Cód. Plan de formación Investigador	Investigador/a responsable	Proyecto	Descripción	Modalidad
Intro UV-IFIC-2023-01	Salvador Martí García	From H to Z	The 4lepton (with electrons or muons) final state channel produces a very clean signal and allows to study the Higgs coupling to muons.	FNPE
Intro UV-IFIC-2023-02	Martín González-Alonso	New Physics searches with precision measurements	Precision measurements are sensitive to new interactions and particles. They can involve nuclear decays, neutrino detection, collider physics, etc. We will study how to analyse these experiments using Effective Field Theory methods, and to produce novel results.	FT
Intro UV-IFIC-2023-03	Fernando Hueso-González	Fast 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
Intro UV-IFIC-2023-04	Sergio Pastor Carpi	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

Intro UV-IFIC-2023-05	Martin Hirsch	Long-lived particles and neutrino masses	Recent experimental progress has triggered also interest from theory into reconsidering heavy neutral leptons (HNLs) as long-lived particles. HNLs appear in seesaw models of neutrino masses and the connection between possible collider phenomenology and neutrino data, as observed in oscillations will be explored.	FT
Intro UV-IFIC-2023-06	Francisco Torrentí Salom	Quantum field theory in the early universe	The candidate will learn and apply quantum field theory techniques to the study of particle production during inflation and reheating in different models of interest. We will use both analytical and computational techniques.	FT
Intro UV-IFIC-2023-07	Francisco Salesa Greus	Detection of high-energy neutrinos in coincidence with Galactic gamma-ray sources	Multi-messenger astronomy has made recent breakthroughs with the detection of cosmic neutrinos, including the first evidence of emission from the Galactic plane. It is proposed to advance in this type of searches, combining electromagnetic information with data from the ANTARES and KM3NeT neutrino telescopes.	FNPE
Intro UV-IFIC-2023-08	Agustín Sánchez Losa	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

Intro UV-IFIC-2023-09	José Francisco Zurita	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, studying the complementarity between this channel, missing energy searches at the LHC, direct detection and indirect detection. The use of Machine Learning techniques to improve the sensitivity is envisioned.	FT
Intro UV-IFIC-2023-10	José Alfonso Soto	Photon-detector development for the Deep Underground Neutrino Experiment	An ARAPUCA is a novel device created in the framework of the Deep Underground Neutrino Experiment to detect VUV photons in liquid argon. The candidate will participate in the construction and optimization of an ARAPUCA. He/she will perform optical measurements in the laboratory, using gas argon and cryogenic liquids, comparing data with simulations.	FNPE
Intro UV-IFIC-2023-11	Sara Rebecca Gozzini	Profiling dark matter features for neutrino telescopes	The KM3NeT neutrino telescope can be used as a dark-matter detector. Different phenomenological models predict a dark matter particle and a specific strategy is used to delineate the search for each signal. This project aims in particular at exploiting the energy reconstruction power of KM3NeT to identify neutrino events from dark matter pair-annihilation.	FNPE

Intro UV-IFIC-2023-12	Ana Isabel Morales López	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. The techniques to be applied will exploit, among others, novel AI clustering algorithms.	FNPE
Intro UV-IFIC-2023-13	Gabriela Barenboim	Cosmology of an open system	The project is to analyze the accelerated expansion of the Universe in the framework of an open quantum system. Derive the corresponding markovian master equations and solve them, getting the irreversible evolution of the system.	FT
Intro UV-IFIC-2023-14	Adrián del Río Vega	Quantum fields and gravitation	We will apply techniques from Quantum Field Theory in Curved Spacetime to study the excitation of quantum fluctuations in the early universe and around the horizon of black holes, and evaluate their impact in the anisotropies of the CMB as well as in gravitational-wave detections.	FT
Intro UV-IFIC-2023-15	Ana Ros García	Improving spatial resolution of TBP (Total-Body PET) scanners	TBP scanners are now a reality in imaging diagnosis in nuclear medicine. The main drawback is its poor spatial resolution. Using an additional probe when measuring with TBP scanners improves the spatial resolution in areas of interest. The optimisation of a prototype of a functioning probe is the goal of the present call.	AFNP

Intro UV-IFIC-2023-16	Juan Zúñiga Román	Search for non-standard neutrino interactions with KM3NeT/ORCA	The KM3NeT/ORCA underwater neutrino detector has started to take data with almost 20 detection lines deployed. This project will consist on using this data to explore the existence of non-standard interactions (NSI) from the measurement of the oscillation of atmospheric neutrinos.	FNPE
Intro UV-IFIC-2023-17	Laura Molina Bueno	New Physics searches with NA64 experiment at CERN	NA64 is a fixed-target experiment looking for New Physics in missing energy events at CERN. Exploiting high-energy electrons/muons and a unique search technique, NA64 sets leading exclusion limits in the Light Dark Matter parameter space. This work will focus on the analysis of the new 2023 data.	FNPE
Intro UV-IFIC-2023-18	Andrea Donini	Dark Matter in Extra-Dimensions	The Standard Model satisfactorily explains most of high-energy physics data, but for a few open problems: the Nature of Dark Matter is one of them. Embedding the SM into more than 3+1 dimensions is an interesting option to address this problem, as its potential in explaining the observed DM abundance has been recently studied.	FT
Intro UV-IFIC-2023-19	Jorge Portolés Ibáñez	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

Intro UV-IFIC-2023-20	Adrián Irles	Higgs Physics at future colliders	Since the observation of the Higgs particle at LHC, precise measurement of its properties has become essential for the confirmation of its SM or BSM nature. The student will study the potential of future colliders for such measurements using machine learning techniques.	FNPE
Intro UV-IFIC-2023-21	Arantxa Ruiz Martínez	Machine learning for Higgs boson pair production searches in ATLAS	This project will be devoted to machine learning developments to improve the sensitivity of the search for diHiggs production in the ATLAS experiment at the LHC, crucial analysis for understanding the Higgs boson self-coupling.	FNPE
Intro UV-IFIC-2023-22	Marcos Martínez Roig	Proton Range and Imaging DEvice for protontherapy (PRIDE)	The candidate will work on the characterization of a radiation detector, based on scintillation crystals and semiconductors, to be used in protons-therapy facilities to verify the treatment. He/She will analyse the data measured in laboratories with accelerated proton beams and will develop Monte Carlo simulations that will be compared with these data.	AFNP
Intro UV-IFIC-2023-23	Luiz Silva	Looking for new physics in the flavour sector	Impressive progress in low-energy precision experiments is taking place due to the appearance of new facilities and techniques. This project provides theoretical foundations needed to support these experimental breakthroughs, in particular, by giving a more rigorous description of lepton flavour violation phenomena.	FT

Intro UV-IFIC-2023-24	Nuria Fuster Martínez	Radio-frequency and radiation studies of a high-gradient accelerating cavity for compact linear particle accelerators for medical applications	In this work we propose to study the non-linear electromagnetic phenomena intensified in high-gradient conditions in a high-gradient accelerating cavity designed for compact linear particle accelerators for medical applications. These studies will be performed by means of measurements in the IFIC high-power laboratory and simulations.	AFNP
Intro UV-IFIC-2023-25	Manuel Gessner	Unveiling multipartite entanglement in qubit systems from quantum fluctuations	We will explore the entanglement structure in many-qubit systems using angular momentum fluctuations. By deriving limits on these fluctuations from the uncertainty principle we will identify the size and number of entangled subgroups and use it to characterize quantum technology devices.	FT
Intro UV-IFIC-2023-26	Luca Fiorini	Higgs boson measurements with LHC data using Artificial Intelligence	The LHC is colliding protons at an unprecedented energy. The Higgs boson is related to many of the aspects to be clarified in the Universe. Data from the ATLAS experiment will be used to measure the properties of the Higgs boson in search of signals for new physics beyond the standard model. The project will rely on Artificial Intelligence methods.	FNPE

Intro UV-IFIC-2023-27	Sonja Orrigo	Beta-decay spectroscopy of exotic nuclei	Exotic nuclei produced in the laboratory decay by emitting particles and gamma rays. The student will analyze data of the beta-decay experiments performed by our international collaboration at GANIL (France) and RIKEN (Japan) to extract valuable information on nuclear structure and decay properties.	FNPE
Intro UV-IFIC-2023-28	Sonja Orrigo	TAS beta-decay studies of odd Hg isotopes	The student will analyze data from the IS707 experiment done at ISOLDE-CERN with the Total Absorption Spectrometer (TAS) Lucrecia. The goal is to extract the beta-strength distribution for odd Hg isotopes/isomers which, compared to QRPA calculations, allows to determine the shape of the parent states.	FNPE
Intro UV-IFIC-2023-29	Andrej Saibel	Study of the mass of the heaviest known elementary particle, the top quark, with the ATLAS detector at the LHC/CERN	Being the heaviest known particle, the top quark has a unique interaction with the Higgs boson. Due to this interaction, the mass of the top quark has implications on the stability of the electroweak vacuum and the consistency of established theories. At the same time, the reconstruction of the top quark is difficult. Therefore, methods based on artificial intelligence and neural networks must be applied to measure the mass accurately.	FNPE