurements with LHC data using Artificial Intelligence	The LHC started in 2022 to collide protons at an unprecedented energy. This project will use data of the ATLAS experiment to measure the properties of the Higgs boson as a test for new physics signals beyond the standard model. The project gives the opportunity to develop Artificial Intelligence methods.	FNPE
JAE Intro ICU-2022-IFIC-12	Fernando Hueso Fernando.Hueso@ific.uv.es	Gamma-ray detectors for application in clinical proton therapy	In proton therapy, gamma-ray detectors are deployed for treatment verification. We propose that the student participates in the development of a very compact scintillation detector capable of withstanding up to 10 million gamma-rays per second, using pile-up reconstruction techniques.	FNPE
JAE Intro ICU-2022-IFIC-13	Sonja Orrigo Sonja.Orrigo@ific.uv.es	Beta-decay spectroscopy of exotic nuclei	Exotic nuclei are unstable and, once created in the laboratory, decay by emitting particles and gamma rays. The selected student will analyze data of the beta-decay experiments performed by our international collaboration at the GANIL (France) and RIKEN (Japan) laboratories. The goal is to extract valuable information on the structure of these nuclei and their decay properties.	FNPE
JAE Intro ICU-2022-IFIC-14	Enrique Nácher Enrique.Nacher@ific.uv.es	Machine Learning techniques applied to beta decay data for its importance in nuclear astrophysics	This work will consist on the implementation of a data analysis program in C++, specifically a genetic algorithm for data deconvolution (machine learning). The result will be applied to the analysis of the decays of $N \sim Z$ nuclei due to their importance in nuclear astrophysics.	FNPE

JAE Intro ICU-2022-IFIC-15	Juan de Dios Zornoza Juan.de.Dios.Zornoza@ific.uv.es	Measurement of neutrino properties with neutrino telescopes	Several neutrino oscillation parameters are measured, but there are still unknowns as how their masses are ordered or whether non-standard neutrino interactions exist. This has important implications in particle physics (CP violation, Majorana neutrinos...). A promising strategy is the detection of atmospheric neutrinos with KM3NeT-ORCA.	FNPE
JAE Intro ICU-2022-IFIC-16	Agustín Sánchez Agustin.Sanchez@ific.uv.es	Multimessenger searches of transient cosmic neutrino sources	The combination of multiple astrophysical messengers increases significantly the chances to find high energy cosmic neutrino sources: analysing the data from ANTARES and KM3NeT neutrino telescopes in combination with transient phenomena, like gamma ray flares, will make possible the discovery of such sources and delve into the mystery of the origin of the cosmic rays.	FNPE
JAE Intro ICU-2022-IFIC-17	Francisco Salesa Paco.Salesa@ific.uv.es	Detection of high-energy neutrinos in coincidence with astrophysical gamma-ray sources	Multi-messenger astronomy has made important advances recently. The first source of cosmic neutrinos, the blazar TXS0506-056, was confirmed thanks to its simultaneous detection in gamma rays. It is proposed to advance in this type of searches, which combines electromagnetic information, with the ANTARES and KM3NeT telescopes.	FNPE
JAE Intro ICU-2022-IFIC-18	Avelino Vicente Avelino.Vicente@ific.uv.es	Grand unified theories	In this work the student will explore several grand unified theories that merge the electromagnetic, weak and strong interactions into a single force at high energies. Special attention will be given to proton decay, the values of the fermion masses at low energies and the existence of a light Higgs boson in the theory.	FT

JAE Intro ICU-2022-IFIC-19	Nuria Rius Nuria.Rius@ific.uv.es	Explaining neutrino masses with flavoured symmetries	The project will be first of all to get acquainted with current knowledge about neutrino masses and mixings, from different experiments. Second, to study several well motivated flavour models, able to reproduce the observed pattern of neutrino properties. Finally, to analyze the allowed parameter space and phenomenology of one selected model.	FT
JAE Intro ICU-2022-IFIC-20	Claudia Hagedorn Claudia.Hagedorn@ific.uv.es	Neutrino masses from the inverse seesaw with flavour and CP symmetries	The inverse seesaw mechanism is interesting, since it explains the smallness of neutrino masses with rather light new particles. Flavour and CP symmetries are useful to explain lepton mixing. Combining them can lead to predictive models with rich phenomenology like charged lepton flavour violation.	FT
JAE Intro ICU-2022-IFIC-21	José Zurita Jose.Zurita@ific.uv.es	Parameter extraction in Long-Lived Particle Signatures	Long-Lived particles appear in theories addressing the big puzzles of the Standard Model (dark matter, neutrino masses, naturalness problem, strong-CP, baryon asymmetry). The goal of this project is to study the expected accuracy of a putative signal in the HL-LHC run, and its possible interpretations, aided by Machine Learning techniques.	FT
JAE Intro ICU-2022-IFIC-22	José Zurita Jose.Zurita@ific.uv.es	Reinterpretation of disappearing track searches at current and future colliders	Disappearing tracks are a distinctive signature of compressed / feeble interacting dark sectors. The current project aims at reinterpreting the ATLAS and CMS results in a large class of dark sector scenarios, and also make a rough estimation of the reach of the next generation of colliders (e.g: FCC, CEPC, ILC). The project might benefit from the use of artificial intelligence algorithms.	FT

JAE Intro ICU-2022-IFIC-23	José Zurita Jose.Zurita@ific.uv.es	Di-Higgs and Dark Matter at the LHC	The current project aims to construct viable models of dark matter featuring the novel di-Higgs plus missing energy signature, and study the complementarity and interplay between standard collider "MET" searches, direct detection and indirect detection. The use of Machine Learning techniques to improve the sensitivity is envisioned.	FT
JAE Intro ICU-2022-IFIC-24	Gabriela Barenboim Gabriela.Barenboim@ific.uv.es	CPT violation and neutrino oscillation experiments	CPT is a cornerstone of our model-building method. Therefore, as the CPT's status in the neutrino sector, will be assessed at an unprecedented level by current and future long baseline experiments, distinguishing it from comparable experimental fingerprints coming from non-standard interactions is critical.	FT
JAE Intro ICU-2022-IFIC-25	Jorge Portolés Jorge.Portoles@ific.uv.es	Quantum vs Classical Effective Actions in particle physics	In field theory it is possible to establish a differential equation that relates the quantum and the classical effective actions. I propose the study and solution of that equation (and its relation with the equivalent path integral formulation), within elementary particle physics, to obtain the quantum action at one-loop.	FT
JAE Intro ICU-2022-IFIC-26	Olga Mena Olga.Mena@ific.uv.es	Getting the most from neutrinos and gravitational waves from Core Collapse Supernovae	We aim to explore the correlated signal of neutrinos and gravitational waves from a future Supernovae explosion to infer the bounce time exploiting a number of possible detectors, such as Icecube, Hyper Kamiokande and DUNE.	FT

JAE Intro ICU-2022-IFIC-27	Armando Pérez Armando.Perez@ific.uv.es	Noisy quantum walks (QWs) at the era of NISQ (Noisy Intermediate Scale Quantum) devices	QWs are discretizations of the Dirac equation, implementable with quantum technologies. Currently, only NISQ computers are available, so we ought to study the effect of noise on QWs. While several results are known, our specific purpose is to study the continuum-limit descriptions of such noisy models, which are still incomplete.	FT
JAE Intro ICU-2022-IFIC-28	Sergio Pastor Sergio.Pastor@ific.uv.es	Non-standard neutrino physics in the early Universe	The implications for cosmology of non-standard neutrino physics, such as oscillations or new interactions, will be explored, including a calculation of the evolution of neutrinos in the stages before primordial nucleosynthesis and the potential bounds from observational data.	FT
JAE Intro ICU-2022-IFIC-29	Víctor Martín victor.martin@ific.uv.es	On the quest of the $Z'$ boson	The candidate will study the $Z'$ boson phenomenology from models of intersecting D6-brane of type IIA string theory. For that purpose the candidate will make use of the $Z'$ -explorer tool. The candidate will be part of the $Z'$ -explorer team and will develop it to include Dark Matter constraints.	FT