



Announcement n. 29216

POST-DOCTORAL FELLOWSHIPS IN THEORETICAL PHYSICS

In accordance with Resolution no. 17938 of September 30th, 2026

the 2027/2028 INFN Fellowship Program offers **16 (sixteen) positions** for research activity in Theoretical Physics.

Eligible candidates may be:

- Non-Italian citizens with a Ph.D. degree (or equivalent qualification) obtained from a foreign institution,
- or
- Italian citizens who, at the time of the application, hold a position in a foreign institution and have been continuously abroad for at least three years.

The Fellowship cannot be awarded to those who have already benefited from the INFN Fellowship for a total duration of twenty-four months.

Those who have already received a Post-Doctoral Fellowship or a fixed-term contract ("contratto a tempo determinato") with the INFN cannot participate in the call.

Applicants must have a Ph.D. degree (or an equivalent qualification), obtained no more than eight years prior to the call deadline, *i.e.* on or after **November 12th, 2018**. This time limit may be extended in case of:

- Maternity (18 months for each child born before or after the Ph.D. award, up to a maximum of 4.5 years);
- Paternity (effective time of leave taken for each child born before or after the Ph.D. award, up to a maximum of 4.5 years);
- National Service (effective time of leave taken after the Ph.D. award);
- Long-term illness, *i.e.* over 90 days, (effective time of leave taken for each incident occurred after the Ph.D. award).

The total elapsed time since the award of the PhD should not in any case surpass twelve years and six months. The reasons for an extension of the time limit must be duly documented only in case of a successful application. Failure in providing the appropriate documentation will result in the ineligibility for the appointment.

Candidates who are preparing their doctoral thesis are eligible to apply; however they must have obtained their Ph.D. degree **by November 1st, 2027 or in any case before** taking up their appointment with INFN.

The research topics of the **16** fellowships and the corresponding INFN sites are listed in Annex 1.

Each candidate may apply up to a maximum of two fellowships.

The annual gross salary is 36.000,00 €. Each fellowship is granted for two years. Travel tickets to and from INFN sites will be reimbursed at the beginning and at the end of the fellowship; also lunch tickets will be provided for working days.



Applications, in electronic form, must be submitted to INFN not later than **November 12th, 2026 (11:59 p.m. CET)** through the website <https://reclutamento.dsi.infn.it>. In the application the candidates must specify the date of their Ph.D., the foreign institution, the institution's country, the selected research topic(s) and the corresponding INFN site(s) (up to a maximum of two) among those listed in Annex 1, and must include:

- a curriculum vitae;
- a publication list;
- the names and e-mail addresses of three referees, each of them may upload a reference letter not later than **November 15th, 2026 (11:59 p.m. CET)**.

Italian applicants must also specify the foreign institution where they hold a position and must certify that they have been continuously abroad at least since **November 12th, 2023**.

Candidates will be excluded from participation in this call if they submit their application later than the deadline indicated.

Incomplete applications (lack of information or missing files) will not be considered.

The selection of the candidates will be based on:

- 1) the candidate's scientific qualities, as shown by his/her CV and his/her track record of results achieved;
- 2) quality and relevance of the submitted scientific publications to be evaluated taking into account the specific research area and the candidate's career stage;
- 3) qualification of the candidate as attested in the submitted reference letters;
- 4) matching of the candidate's scientific experience and qualifications with the research topic of the Fellowship.

For each fellowship primary consideration will be given to candidates working in the corresponding specific research topic; however candidates working in other subjects may be also considered.

At the end of the selection process, the results of the selection will be published at INFN website (Job Opportunities – Details of the announcement). Successful candidates will then receive an official communication from the INFN administration offices. The appointed fellows should start their fellowships **not later than November 1st, 2027**; however, special requests to defer the starting date can be considered.

The INFN guarantees equal work access opportunities to men and women in accordance with Law No. 125 of 10 April 1991, Legislative Decree 57/165/2001 and Articles 42 and 48 of Legislative Decree 198/2006.

This public selection procedure is funded by INFN ordinary funds.

Data Controller: National Institute of Nuclear Physics: email address: presidenza@presid.infn.it.

Data Protection Officer email address: dpo@infn.it.

In accordance with the provisions of Art. 13 of the EU Regulation 2016/679, the personal data requested will be collected and processed, also with the use of multiple IT tools, exclusively within the call and in compliance with the legal regulation for these activities. All information candidates provide will be treated confidentially to establish their eligibility and qualifications; if not provided, candidates will be excluded from the selection process. Data shall be kept just for the selection period and subsequently retained for storage purposes only.



INFN guarantees that candidates can access to their personal data concerning, as well as their rectification, deletion and limitation and the right to object to the personal data processing; it also guarantees the right to file a complaint with the Data Processing Authority regarding the processing carried out.

For other issues not covered by this announcement, reference is made to the Disciplinary of July 1st, 2025 which is an integral part of this announcement and is available on the website:

<https://jobs.dsi.infn.it>

For information please send an e-mail to ac.dru.assegni.borse@lists.infn.it

Roma, October 13th 2026

RC/ADV

ISTITUTO NAZIONALE DI FISICA NUCLEARE
II PRESIDENTE
(Prof. Antonio Zoccoli)¹

¹ Documento informatico firmato digitalmente ai sensi della legge 241/90 art. 15 c 2, del testo unico D.P.R. 28 dicembre 2000, n. 445, del D.Lgs. 7 marzo 2005, n. 82, e norme collegate, il quale sostituisce il testo cartaceo e la firma autografa

	INFN Section or Laboratory	Research Topic	Research Program
1	Bari	Astrophysical probes of novel Weakly Interacting Slim Particles (WISPs)	The project aims to investigate the production and observable signatures of weakly interacting slim particles (WISPs, such as axions, dark photons, and massive gravitons) in stars, supernovae, and neutron stars. It combines quantum field theory in high-temperature and high-density astrophysical environments, advanced stellar evolution simulations, and multi-messenger analyses (photons, γ -rays, neutrinos, and gravitational waves) to identify new observational signatures, place tighter constraints on theoretical models, and uncover potential evidence for new physics beyond the Standard Model
2	Bologna	String theory in the sky: cosmology, gravitational waves and axions	This research program is focused on string cosmology, in particular on signatures of string theory in current observations. The areas under study will be early and late time cosmology, gravitational wave signals and axion physics. Each of them are promising to test string theory since they involve typical features of string compactifications like rolling moduli fields, de Sitter and quintessence models, cosmic superstring networks, primordial black holes, gravitational reheating and axion-like particles. The program will exploit modern computational techniques based on Machine Learning
3	Bologna	Next-Generation Quantum Observables for Precision Collider Physics and Indirect Searches for New Physics	The project aims to develop a new generation of observables for collider physics by combining high-precision theoretical predictions, tools inspired by quantum information (tomography, density matrices, entanglement etc.), and effective descriptions of fundamental interactions within the SMEFT and HEFT frameworks. Its objective is to enhance sensitivity to possible deviations from the Standard Model through innovative analysis strategies for the LHC and future colliders, integrating methodological advances, state-of-the-art perturbative calculations, and phenomenological studies
4	Cagliari	Phenomenological applications of noncommutative geometry in quantum gravity	The research program will focus on the study of noncommutative (NC) quantum field theory in kappa-Minkowski and Snyder spacetimes, with particular attention to potentially observable consequences related to deformed relativistic symmetries. A specific topic will be the interrelations between NC geometry and spacetime curvature in models of Yang type and their formulation as a (local) gauge-invariant theory of NC gravity. Another objective will be the study of possible effects of violation/deformation of CPT symmetries in scenarios where relativistic symmetries are modified at the Planck scale

5	Firenze	Exploring the Dark Universe: Phase Transitions, Gravitational Waves, and Physics Beyond Λ CDM	The new researcher will be involved in the cosmology and astroparticle physics projects currently pursued by the scientific supervisor and their collaborators. The first research direction will focus on first-order cosmological phase transitions and the precision calculation of the spectra of the particles produced, with applications to gravitational-wave physics and dark matter production mechanisms. The second research direction will investigate the cosmological implications of dark matter and dark energy models beyond the ΛCDM paradigm. This activity will field theory and their comparison with current and forthcoming experimental and observational data. The proposed activities consist of clearly defined projects with concrete objectives that can be achieved within the two-year duration of the fellowship. Recruiting a new researcher will enable the full development of these research directions and the achievement of the expected scientific results. The researcher will collaborate closely with several members of the Florence research unit, investigating a range of cutting-edge topics in physics beyond the Standard Model
6	Genova	Exploring Dark Energy Dynamics with Large-Scale Structure Data	The project will investigate the dynamics of dark energy by combining clustering, weak-lensing, BAO, supernova, and CMB data from DES, DESI, and Euclid. The goal is to determine whether current indications of deviations from ΛCDM reflect new physics or instead arise from systematic effects and modelling uncertainties. Models of dark energy and modified gravity will be analysed, with particular attention to testing the robustness of BAO measurements. Machine-learning techniques, including normalizing flows, will be used to accelerate the exploration of complex parameter spaces and to construct consistency tests across cosmological datasets
7	Genova	New Exotic states of hadrons	The project aims at investigating the dynamics of the strong interaction in the non-perturbative regime of QCD through the spectroscopy of exotic hadronic states. The research activity will focus on the development of innovative theoretical frameworks for tetraquarks and multiquark configurations, with particular emphasis on the newly observed all-charm tetraquark family at CERN. The program will provide quantitative predictions for masses, decay properties and production mechanisms, enabling direct comparisons with current and future data from LHCb, ATLAS and CMS, and advancing our understanding of hadron structure beyond the conventional quark model

8	National Laboratories of Gran Sasso	Implications for Fundamental Physics from LISA Observations: Source Modelling, Population Analyses, and Systematic Effects	The Laser Interferometer Space Antenna (LISA), recently adopted by ESA for launch in the mid-2030s, will observe extreme- and intermediate-mass-ratio inspirals (E/IMRIs), offering unique opportunities to probe astrophysical environments and test gravity in the strong-field regime. This project will develop self-force-based waveform models for these systems that include the effects of dark matter, accretion disks, and new fields beyond General Relativity, and devise population-based data-analysis strategies to isolate these signatures, quantify their interplay, and assess their detectability
9	Milano	Advancing Charge Exchange Response of Atomic Nuclei and Double Beta Decay within QCD-rooted approaches	Microscopic response functions are key to interpreting radioactive nuclei data. Single/double-charge exchange links to electroweak interactions and double-beta decay, but this connection has not been fully exploited yet in ab initio, QCD-rooted, approaches. The postdoc will advance a novel theory combining Algebraic Diagrammatic Construction (ADC) with particle-vibration effects, surpassing mean-field approximations. Implemented in ab initio/DFT, this directly impacts current research by INFN experimental groups engaged in nuclear spectroscopy and neutrino studies, while establishing a path toward a novel approach for 0vBB matrix elements in key nuclei (76Ge, 82Se, 100Mo)
10	Milano Bicocca	Gravitational Path Integrals, Quantum Gravity and Holography	The research program will focus on gravitational path integrals and their role in quantum gravity and holography. Topics will include semiclassical and supersymmetric gravitational saddles, black holes, quantum corrections, and the relation between bulk observables and quantum field theory. Particular emphasis will be placed on exact and non-perturbative methods, localization, dualities, and the interplay between geometry and quantum field theory
11	Milano Bicocca - INFN Parma Unit	Exact holography and complexity in Quantum Gravity	The project will investigate DSSYK model and low-dimensional dilaton gravities as controlled laboratories for quantum holography, with quantum complexity providing a powerful probe of their dynamics and emergent geometry. Building on recent results in these models, we will develop exact and non-perturbative methods to study holographic dictionaries, fi-nite- N effects and quantum evolution beyond the semiclassical regime, and explore universal structures connecting black-hole dynamics, critical phenomena and cosmological spacetimes

12	Napoli	Neutrino physics and heavy-flavour phenomenology as probe of new physics	New physics around few TeV scale can be studied and probed in the leptonic as well as in the strong sectors. In particular, for the leptonic sector, we will focus on the analysis of neutrino fluxes at next-generation accelerators, such as HyperKamiokande and JUNO. Special attention will be paid to the possibility of non-standard neutrino-matter interactions and leptonic flavor violation in the cores of supernovae. Moreover motivated by the recent indication of the diffuse supernova neutrino background, we investigate its potential as a probe of physics beyond the Standard Model. On the other side we plan to study the hadronic dynamics in heavy-meson decays, with particular emphasis on rare semileptonic B-meson decays and CP violation in the charm sector, for precision tests of the Standard Model and searches for new physics
13	Pavia	Precision calculations for quantum tests of the SM and new physics searches	The activity involves phenomenology for precision physics at current and future accelerators. The research will focus on processes for determining the hadronic correction to the muon $g-2$, precision determination of the luminosity of future leptonic accelerators, and Drell-Yan processes in hadronic collisions to measure the electroweak mixing angle and the W mass. It includes developing perturbative calculations, resummation of the dominant radiative corrections, and integrating them into Monte Carlo event generators used by experiments
14	Perugia	Accelerating Monte Carlo simulations through generative neural networks and quantum computers	While generative neural networks have recently demonstrated remarkable efficiency in boosting Monte Carlo simulations of complex systems, open challenges remain in rugged energy landscapes due to mode collapse. Quantum devices, e.g., D-Wave quantum annealers, give access to training data beyond the reach of classical computers. This project explores the combined use of deep learning and quantum computers to boost the simulation of classical and quantum spin glasses. This endeavor is synergic with the INFN quantum computing initiatives and valorizes HPC CINECA-INFN and EuroHPC agreements

15	Trieste	Soliton gas and rogue waves	The concept of soliton gas was introduced by V. Zakharov to describe a chaotic state of strongly nonlinear waves where the dynamic is dominated by a large number of interacting structures known as solitons. The goal of this proposal is to construct models of a soliton gas that describe the formation of rogue waves in nonlinear media. Rogue waves are statistical extreme events that emerge through the constructive interference and nonlinear focusing of Fourier modes. However these events are extremely unlikely and unpredictable. The goal of this program is to construct models of soliton gas that permit to derive a large deviation principle for the formation of rogue waves
16	Trieste	Quantum Simulation and Spectral Diagnostics of Non-Integrable Quantum Field Theories	The project will develop a quantitative continuum-to-simulator framework for non-integrable low-dimensional quantum field theories, combining Hamiltonian truncation and tensor-network methods. Using sine-Gordon, Ising/tricritical Ising and multicritical Yang-Lee theories, it will investigate RG flows, confinement, unstable particles and resonances, quantum-chaotic spectra, and false-vacuum decay. The programme will connect non-perturbative continuum predictions to experimentally accessible observables in Josephson-circuit quantum simulators