Istituto Nazionale di Fisica Nucleare
SEZIONE DI ROMA TOR VERGATA

Preventivi 2026

Gruppo IV

Iniziative Specifiche

- FTE Becchi:

- FIELDTURB: Sistemi complessi, turbolenza
  Massimo Cencini, ricercatori: 24, FTEb: 17.0
  TO(10), BA(8), LE(6+1), GE(4)

- STEFI: Teoria di stringa, gauge e gravità
  Raffaele Savelli, ricercatori: 18, FTEb: 12.25
  TS(27), TO(17), NA(15), PD(9), BO(8), CT(1)

- Time2quest: Struttura della materia
  Gianluca Stefanucci, ricercatori: 8, FTEb: 6.0
  CS(11+1), MI(8)

- BIOPHYS: Biofisica
  Velia Minicozzi, ricercatori: 8, FTEb: 5.0
  TIFP(20), NA(13), TO(12), BA(4+2), MI(4), PI(4), SA(3)

- INDARK: Cosmologia
  Marina Migliaccio, ricercatori: 9, FTEb: 4.9
  TS(28), PD(18), BO(17), FE(10+1), TO(9), PR(7), GE(6), LNGS(4), MI(4)

- LQCD123: Teorie di gauge su reticolo
  Nazario Tantalo, ricercatori: 7, FTEb: 4.25
  RM3(7)

- ENP: Fisica standard model e beyond
  Alberto Salvio, ricercatori: 5, FTEb: 2.50
  RM1(13), PG(5), LNF(4), NA(3)

- QCDLAT: QCD sul reticolo
  Giulia Maria de Divitiis, ricercatori: 4, FTEb: 1.75
  MIB(13), PR(6+1)

Evento @ Roma ToV

organizzato da LQCD123 e ENP

Muon g-2 or stress-testing the SM

legacy & implications of the FNAL g-2 experiment and theory progress

Martedì 14 ottobre 2025, 10:00 - 15:00

@ Aula Magna Gismondi

FieldTurb

Particles and Fields in Turbulence and in Complex Fluids

Responsabile locale: Massimo Cencini (CNR)
Responsabile nazionale: Giuseppe Gonnella (Bari)

1. Bellantoni Elisa PhD (100%)
2. Benzi Roberto PO-retired (0%)
3. Biferale Luca PO (100%)
4. Bonaccorso Fabio TECH (100%)
5. Buzzicotti Michele RTDB (100%)
6. Carbone Maurizio AdR-CNR (50%)
7. Cencini Massimo Ric-CNR (50%)
8. Cimini Giulio PA (100%)
9. Cirulli Daniele PhD (100%)
10. Cocciaglia Niccolò AdR (100%)
11. Fossella Francesco PhD (100%)
12. Guglietta Fabio RTDA (100%)
13. Li Tianyi AdR (100%)
14. Mancini Anna AdR (100%)
15. Marra Rossana PO-retired (0%)
16. Marreiros de Freitas Andres PhD (100%)
17. Piro Lorenzo AdR (100%)
18. Puglisi Andrea DR-CNR (50%)
19. Sbragaglia Mauro PO (100%)
20. Scagliarini Andrea Ric-CNR (50%)
21. Scarpolini Martino AdR-GSSI (100%)
22. Simeoni Daniele AdR (100%)
23. Tiribocchi Adriano Ric-CNR (50%)
24. Tommasi Samuele PhD-TOV (100%)

Ricercatori: **24** FTEb: **17.0**

Richiesta: **34.0 KE**

A) Complex fluids and complex flows:

- Statistical and Dynamical properties of hydrodynamic fields
- Artificial Intelligence and Machine Learning applications to data assimilation, generation and augmentation for hydrodynamic fields
- Control and navigation (olfactory search) in turbulent environments
- Hemodynamics with applications to heart circulation
- Multiphase-flows and emulsions: study of dynamical and statistical properties and development of numerical methods

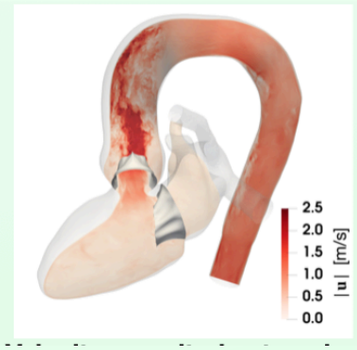
B) Turbulence in quantum fluids and and complex plasma flows:

- Development of relativistic Lattice Boltzmann methods for the simulation of collisionless plasma dynamics with applications to plasma acceleration physics.

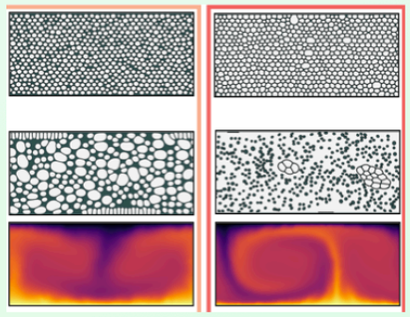
C) Active and non equilibrium systems

- Non-equilibrium statistical mechanics of active matter
- Models of self-propelled particles in fluid flows

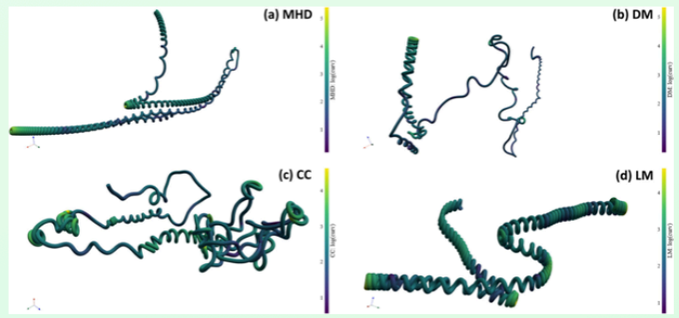
Highlights of 2025 (20 published or pre-prints)



Velocity magnitude at peak systole
arxiv:2505.22687



Dynamical regimes in thermally convective emulsions
Phys. Rev. E



Generation of Cosmic Ray trajectories by Diffusion models trained on 3D-MHD
The Astron. J.

STEFI

Strings & Fundamental Interactions

Responsabile locale: Raffaele Savelli
Responsabile nazionale: Marialuisa Frau (Torino)

Anagrafica:

1. Mohammad Akhond, AdR (100%)
2. Valentina Bevilacqua, PhD (100%)
3. Massimo Bianchi, PO (100%)
4. Andrea Cipriani, PhD (100%)
5. Carlo Di Benedetto, PhD (100%)
6. Giuseppe Dibitetto, PA (100%)
7. Francesco Fucito, ex-DdR INFN, ass. senior (0%)
8. Alfredo Grillo, Ric. Altro Ente (50%)
9. Lorenzo Grimaldi, PhD (100%)
10. Carlo Iazeolla, PA, Università G. Marconi (100%)
11. Daniele Mauri, PhD (100%)
12. Francisco Morales, DdR INFN (100%)
13. Gianfranco Pradisi, PA (100%)
14. Fabio Riccioni, PR INFN-Sapienza (50%)
15. Alejandro Ruipérez, AdR (100%)
16. Alberto Salvio, PA (25%)
17. Raffaele Savelli, PA (100%)
18. Giuseppe Sudano, PhD (100%)

Ricercatori: **18** FTEb: **12.25**

Richiesta: **27.0 KE**

Attività scientifica:

- Study of correlation functions in various regimes, for N=2 supersymmetric field theories in four dimensions, including non-Lagrangian strongly-coupled systems.
- Investigation of fuzzball phenomenology through the connection between black holes and N=2 Super-Yang-Mills theories. Study of the gravitational wave response of black holes and fuzzballs, their spectrum of QNMs, the multipolar structure and echo signals.
- Study of string geometries to engineer and classify superconformal field theories with eight and four supercharges.
- Study of string theory at low energy: Flux compactification, string corrections to effective actions in diverse dimensions, connections to the Swampland program.
- Study of metric-affine theories of gravity with dynamical torsion: Examination of inflationary scenarios, their embedding in string theory, and their predictions on reheating, leptogenesis, and dark matter.
- Computation of loop amplitudes involving highly excited string states and analysis of their chaotic behavior.
- Study of higher-spin gravity and holographic dual thereof.
- Study of astrophysical and cosmological applications of thermal field theory.
- Implementation of hamiltonian neural networks for the study of trajectories of particles moving in gravitational backgrounds.

TIME2QUEST

Advanced Theoretical methods for emerging 2D materials in Quantum Information Technology Studies

Responsabile locale: Gianluca Stefanucci
Responsabile nazionale: Antonello Sindona (Cosenza)

1. Carlos Bentancur, PhD (100%)
2. Domenico Corona, PhD (100%)
3. Alessandro Moreci, PhD (100%)
4. Alessia Muroni, PhD (100%)
5. Maurizia Palummo, PA (100%)
6. Enrico Perfetto, PA (100%)
7. Olivia Pulci, PO (100%)
8. Gianluca Stefanucci, PA (100%)

Ricercatori: **8** FTEb: **6.0**

Richiesta: **12.0 KE**

Attività scientifica:

- No optical gain in a novel excitonic Mott transition (collaboration with Politecnico di Milano)
- Engineering optical properties with coherent phonons (collaboration with Politecnico di Milano)
- Exciton phases at high densities (collaboration with Okinawa Institute of Science and Technology)
- Microscopic description of exciton formation (collaboration with Okinawa Institute of Science and Technology)
- Topological phases and exceptional points in correlated dissipative systems (collaboration with University Santa Barbara)
- First principles theory of anharmonic phonons

Biophys

Protein interactions: multi-level computational approaches

Responsabile locale: Velia Minicozzi
Responsabile nazionale: Sebastiano Stramaglia (Bari)

1. Stefania Alleva, PhD (100%)
2. Francesco Barbero, PhD (100%)
3. Emiliano De Santis, AdR (100%)
4. Giovanni La Penna, CNR (50%)
5. Velia Minicozzi, PA (100%)
6. Silvia Morante, ass. senior (0%)
7. Marco Sette, Ric. Chimica ToV (50%)
8. Francesco Stellato, PA (100%)

Ricercatori: **8** FTEb: **5.0**

Richiesta: **10.0 KE**

Research objectives

- Study of biomolecular structure and dynamics via classical and *ab initio* MD
- Use of HPC for enhanced statistical sampling
- Integration with data from synchrotron, FEL, IR, EPR

Key Applications in 2024

- **SARS-CoV-2 Spike Protein**: IR + modeling for biosensor design *(Mancini et al., Adv Sci 2024)*
- **Hydrogenases**: Computational discovery for green H_2 production *(Botticelli et al., Int J Mol Sci 2024)*
- **Statistical MD Tools**: Multi-trajectory methods via HPC *(La Penna et al., Molecules 2024)*
- **Copper Detox (Bacteria)**: X-ray + computation on bufferin proteins *(Leprevost et al., PNAS 2024)*
- **Anticancer Copper Agents**: Cu-phenanthroline ROS generators *(Falcone et al., Ang Chem Int Ed 2024)*

INDARK

Inflation, Dark Matter and the Large-Scale Structure of the Universe

Responsabile locale: Marina Migliaccio
Responsabile nazionale: Massimiliano Lattanzi (Ferrara)

1. Giampaolo Benevento, AdR (100%)
2. Hervé Bourdin, PA (50%)
3. Federico De Luca, AdR (100%)
4. Arianna Favale, PhD (100%)
5. Guglielmo Frittoli, PhD (100%)
6. Pasquale Mazzotta, PO (50%)
7. Marina Migliaccio, PO (50%)
8. Matteo Peronaci, PhD (80%)
9. Nicola Vittorio, Docente D'Onore (0%)

Ricercatori: **9** FTEb: **4.9**
Richiesta: **10.0 KE**

The InDark project aims to investigate crucial aspects of the standard cosmological model and its extensions, together with their connection with particle physics.

Prodotti @Roma2 RU mid 2024/2025:

Papers: > 15
Theses: 2 Master, 1 Bachelor
Talks: > 20

Late-time Cosmology.

a. Constrain models of **Dark Energy** and **Modified Gravity** with current cosmological datasets and derive forecasts for the combination of future observations of the Cosmic Microwave Background (LiteBIRD, Simons Observatory, CMB-S4) and the large-scale structure of the Universe (especially from the Euclid galaxy survey).
b. Explore the origin of the **Hubble constant tension** following complementary approaches: 1) assess the impact of data analysis methodological choices and approximations, also performing model-independent tests of data consistency; 2) explore extensions to the standard cosmological model; 3) adopt novel observables to estimate the universe expansion rate, such as galaxy clusters, quasars, and gamma ray bursts.

Dark Matter. Characterize the distribution of dark matter and the growth of structures in the universe with CMB lensing and other tracers of the large-scale structure, such as galaxy counts, cosmic shear, cosmic filaments, and galaxy clusters.

Inflation and the primordial universe. Learning about inflation with future CMB B-mode polarization data: development of new statistical methods to characterize the CMB polarization field and improvement of component separation techniques to mitigate Galactic foreground emissions. Study of primordial non-Gaussianity to constrain cosmic inflation with the cross-correlation of CMB and large-scale structure data.

LQCD123

Phenomenology with Lattice QCD in Roma123

Responsabile locale: Nazario Tantalo
Responsabile nazionale: Vittorio Lubicz (Roma Tre)

1) Alfano Davide, PhD (25%)
2) Antonio Evangelista, PhD (60%)
3) Roberto Frezzotti, PO (60%)
4) Marco Guagnelli, Ric. INFN (100%)
5) Lorenzo Maio, AdR (100%)
6) Francesca Margari, PhD (50%)
7) Nazario Tantalo, PO (100%)

Ricercatori: **7** FTEb: **4.25**

Richiesta: 12**.0 KE**

Attività scientifica:

Gran parte della nostra attività è costantemente dedicata ad effettuare simulazioni numeriche di QCD e QCD+QED, all'interno delle collaborazioni internazionali ETM e RC* e utilizzando metodi innovativi da noi sviluppati, che poi ci permettono di ottenere risultati teorici allo stato dell'arte sulla fisica del sapore e sulla fenomenologia non-perturbativa degli adroni.

La nostra attività, come dimostrato dai recenti risultati che la comunità di reticolo ha ottenuto nel calcolo da principi primi dei contributi adronici al g-2 del muone, è di **cruciale importanza per la ricerca di nuova fisica sulla frontiera di precisione.**

Senza risultati teorici da principi primi su osservabili adroniche gran parte dei risultati degli esperimenti di fisica delle particelle, inclusi quelli dedicati alla ricerca diretta, è di fatto inutilizzabile: **non è possibile testare una teoria senza aver fatto predizioni partendo da essa!**

Attività svolta nel 2025:

- lattice prediction of radiative leptonic decay rates of the kaon in QCD+QED, ***Phys.Rev.D*** **111 (2025)**
- hadronic vacuum polarization (HVP) contribution of the strange and charm quarks to the muon g-2, ***Phys.Rev.D*** **111 (2025)**
- obtaining spectral densities from lattice data from a Bayesian perspective, **Eur.Phys.J.C 85 (2025)**
- non-perturbative method to extract scattering amplitudes from Euclidean correlators in infinite volume, ***JHEP*** **01 (2025) 091**
- participation to the 2nd White Paper of Muon g-2 Theory Initiative: **arXiv:2505.21476**

Attività prevista nel 2026:

- study of inclusive semileptonic decays of heavy, D(s) and B(s), mesons
- inclusive hadronic decays of the tau lepton in QCD+QED: leading isospin breaking correction
- lattice determination of the radiative decay rates $h_c \to \eta_c$, $h_b \to \eta_b \gamma$ and $\chi_{c1} \to J/\psi \gamma$
- leading order hadronic vacuum polarization (HVP) in isospin symmetric QCD (isoQCD)
- renormalization constants of quark bilinear operators and renormalized quark masses in isoQCD

Parte di questa attività è stata già svolta e i relativi lavori sono stati sottomessi a PRL e PRD e sono under review

ENP

Exploring New Physics

Responsabile locale: Alberto Salvio
Responsabile nazionale: Gennaro Corcella (Laboratori Nazionali Frascati)

1. Davide Alfano, PhD (75%)
2. Filippo Cutrona, PhD (100%)
3. Roberto Frezzotti, PO (40%)
4. Francesco Rescigno, PhD (100%)
5. Alberto Salvio, PA (75%)

Ricercatori: **5** FTEb: **2.50**

Richiesta: **6.0 KE**

Attività scientifica:

We will investigate

- a precision refinement of the SM lattice calculations for the anomalous magnetic moment and computation of the bottom quark mass from heavy meson mass input(s)
- the feasibility of non-perturbative lattice regularizations of chiral gauge theories such as the Standard Model
- new physics effects in gravity and cosmology:
  - phase transitions,
  - thermal field theory applied to the production of new particles from rotating compact objects (e.g. black holes and neutron stars),
  - higher-derivative theories and inflation.

QCDLAT

Non-perturbative QCD on the lattice: advancing the frontiers of extreme conditions and of precision physics

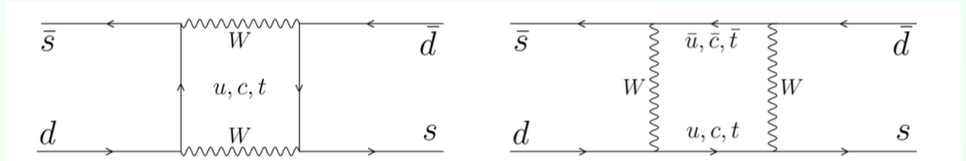
Responsabile locale: Giulia Maria de Divitiis
Responsabile nazionale: Michele Pepe (Milano Bicocca)

1) Giulia Maria de Divitiis, PA (100%)
2) Riccardo Marinelli, PhD-Sapienza (50%)
3) Mauro Lucio Papinutto, PA-Sapienza (50%)
4) Anastassios Vladikas, ex-PR INFN ass. senior (0%)

Ricercatori: **4** FTEb: **1.75**

Richiesta: **5.0 KE**

Attività scientifica:



$$\mathcal{H}_{\text{eff}} = \frac{G_F}{\sqrt{2}} \sum_i V^i_{CKM} C_i(\mu) O_i(\mu)$$

The aim of the QCDLAT project is to give high-precision theoretical predictions of QCD,
thus providing useful results for the search for potential signals of physics beyond the Standard Model.
The regularisation of the lattice allows for non-perturbative investigations from first principles using Monte Carlo simulations.
The Tor Vergata unit focuses on research concerning renormalization and non-perturbative evolution in QCD and Flavour physics in SM and beyond.
In particular, the study concerns

1) the non-perturbative renormalization and RG-running in QCD with three dynamical flavours Nf=3 of flavour non-singlet quark bilinears and DeltaF=2 four-fermion operators present in the effective weak Hamiltonian relevant for the study of neutral meson oscillations. The RG-evolution uses chirally-rotated Schrödinger-Functional (XSF) renormalization scheme and runs between a hadronic scale (~200 MeV) and an electroweak energy scale (~100 GeV) where perturbation theory can safely be applied.
   Phys.Rev.D 109 (2024) 5, 054511 e-Print: 2311.15046 (tensor bilinear)
   PoS LATTICE2023 (2024) 270, PoS LATTICE2024 (2025), 286 (four-quark operators)

2) the determination of the matrix elements of DeltaF=2 four-fermion operators on hadronic states.
   Numerical code for bare correlation functions written and tested in 2024. Production runs starting in fall 2025.

3) (by-products) the computation of coefficients for the O(a) Symanzik improvement in lattice QCD with Wilson fermions

Dotazione IV

Coordinatore: Raffaele Savelli
FTEb: **53.65**
Richiesta: **85 KE**

requests-i_infn_roma2_csn4_dotazioni-2

Capitolo	Descrizione	Parziali (K-EUR)	Parziali SJ (K-EUR)	Totale/Cap (K-EUR)	Totale/Cap SJ (K-EUR)
consumo	Cancelleria, toner, manutenzione	3.00	0.00	3	0
interno	Rimborso spese per missioni del personale	20.00	0.00	20	0
inventario	Acquisto materiale informatico e libri	20.00	0.00	20	0
inviti	Inviti di ospiti stranieri per seminari e collaborazioni scientifiche	20.00	0.00	20	0
licenze-SW	Licenze software	5.00	0.00	5	0
seminari	Organizzazione conferenze e workshop	15.00	0.00	15	0
spservizi	Catering per convegni	2.00	0.00	2	0
Totale	/	0	0	85	0