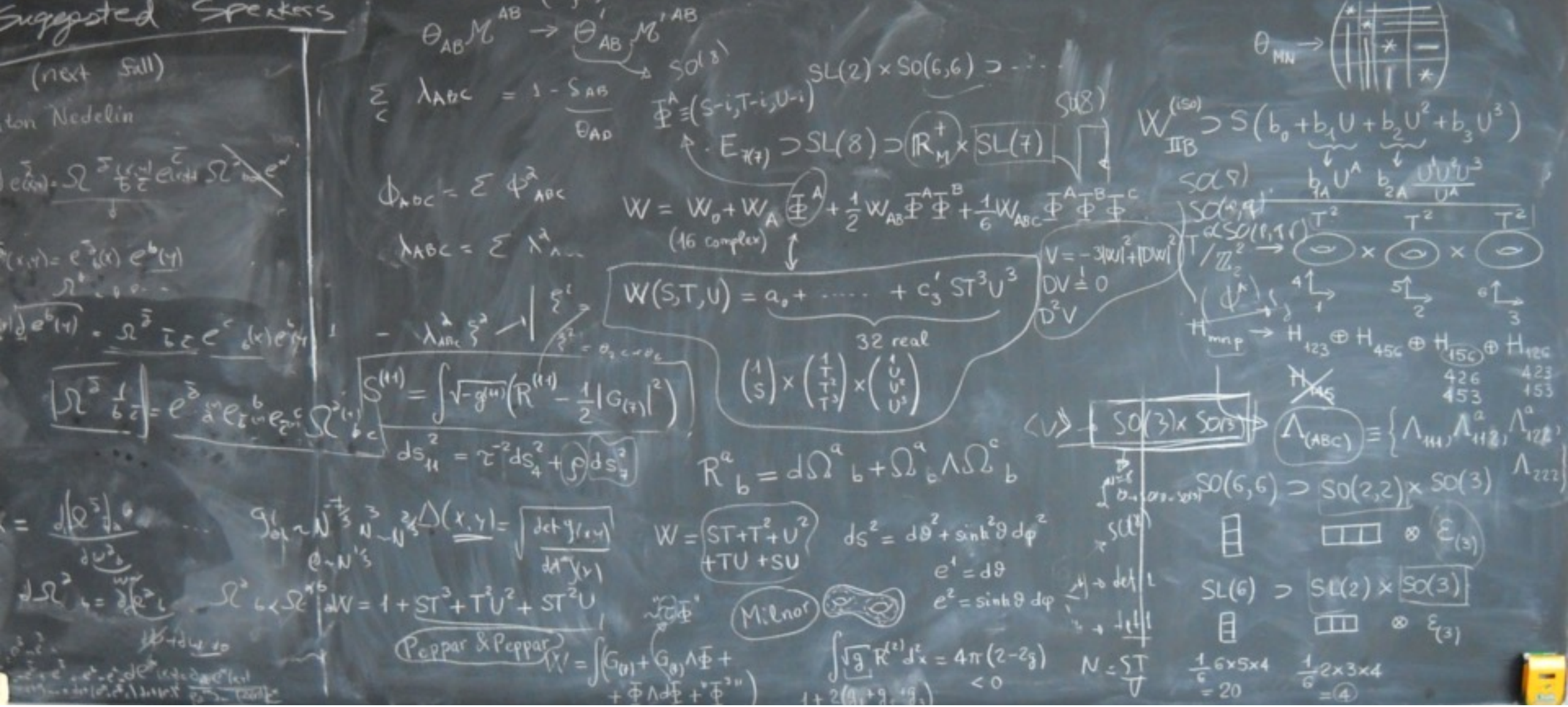
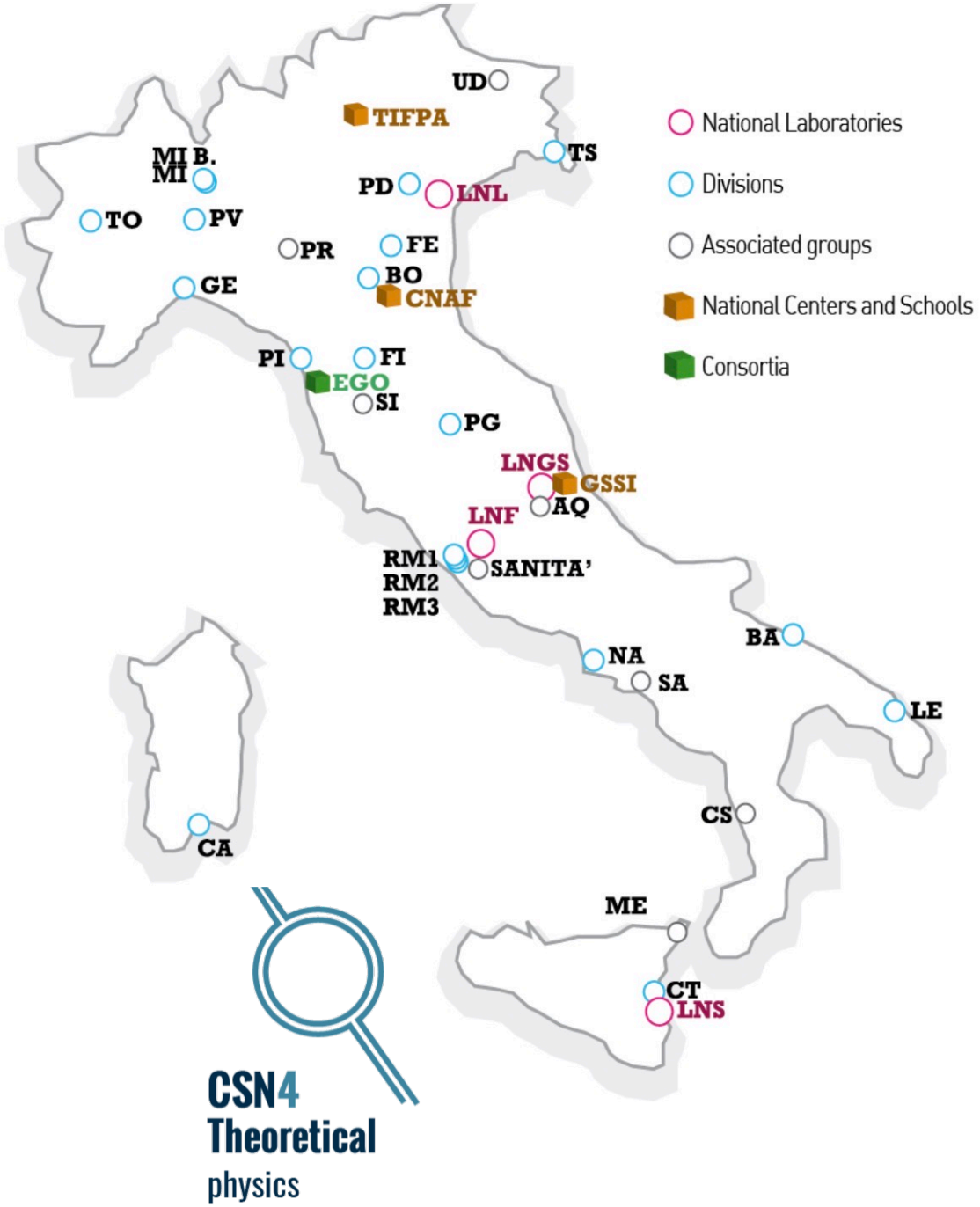


INFN - SEZIONE DI LECCE
Preventivi 2023 - Gruppo 4

Daniele Montanino

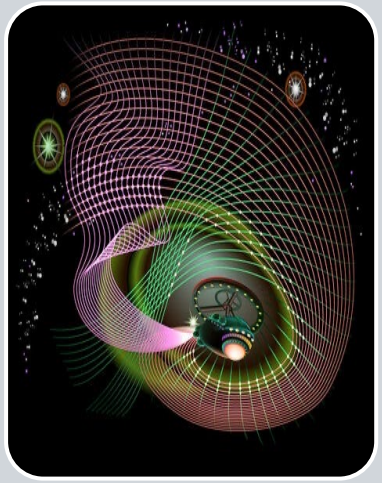
3 luglio 2024

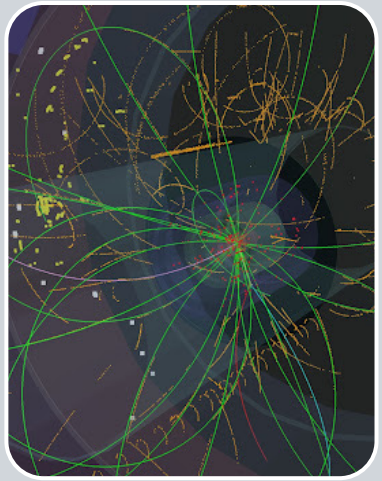


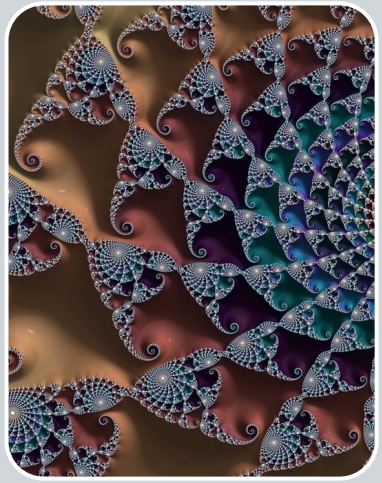
La commissione 4

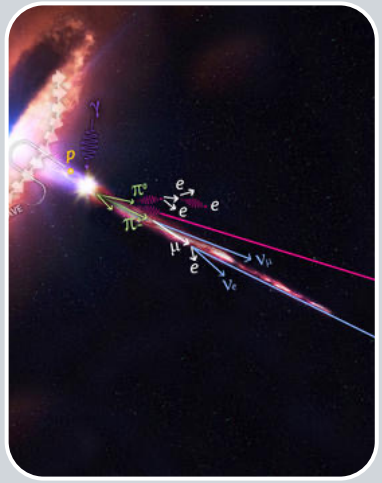
La CSN4 coordina le ricerche in fisica teorica, che sviluppano ipotesi, modelli e teorie fisiche per spiegare i risultati sperimentali già acquisiti e aprire nuovi scenari per la fisica del futuro. Gli argomenti più significativi su cui sono impegnati oggi i fisici teorici della CSN4 riguardano le indagini sull'origine della massa delle particelle elementari, la natura e le proprietà della cosiddetta materia oscura, la spiegazione dell'asimmetria esistente fra materia e antimateria nell'Universo, l'unificazione a livello quantistico di tutte le interazioni fondamentali, inclusa la gravità. Altre ricerche riguardano lo studio della natura e della struttura intrinseca dello spazio-tempo, la fisica del nucleo e delle particelle che lo costituiscono, inclusi i processi all'epoca del Big-Bang e la successiva evoluzione dell'Universo. Tali studi teorici si avvalgono, da un lato dei risultati sperimentali prodotti dagli acceleratori di particelle e dagli esperimenti di fisica astroparticellare, e dall'altro di metodi matematici e tecniche formali e numeriche.

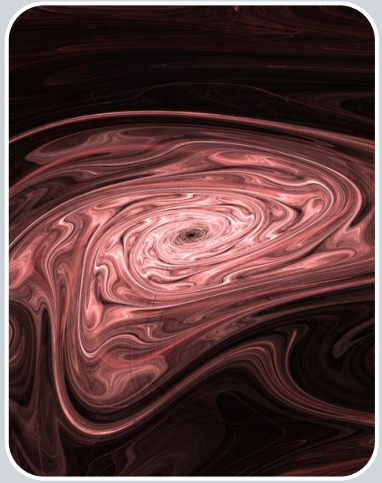
Presidente della Commissione 4: Fulvio Piccinini (PV)











Linea 1:
Teoria dei campi e stringhe

FLAG
GAGRA
GAST
GSS
NPQCD
QGSKY
SFT
ST&FI

Linea 2:
Fenomenologia

AMPLITUDES
APINE
ENP
LQCD123
PML4HEP
QCDLAT
QFT@COLLIDERS
SPIF
TPPC

Linea 3:
Fisica nucleare e adronica

MONSTRE
NNPHA
NUCSYS
SIM

Linea 4:
Fisica non lineare e modelli matematici

BELL
DYNSYSMATH
GEOSYM_QFT
MMNLP
QUANTUM

Linea 5:
Fisica astroparticellare

INDARK
NEUMATT
QUAGRAP
TASP
TEONGRAV

Linea 6:
Fisica statistica e teoria dei campi applicata

BIOPHYS
ENESMA
FIELDTURB
TIME2QUEST
LINCOLN

Attività della CSN4

- Premio Nazionale «**Sergio Fubini**» dell'INFN, per le migliori tesi di dottorato nel campo della Fisica Teorica
- Premio nazionale «**Milla Baldo Ceolin**» per la migliore tesi magistrale di fisica teorica

Alessia Stefano, vincitrice 2023 è laureata in "Nanotecnologie, Fisica della materia e Applicata" presso l'Università del Salento. Ha fatto parte del gruppo di ricerca in Ottica Quantistica, in collaborazione con l'Università di Campinas (Brasile). Nel lavoro di tesi, si è occupata di usare la Teoria delle Matrici Random per descrivere la decoerenza di un sistema quantistico. Attualmente è dottoranda presso l'Università di Pavia, dove si dedica al design di sorgenti di stati non-classici della luce tramite processi non-lineari del secondo ordine in circuiti fotonici integrati, per applicazioni in diverse tecnologie quantistiche.

The Galileo Galilei Institute For Theoretical Physics

Centro Nazionale di Studi Avanzati dell'Istituto Nazionale di Fisica Nucleare

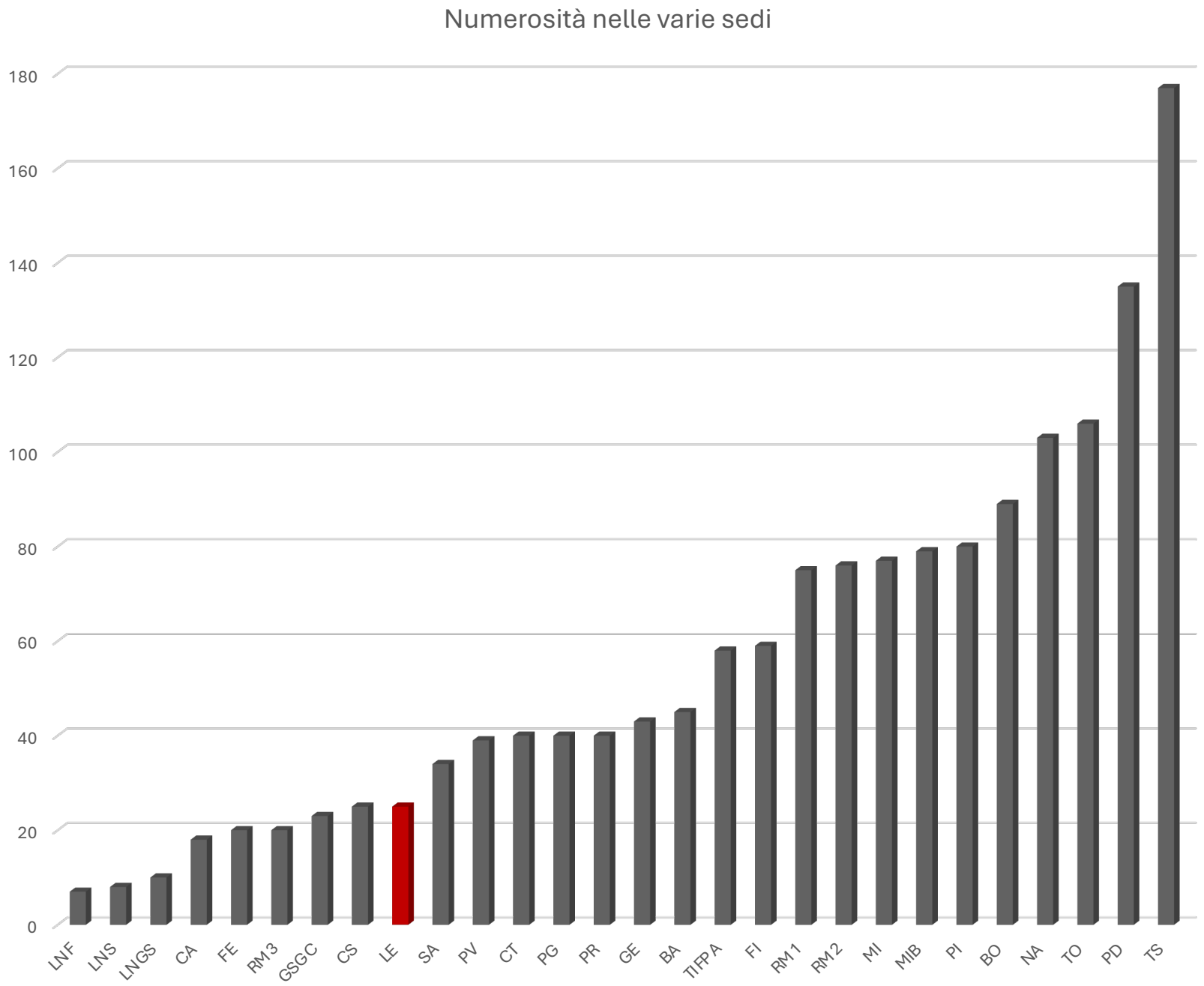
Arcetri, Firenze

- **The Galileo Galilei Institute** (GGI), founded in 2005 by the partnership between the National Institute of Nuclear Physics (INFN) and the University of Florence, has been the first European Institute dedicated to organizing and hosting long-term workshops dedicated to theoretical physics of fundamental interactions.
- In 2018 the GGI became "**Centro Nazionale di Studi Avanzati dell'Istituto Nazionale di Fisica Nucleare**" (National Center for Advanced Studies of INFN), once again in partnership with the University of Florence. The Institute thus confirmed its status as a reference point for the international scientific community and as a site dedicated to high-level training of young Italian and foreign researchers. The basic referent of the Center is the INFN National Scientific Committee for Theoretical Physics, which gives its full support to favour the activities of the Institute. Support to its initiatives is also provided by a grant of the Simons Foundation. Workshop proposals, every year, are selected by the GGI Scientific Committee.

Riunioni CSN4

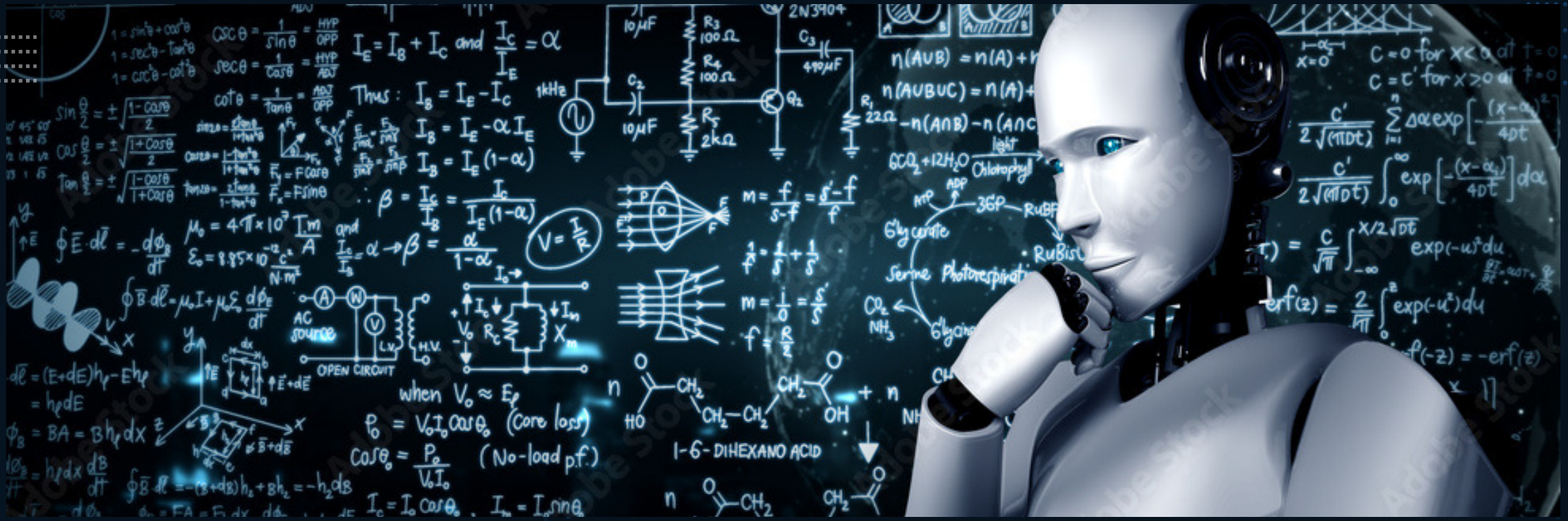
- 20-21 Aprile 2023, Aula seminari rettorato (Lecce)
- 25-26 Settembre 2023, sede presidenza INFN (Roma)
- 18-19 Aprile 2024, Hotel Regina Margherita (Cagliari)
- 26-27 Settembre 2024, sede presidenza INFN (Roma)

Il gruppo 4 @ Lecce



Il gruppo 4 @ Lecce

- Situazione al 1/7/2024
  - 1 ricercatore dipendente INFN
  - 1 assegno di ricerca INFN
  - Associati incaricati di ricerca: 1 PO, 7PA, 1RTI
  - Associati:
    - UNISALENTO: 1PO, 2PA, 1RTDA
    - Altre università: 1PO, 1PA
    - 1 PO associazione senior
    - 1 PO Associato affiliato
    - 3 ricercatori altri enti (CNR)
    - 6 dottorandi



Attività del gruppo teorico

Italiadomani
PIANO NAZIONALE
DI RIPRESA E RESILIENZA

- Il gruppo teorico è coinvolto nel progetto PNRR HPC, Big Data and Quantum Computing, spoke 2, working package 1 (High Performance Calculation and Theoretical Physics)
  - 1 RTDA assegnato con profilo FIS/02 all'Università del Salento
  - 1 PhD teorico

Attività cofinanziate a Lecce

- **PRIN 2020**
  - D. Montanino, PANTHEON: Perspectives in Astroparticle and Neutrino THEory with Old and New messengers
  - C. Corianò, The Holographic Bootstrap for all Lambdas
  - F. De Paolis, SUNRISE: Exploring the extreme universe: a preview of the galaxy Structure to be Unveiled from the Next geneRatIon aStronomical survEys, codice 2022383WFT.
  - A. Lanotte, Equations informed and data-driven approaches for collective optimal search in complex flows
  - L. Albanese, Statistical mechanics of learning machines
  - S. Abenda, PRIN codice 2022TEB52W
  - D. Pallara, PRIN codice 20223L2NWK
  - R. Vitolo, PRIN codice 2022TEB52W
  - G. Saccomandi, PRIN codice 2022P5R22A
  - A. Barra, Statistical mechanics of learning machines
- **Altre attività cofinanziate**
  - D. Montanino, COST ACTION CA21106 COSMIC WISPers in the Dark Universe: Theory, astrophysics and experiments (CosmicWISPers)
  - S. Abenda, COST ACTION CA21109 CaLISTA Cartan geometry, Lie, Integrable Systems, quantum group Theories for Applications
  - S. Abenda, CaLIGOLA MSCA Staff Exchange 2021 (Horizon- MSCA-2021-SE-01)

Iniziative specifiche attive a Lecce

QGSKY (Catania, Genova, Lecce, Napoli, Salerno, Trieste)
RN: Salvatore Capozziello (NA), RL: Claudio Corianò

NUCSYS (Lecce, Napoli, Padova, Pavia, Pisa, Torino, TIFPA)
RN: Alejandro Kievsky (PI), RL: Luca Girlanda

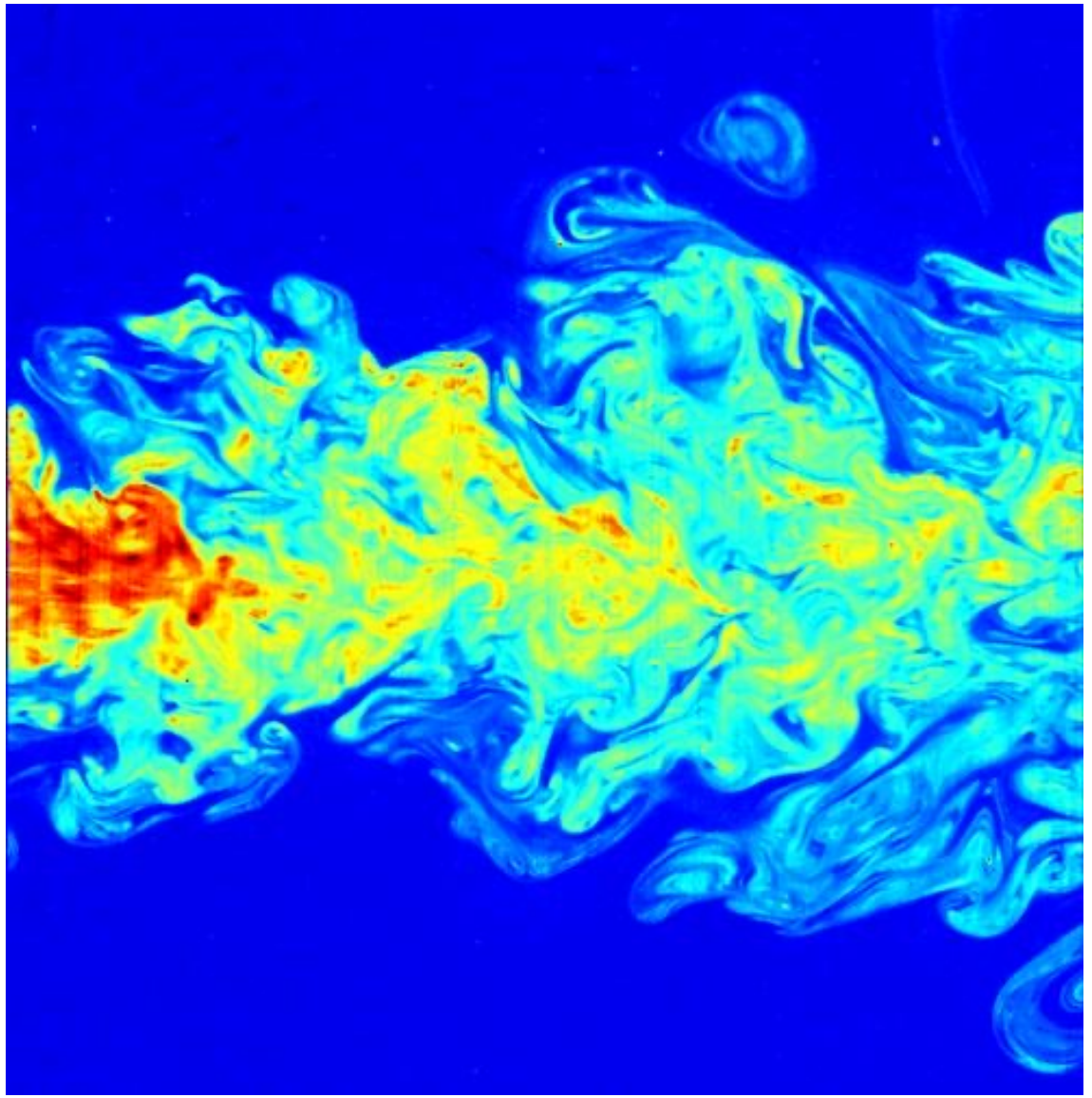
MMNLP (Lecce, Milano, Milano Bicocca, Roma1, Torino, Trieste)
RN: Raffaele Vitolo

TASP (Bari, Bologna, Ferrara, Lecce, LNF, LNGS, Napoli, Padova, Pisa, Roma1, Torino, Trieste)
RN: Fiorenza Donato (TO), RL: Francesco De Paolis

FIELDTURB (Bari, Genova, Lecce, Roma Tor Vergata, Torino)
RN: Giuseppe Gonnella (BA), RL: Alessandra Lanotte (CNR Nanotech)

FIELDTURB

Dottoranda (in scadenza)	Albanese	Linda	100%
Dottorando Unisalento	Alessandrelli	Andrea	100%
(trasferito a Roma 1)	Barra	Adriano	100%
I ricercatore CNR	Lanotte	Alessandra Sabina	100%
Dottorando nazionale AI	Lotito	Daniele	100%
Ricercatore CNR	Martone	Giovanni Italo	100%
Ricercatore CNR	Pucci	Giuseppe	100%



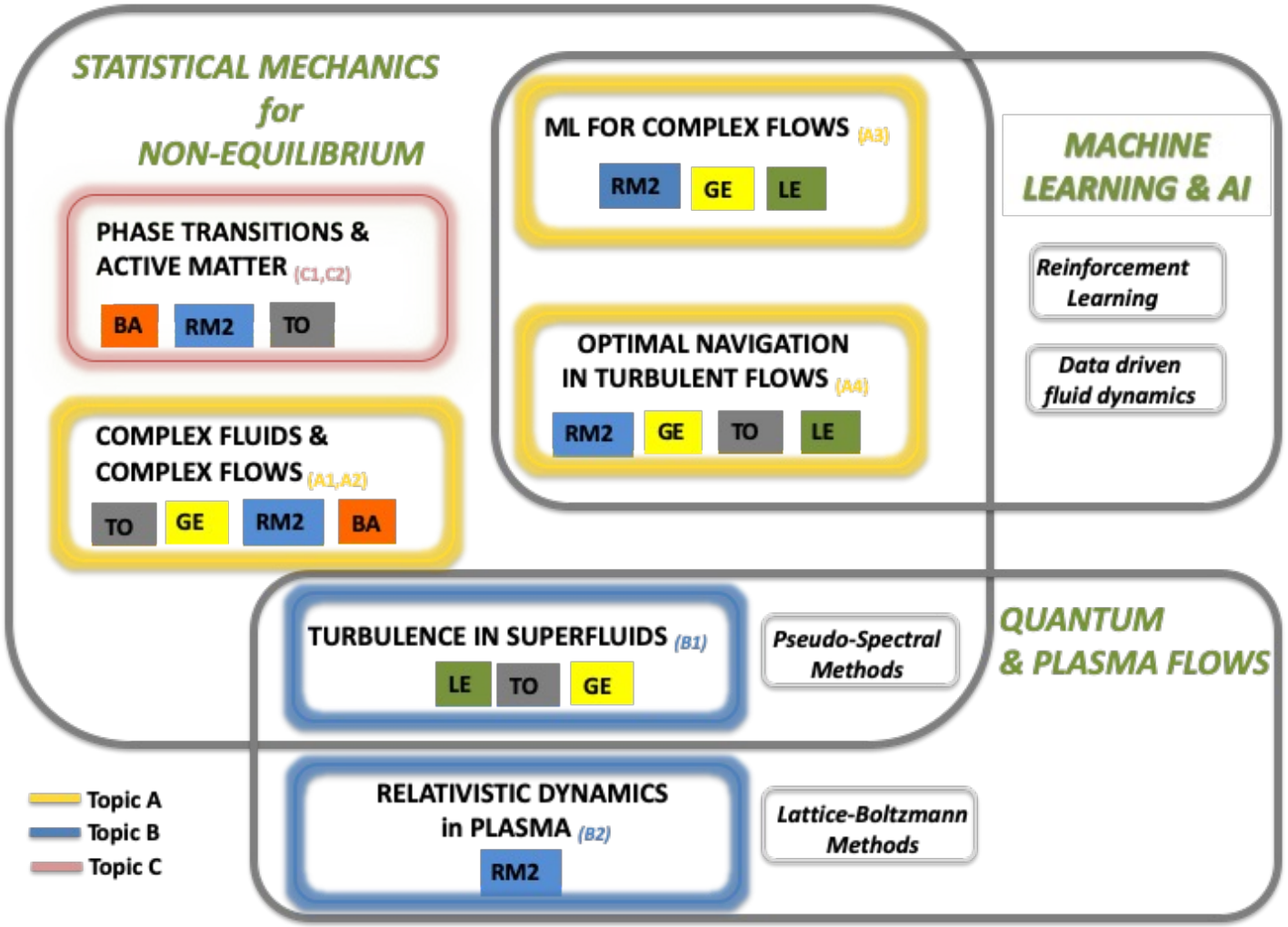
Iniziativa Specifica FIELDTURB
Particle and Fields in Turbulence and in Complex Fluids

- <u>Keywords</u>**: Turbulence, Complex fluids, Active matter, Out-of-equilibrium statistical mechanics, Machine learning**
- **Goal:** understanding fundamental questions about general problems of classical field theories of out-of-equilibrium systems at macro-, micro- and nano-scales, as well as of many applied problems involving non-ideal turbulence, quantum and relativistic flows, optimal control, active matter.
- **CHI : 5 unità** 25 staff + 17 studenti
- **Torino** 5 staff +5 studenti **Genova** 4 staff +1 studente **Roma II** 9 staff + 7 studenti
- **Bari** 4 staff +2 studenti **Lecce** 3 staff +3 studenti
- **Rinnovo nel 2023** Entrambi referees : 4A
- **Resp. nazionale: P.O. Giuseppe Gonnella**, Uni. Bari; **Resp. locale: Dir. Ricerca Alessandra Lanotte**, CNR NANOTEC

LINEE DI RICERCA A LECCE

- Fondamenti teorici per l'intelligenza Artificiale tramite meccanica statistica
- Applicazioni in problemi complessi di biofisica
- Super-solidità in condensati di Bose Einstein
- Comportamenti turbulent-like in fluidi quantistici bidimensionali
- Fluidodinamica di interfaccia, sistemi attivi

FIELDTURB
Particle and Fields in Turbulence and in Complex Fluids



ATTIVITA' DI RICERCA FIELDTURB-Lecce

Intelligenza Artificiale Intelligence & Meccanica Statistica

Adriano Barra (P.A.) [--> La Sapienza]; Linda Albanese (PhD) [Unisalento], Andrea Alessandrelli (PhD) [Unisalento], Daniele Lotito (PhD) [Dottor. Naz. AI]

- E. Agliari, A. Alessandrelli, A. Barra, F. Ricci-Tersenghi, **Parallel learning in multitasking neural networks**, Journal of Statistical Mechanics 113402 (2023).
- M. S. Centonze, I. Kanter, A. Barra, **Statistical mechanics of learning via reverberation in bidirectional associative memories,** Physica A 129512 (2023).
- E. Agliari, F. Alemanno, M. Aquaro, A. Barra, **Ultrametric identities in glassy models of Natural Evolution**, J. Phys. A: Math. & Theor. 56, 385001 (2023).
- L. Albanese, A. Alessandrelli, A. Annibale, A. Barra, **On the Almeida-Thouless line in neural networks**, Physica A 663, 129372, (2024).
- F. Alemanno, M. Cavo, D. Delle Cave, E. D'amone, G. Gigli, E. Lonardo, A. Barra, L. Del Mercato, **Quantifying heterogeneity to drug response in cancer-stroma kinetics,** PNAS 120(11) e2122352120 webpage (2023).
- L. Albanese, F. Alemanno, A. Alessandrelli, A. Barra, F. Giannotti, D. Lotito, D. Pedreschi, **Dense neural networks: a replica symmetric picture of Unsupervised Learning**, Physica A 627, 129143 (2023).
- L. Albanese, F. Alemanno, A. Alessandrelli, A. Barra, F. Giannotti, D. Lotito, D. Pedreschi, **Dense neural networks: a replica symmetric picture of Supervised Learning**, Physica A 626, 129076 (2023).
- A. Barra, G. Catania, A. Decelle, B. Seoane, **Thermodynamics of bidirectional associative memories**, J. Phys. A: Math. & Theor. 56, 205005, (2023).
- E. Agliari, M. Aquaro, A. Barra, A. Fachechi, C. Marullo, **From Pavlov Conditioning to Hebb Learning**, Neural Computation MIT Press a1, 28 (2023).

ATTIVITA' DI RICERCA FIELDTURB-Lecce

SUPERFLUIDI e SUPERSOLIDI

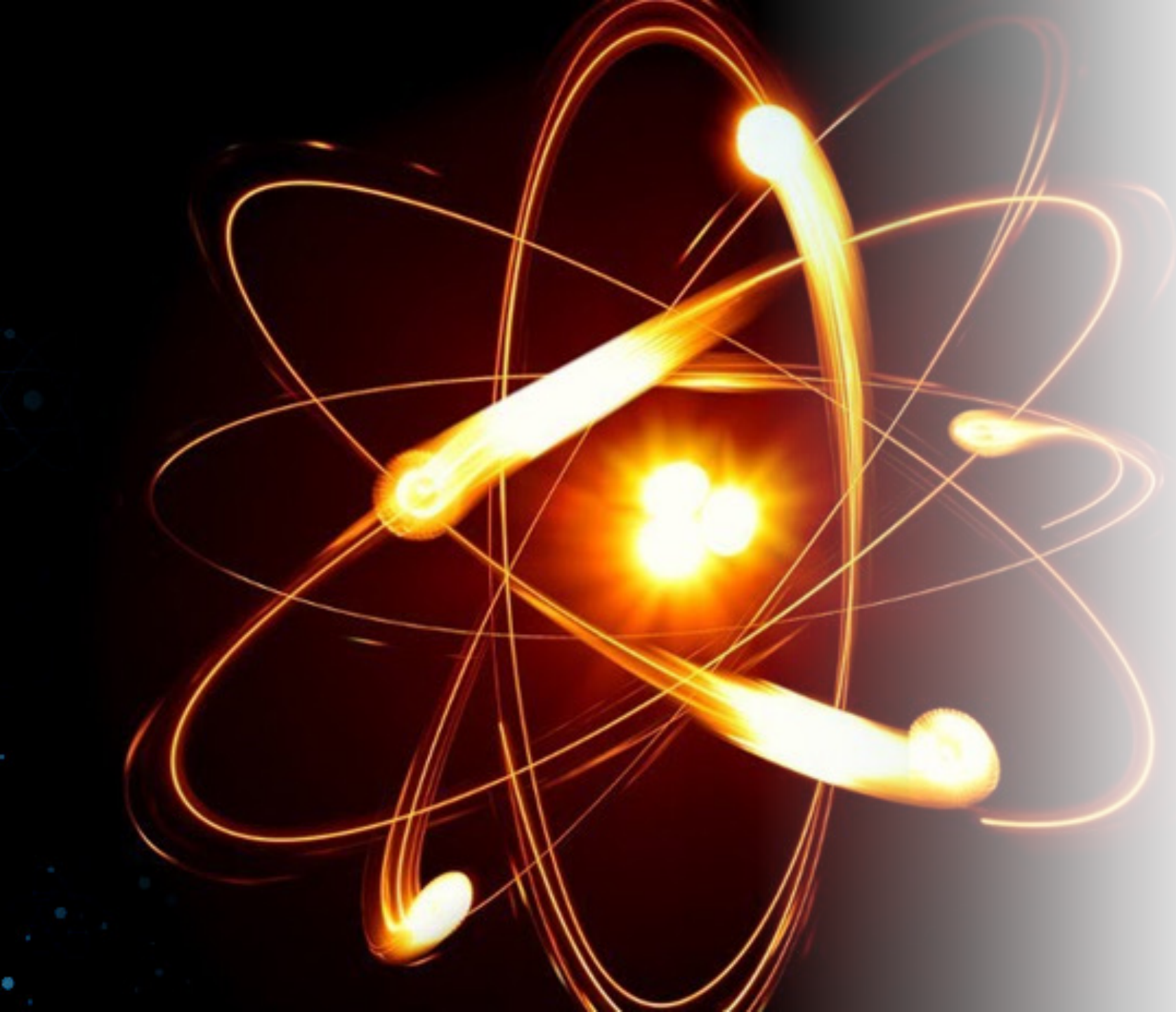
Alessandra S. Lanotte (DR), Giovanni Martone (Ric), Giuseppe Pulci (Ric) [CNR NANOTEC]

- R Panico, AS Lanotte, D Trypogeorgos, G Gigli, M De Giorgi, D Sanvitto, D Ballarini **Conformal invariance of 2D quantum turbulence in an exciton-polariton fluid of light,** *Applied Physics Review* **10** (4)(2023)
- G. Martone, **Bose-Einstein condensates with Raman-induced spin-orbit coupling: An overview,** Europhysics Letters 143 (2), 25001 (2023). Martone
- GI Martone, N Cherroret, **Time Translation Symmetry Breaking in an Isolated Spin-Orbit-Coupled Fluid of Light,** Physical Review Letters 131 (1), 013803 (2023).
- KT Geier, GI Martone, P Hauke, W Ketterle, S Stringari, **Dynamics of stripe patterns in supersolid spin-orbit-coupled bose gases**, Physical Review Letters 130 (15), 156001 (2023).

PARTICELLE DISCRETE E FLUIDI COMPLESSI

Alessandra S. Lanotte (DR), Giuseppe Pulci (Ric) [CNR NANOTEC]

- T. Li, A. S. Lanotte, M. Buzzicotti, F. Bonaccorso, L. Biferale **Multi-scale reconstruction of turbulent rotating flows with generative diffusion models,** *Atmosphere* **15**(1), 60 (2024).
- AU Oza, G Pucci, I Ho, DM Harris, **Theoretical modeling of capillary surfer interactions on a vibrating fluid bath,** Physical Review Fluids 8 (11), 114001 (2023).



NUCSYS

NUCSYS

The strongly correlated nuclear system: effective interactions, models, reactions, fundamental symmetries and applications

- **Composizione**:
  - Lecce: Luca Girlanda (Responsabile nazionale), Giampaolo Co’, Ylenia Capitani (assegnista PRIN, nuova acquisizione)
  - Napoli: Luigi Coraggio et al.
  - Padova: Luciano Canton et al.
  - Pisa: Michele Viviani et al.
  - Torino: Maria Barbaro et al.
  - Trento: Winfried Leidemann, Giuseppina Orlandini - > afferiranno al nodo di Lecce

- **Attivitàdi NUCSYS di Lecce**:
  - Calcoli ab-inizio su reazioni e struttura di nuclei leggeri e halo con il metodo della Lorentz Integral Transform e dell'espansione in armoniche ipersferiche
  - Applicazione delle tecniche di teorie di campo effettive al calcolo delle interazioni e degli operatori di corrente elettrodeboli nucleari
  - Applicazioni di teorie effettive autoconsistenti, come Hartree-Fock o Random Phase Approximation, per la descrizione delle risposte elettrodeboli di nuclei medio-pesanti

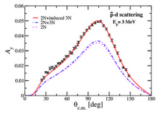
Iniziativa specifica collocata in fascia I (valutata 4A da entrambi i referees)

Collegata con il PRIN « Exploiting separation of scales in nuclear structure and dynamics » (Pi : Laura Marcucci)

Editors' Suggestion | Letter | 9 citations

Effect of the N3LO three-nucleon contact interaction on p–d scattering observables

L. Girlanda, E. Filandri, A. Kievsky, L. E. Marcucci, and M. Viviani
Phys. Rev. C **107**, L061001 (2023) – Published 16 June 2023



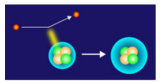
Chiral effective field theory allows one to express nuclear physics observables in terms of low-energy constants (LECs), representing physics at unresolved scales. In this work the authors focus on the two-nucleon contact interaction at fourth order (N3LO) and use a unitary transformation to reduce the number of involved LECs. This procedure induces a three-nucleon ($3N$) interaction depending on five unconstrained LECs. Those can be used, in association with a two-nucleon ($2N$) interaction, to fit very accurate data on polarization observables at low energies, in particular the p-d A_y polarization asymmetry. Thereby, adjusting the induced $3N$ N3LO LECs can solve the long-standing A_y puzzle.

Featured in Physics | Editors' Suggestion | 11 citations

Measurement of the α-Particle Monopole Transition Form Factor Challenges Theory: A Low-Energy Puzzle for Nuclear Forces?

S. Kegel *et al.*
Phys. Rev. Lett. **130**, 152502 (2023) – Published 10 April 2023

Physics Viewpoint: Probing the Helium Nucleus beyond the Ground State



A new electron-scattering experiment challenges our understanding of the first excited state of the helium nucleus.

Show Abstract +

NUCSYS
Pubblicazioni 2023/24

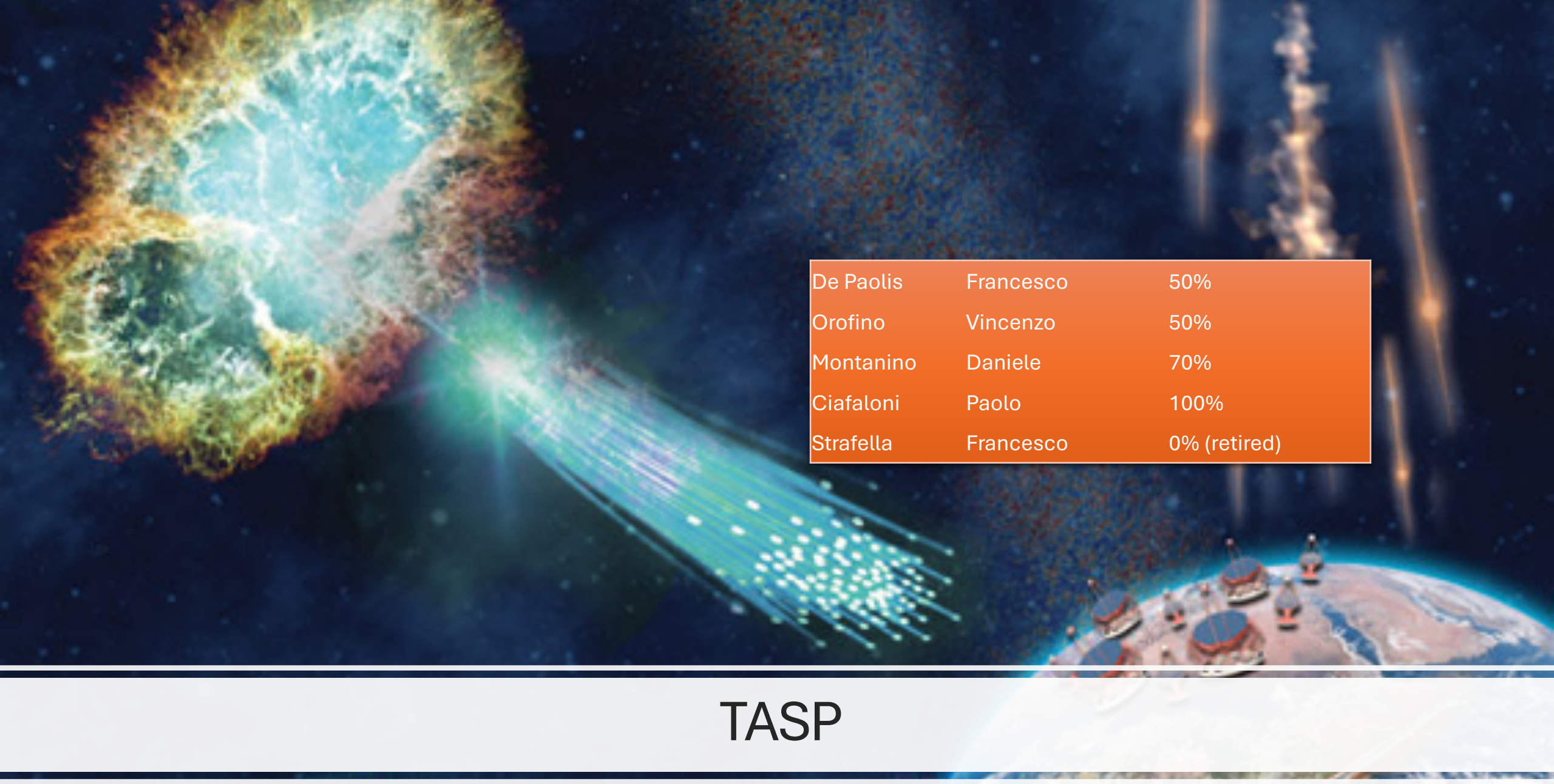
- G. Co', «Introducing the Random Phase Approximation Theory», **Universe 9 (2023) 141**
- S. Kegel, W. Leidemann, G. Orlandini et al., «Measurement of the alpha-particle monopole transition form factor challenges theory : a low-energy puzzle for nuclear forces ?», **Phys. Rev. Lett. 130 (2023) 152502**
- M. Viviani, L. Girlanda, A. Kievsky, L.E. Marcucci, «Theoretical Study of the d(d, p)H3 and d(d, n)He3 Processes at Low Energies», **Phys. Rev. Lett. 130 (2023) 122501**
- L. Girlanda, E. Filandri, A. Kievsky, L.E. Marcucci, M. Viviani, «Effect of the N3LO three-nucleon contact interaction on p-d scattering observables», **Phys. Rev. C 107 (2023) L061001**
- E. Filandri, L. Girlanda, «Momentum dependent nucleon-nucleon contact interaction from a relativistic Lagrangian», **Phys. Lett. B 841 (2023) 137957**
- A. Nasoni, E. Filandri, L. Girlanda, «Relativistic constraints on 3N contact interactions», **Eur. Phys. J. A 59 (2023) 293**
- A. Lella, P. Carenza, G. Co', G. Lucente, M. Giannotti, A. Mirizzi, T. Rauscher, «Getting the most on supernova axions», **Phys. Rev. D 109 (2024) 023001**
- P. Carenza, G. Co', G. Lucente, M. Giannotti, A. Lella, G. Lucente, A. Mirizzi, T. Rauscher, «Cross section for supernova axion observation in neutrino water Cherenkov detectors», **Phys. Rev. C 109 (2024) 015501**
- E. Filandri, L. Girlanda, A. Kievsky, L.E. Marcucci, M. Viviani «Momentum dependent nucleon-nucleon contact interactions and their effect on p-d scattering observables», **Few Body Syst. 65 (2024) 57**

NUCSYS
Richieste finanziarie

- 3k€/FTE per missioni

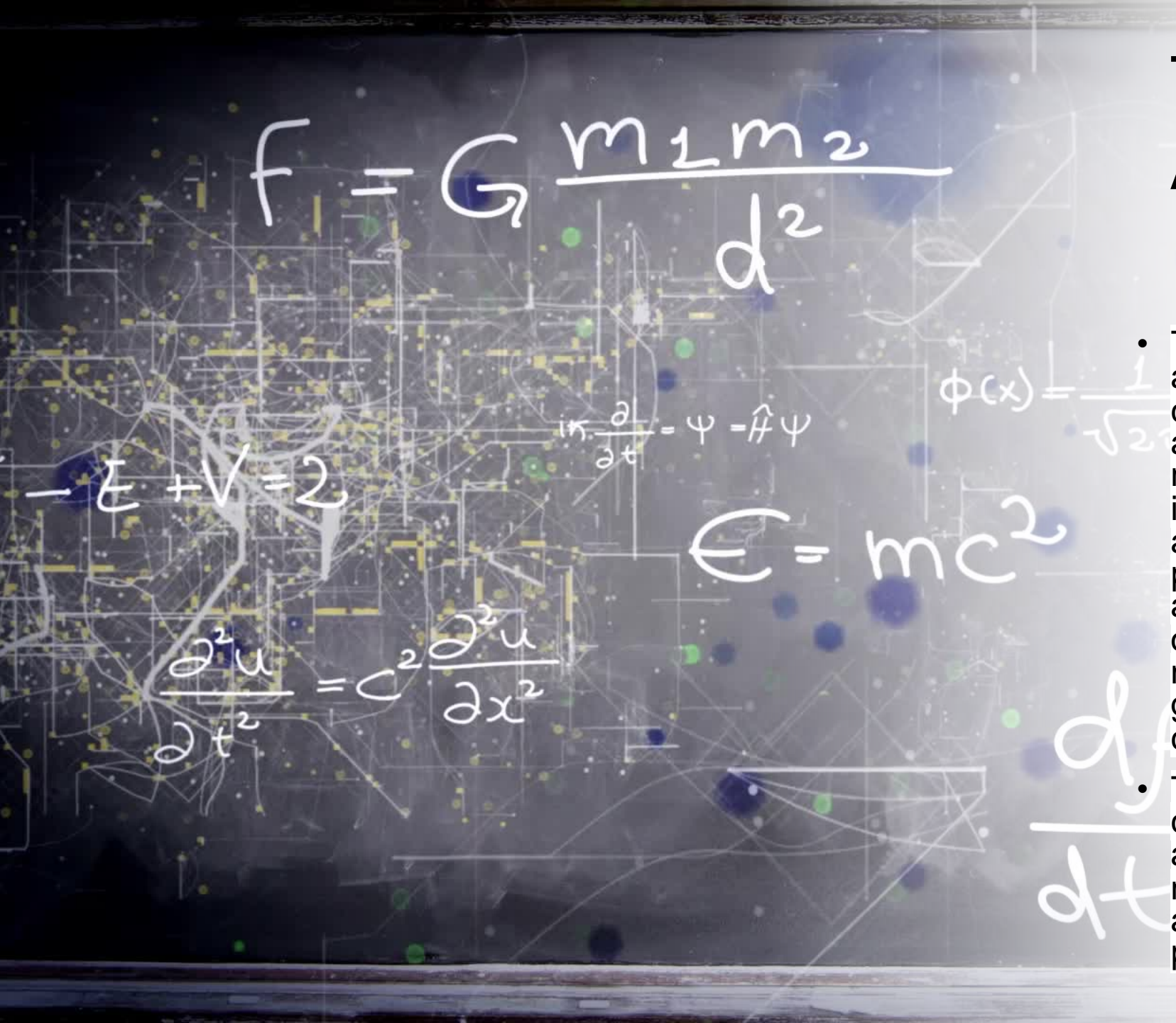
- 5 FTE :
- Luca Girlanda
- Giampaolo Cò
- Ylenia Capitani (assegnista PRIN dal 1/3/2024)
- Winfried Leidemann (Professore associato Univ. Trento in pensione)
- Giuseppina Orlandini (Professore ordinario Univ. Trento in pensione)

- Totale : 15 k€



De Paolis	Francesco	50%
Orofino	Vincenzo	50%
Montanino	Daniele	70%
Ciafaloni	Paolo	100%
Strafella	Francesco	0% (retired)

TASP



TASP (Theoretical Astroparticle Physics)

- The goal of TAsP is to undertake a wide and diversified research program at the crossroad of particle physics, astrophysics and cosmology covering: neutrino masses, mixings and interactions; the puzzles of dark energy and dark matter, including axion phenomenology; the observed baryon asymmetry of the universe; the physics of high-energy cosmic rays and gamma rays, and their connections with gravitational waves in a multimessenger context.
- The main planned research activities cover neutrino physics, dark matter, astrophysical sources of radiation, multimessenger astronomy, cosmology, and the interplay of astrophysics with particle physics.

Attività di TASP @ Lecce

- Pulsar timing come tecnica per rivelare onde gravitazionali di bassa frequenza, sia cosmologiche che dovute a sistemi binari di buchi neri supermassicci.
- Produzione di assioni da buchi neri primordiali e oscillazioni fotone assione in campi magnetici astrofisici.
- Oscillazioni di neutrino e relativa fenomenologia.
- Fisica del modello standard and beyond.

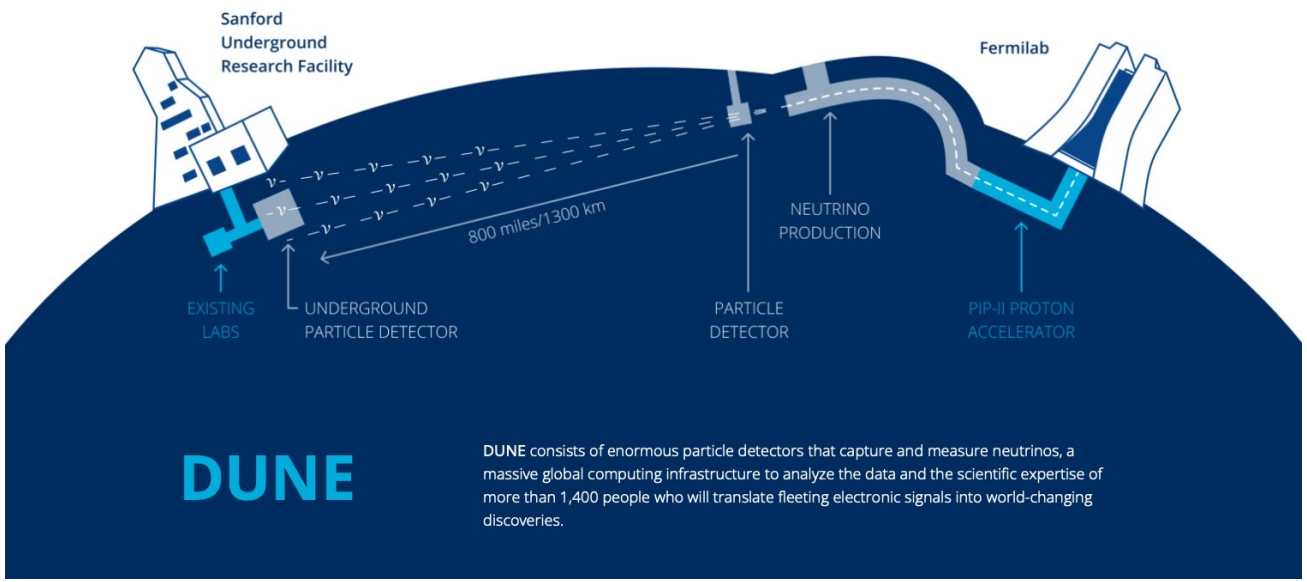
TASP
Pubblicazioni 2023/24

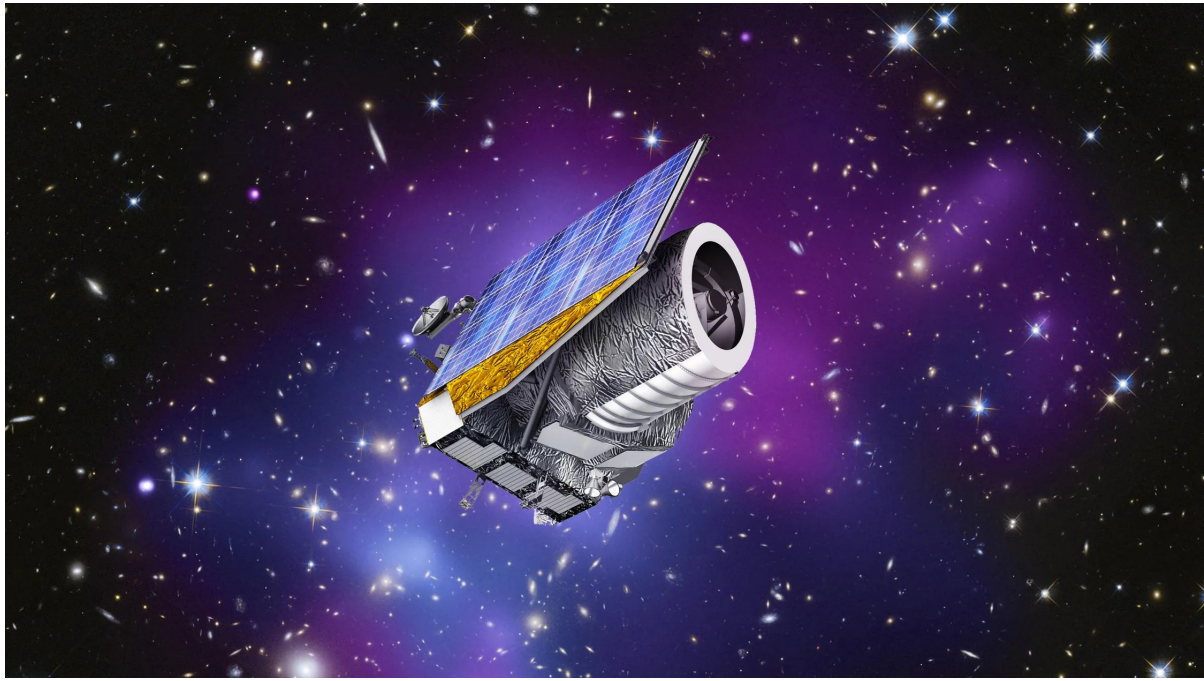
- N. Tahir, F. De Paolis, A. Qadir, A. Nucita, «On the Galactic Halos Rotation by Planck Data», **Symmetry, Volume 15, Issue 1, id.160**
- L. Hamolli, M. Hafizi, F. De Paolis, E. Guliqani, «Investigating Gravitationally Lensed Quasars Observable by Nancy Grace Roman Space Telescope», **Galaxies, Volume 11, Issue 3, id.71**
- L. Hamolli, M. Hafizi, F. De Paolis, A. Nucita, «Primordial black holes as dark matter candidates in the Galactic halo», The Sixteenth Marcel Grossmann Meeting 5-10 July, 2021. Edited by R. Ruffini and G. Vereshchagin. Published by World Scientific Publishing Co.
- A. Franco, A. Nucita, F. De Paolis, F. Strafella, M. Maiorano, «Searching for Intermediate Mass Black Holes in the Milky Way's galactic halo», The Sixteenth Marcel Grossmann Meeting 5-10 July, 2021. Edited by R. Ruffini and G. Vereshchagin. Published by World Scientific Publishing Co.
- N. Tahir, A. Qadir, M. Sakhi, F. De Paolis, «Virial clouds evolution from the last scattering up to the formation of first stars», The Sixteenth Marcel Grossmann Meeting 5-10 July, 2021. Edited by R. Ruffini and G. Vereshchagin. Published by World Scientific Publishing Co.
- M. Maiorano, F. De Paolis, A. Nucita , A. Franco, «Advantages of including globular cluster millisecond pulsars in Pulsar Timing Arrays», The Sixteenth Marcel Grossmann Meeting 5-10 July, 2021. Edited by R. Ruffini and G. Vereshchagin. Published by World Scientific Publishing Co.
- A. Franco, A. Nucita, F. De Paolis, F. Strafella, S. Sacquegna, «New variable sources revealed by DECam toward the LMC: The first 15 deg^2», **New Astronomy, Volume 103, article id. 102043**
- A. Franco, A. Nucita, F. De Paolis, F. Strafella, «Evidence of a sub-solar star in a microlensing event toward the LMC», **New Astronomy, Volume 108, article id. 102174**
- P. Ciafaloni, G. Co', D. Colferai and D. Comelli, «Electroweak Evolution Equations and Isospin Conservation», arXiv:2403.08583

Collaborazioni sperimentali

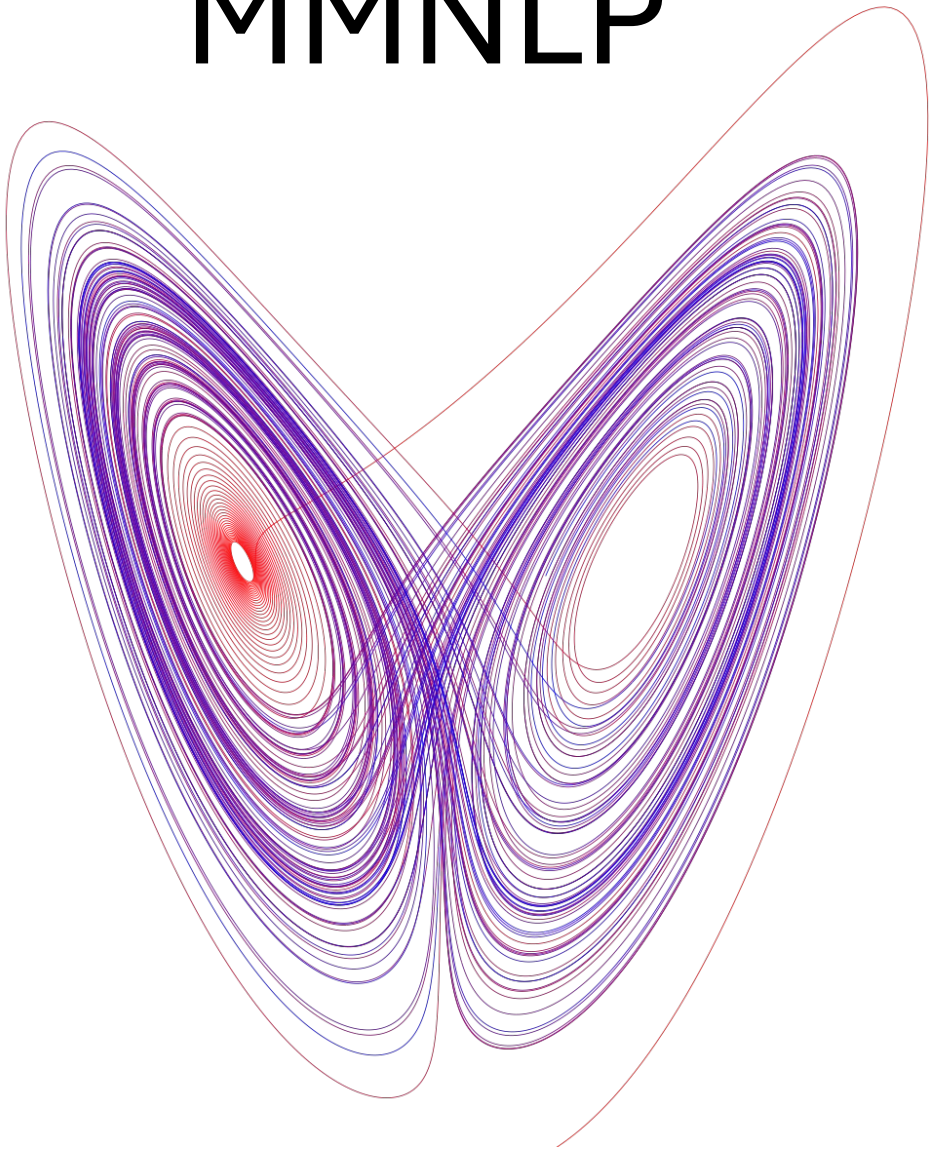
D. Montanino (DUNE 30%)
L. Martina (DUNE 20%)

F. De Paolis (EUCLID, 50%)





MMNLP



New MMNLP: 2024–2026

6 units: **Lecce, Milano, Milano-Bicocca, Roma, Trieste, Torino**

Team members:

- **Lecce**: S. Abenda (50%, Sez. Bologna), G. Landolfi (50%), L. Martina (80%), S. Opanasenko (assegnista INFN), G. Saccomandi (Sez. Perugia), R. Vitolo (national responsible), B. Konopelchenko (affiliato).
- **Milano**: G. Gaeta, G. Gubbiotti,, L. Pizzocchero (local responsible, 80%) P. Vergallo (assegnista UniMessina)
- **Milano-Bicocca**: G. Falqui, P. Lorenzoni (local responsible), M. Pedroni, A. Raimondo, K. van Gemst (post-doc), F. Magri (affiliation in progress)

New MMNLP: 2024–2026

Team members:

- **Roma**: S. Carillo, F. Coppini (PhD), A. De Sole (local responsible), P.M. Santini, D. Valeri, F. Zullo, M.V. Falessi (Ric. ENEA 50%), L. Casarin (PhD)
- **Torino**: M. Onorato (50%), G. Ortenzi (local responsible).
- **Trieste**: T. Grava (local responsible) D. Lewanski, P. Rossi (Univ Padova), D. Guzzetti, I.S. Jaztar Singh (PhD UniPD) D. Rachenkov (PhD), Bing-Ying Liu (post-doc), P. Drozdov (Univ. Udine) D. Klompenhouwer (Univ. Padova).

MMNLP topics: Lecce

- Combinatorial and graph theory methods for spectral problems associated to integrable systems (Abenda)
- Symmetries in nonlinear partial evolution equations (Landolfi, Martina)
- Topological states in classical field theory (Martina)
- Decoherence in unstabile quantum systems (Martina)
- Integrable systems in nonlinear elasticity theory (Saccomandi)
- Geometric properties of Hamiltonian operators for PDEs and integrability (Opanasenko, Vitolo)

External collaborations

- Lebedev Physical Institute of the Russian Academy of Sciences, Moscow RU Maxim Pavlov
- Loughborough University, UK, E.V. Ferapontov
- Steklov Mathematical Institute of Russian Academy of Sciences, Moscow, RU Petr Grinevich
- Texas University at College Station USA Kumbakonan Rajagopal
- Jagellonian Univ. Krakow PL Carlos Naya
- Northumbria University GB Antonio Moro
- University of Amsterdam NL Sergey Shadrin
- European Space Agency NL Piero Angeletti
- European Space Agency NL Giovanni Toso
- Ningbo University, Ningbo, CN Matteo Casati

Conferences 2023/2024

- (Abenda) Spectral problems in integrable systems, Grassmannians and graph theory International Workshop A quantum day in Bologna, Bologna, Italia (2023)
- (Abenda) Geometric relations on plabic graphs, totally non-negative Grassmannians and applications International Conference Siamag 2023 - SIAM Conference on Applied Algebraic Geometry, Eindhoven, Olanda.
- (Opanasenko) Workshop on Poisson brackets and Integrability 28/2 - 1/3/2024, Korteweg - de Vries Institute for Mathematics, Amsterdam University `https://gcarlet.perso.math.cnrs.fr/page/pbi2024/`
- (Vitolo) National meeting of Gruppo Nazionale di Fisica Matematica of IndAM, to foster the collaboration between GNFM and INFN, and to an international workshop (see the DB), October 2024.
- (Martina, Vergallo, Vitolo) STP 2023 conference in Otranto, 4-9/06/2023, http://www.sptspt.it/ co-organizer (Vitolo) and speakers (Martina, Vergallo).
- (Saccomandi) WASCOM 2023, Bari, June 2023 (invited speaker).
- (Vitolo, invited speaker) UMI 2023, title of the talk: Reciprocal transformations and Hamiltonian geometry of PDEs.

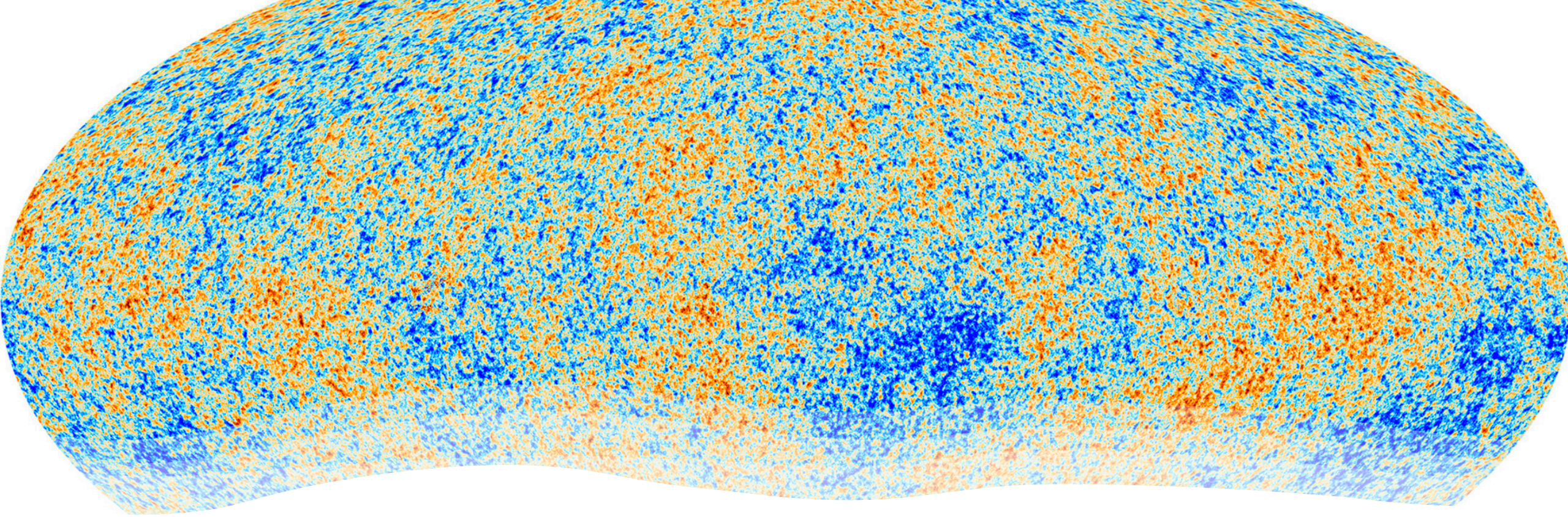
Publications

1. F. Giglio, G. Landolfi, L. Martina, On solutions to a novel non-evolutionary integrable 1+1 PDE, JOURNAL OF PHYSICS A (2023).
2. Konopelchenko, B. G.; Ortenzi, G. On blowups of vorticity for the homogeneous Euler equation STUDIES IN APPLIED MATHEMATICS 2024
3. Konopelchenko, B. G.; Ortenzi, G. On the hierarchy and fine structure of blowups and gradient catastrophes for multidimensional homogeneous Euler equation JOURNAL OF PHYSICS A 2024
4. Saccomandi, G; Vergori, L Waves in elastic solids WAVE MOTION 2023
5. Amendola A. , Motta J. de Castro , Vergori L. , Saccomandi G.: A constitutive model for transversely isotropic dispersive materials PROCEEDINGS OF THE ROYAL SOCIETY A 2024
6. M. Dell'Atti, P. Vergallo: Classification of degenerate non-homogeneous Hamiltonian operators J MATH PHYS (2023) Volume 64 Issue 3
7. Opanasenko S., Vitolo R.: Bi-Hamiltonian Equations of WDVV type, submitted (2024).
8. Lorenzoni, P., Shadrin S. Vitolo R.: Miura-reciprocal transformations and localizable Poisson pencils NONLINEARITY 2024
9. Lorenzoni P.; Vitolo R.: Projective-geometric aspects of bi-Hamiltonian structures of KdV type, Contemporary Mathematics (American Mathematical Society) 2023
10. Rizzello S, Scaraggi M, Nelson AD, Primavera L, Napoli G, Stecca G, Vitolo R, De Bartolo S: Multiscaling behavior of braided channel networks: An alternative formulation of Taylor's law variate transformations PHYSICAL REVIEW E 2024.
11. P. Vergallo, R. Vitolo: Projective geometry of homogeneous second-order Hamiltonian operators NONLINEARITY (2023) Volume 36 Issue 10

Request for financial support

- Abenda: 1k (50%)
- Landolfi: 1k (50%)
- Martina: 1.5k (80%)
- Opanasenko: 2k (50%)
- Saccomandi: 2k (100%)
- Vitolo: 2k (100%)

Total request: 9.5kEUR.



QGSKY

The QGSKY project focuses on theoretical and phenomenological aspects of QFT, GR, and theories beyond GR taking into account observations resulting from the so-called precision cosmology. Our nodes have a joint collaboration in various projects, and although our main interests are in the theoretical and phenomenological aspects, the competences of our IS range from phenomenology of particle physics to cosmology and relativistic astrophysics.

Prof II fascia	Coriano'	Claudio	100%
Dottorando	Cretì	Mario	100%
Dottorando	Lionetti	Stefano	100%
Dottorando	Melle	Dario	100%
Dottorando	Tommasi	Riccardo	100%

QG SKY

Membri: Claudio Coriano', Dario Melle, Stefano Lionetti, Riccardo Tommasi, Mario Creti'

Giovanni Chirilli (in fase di associazione)

temi di ricerca:
1. fisica dell universo primitivo
2. fisica BSM
3. azioni effettive assioniche e dilatoniche per studi di materia oscura
4. analisi di effetti termici in plasmi primordiali

Collaborazioni esterne: Tours, Bologna e Modena

Organizzazione di eventi: QCD at work 2024

Incontro della Iniziativa specifica nazionale: Lecce, 28-29 Otobre 2024 (aula rettorato)

Seminari 2024

Salonicco, grecia, Gennaio 2024

Marcel Grossmann meeting (Pescara 2024)

QCD at work 2024

Tours (CNRS) "conformal anomalies"

Axion-like Quasiparticles and Topological States of Matter: Finite Density Corrections of the Chiral Anomaly Vertex

Claudio Corianò, Mario Cretì, Stefano Lionetti, Riccardo Tommasi (Feb 5, 2024)

e-Print: 2402.03151 [hep-ph]

PRD

Lavori pubblicati/accettati

The Gravitational Chiral Anomaly at Finite Temperature and Density

Claudio Corianò, Mario Cretì, Stefano Lionetti, Riccardo Tommasi (Apr 9, 2024)

e-Print: 2404.06272 [hep-th]

PRD

The SU(3)C × SU(3)L × U(1)X (331) Model: Addressing the Fermion Families Problem within Horizontal Anomalies Cancellation #3

Claudio Corianò (INFN, Lecce and Salento U.), Dario Melle (INFN, Lecce and Salento U.) (Apr 8, 2024)

Published in: *Entropy* 26 (2024) 5, 420 • e-Print: 2404.05821 [hep-ph]

Axion-like Interactions and CFT in Topological Matter, Anomaly Sum Rules and the Faraday Effect

Claudio Corianò, Mario Cretì, Stefano Lionetti, Dario Melle, Riccardo Tommasi (Mar 22, 2024)

e-Print: 2403.15641 [hep-ph]

Advanced Physics Research, Wiley

Parity-violating CFT and the gravitational chiral anomaly #6

Claudio Corianò (Salento U. and INFN, Lecce), Stefano Lionetti (Salento U. and INFN, Lecce), Matteo Maria Maglio (Heidelberg U.) (Sep 11, 2023)

Published in: *Phys.Rev.D* 109 (2024) 4, 045004 • e-Print: 2309.05374 [hep-th]

4D Einstein Gauss-Bonnet Gravity without a Dilaton #8

Claudio Corianò (Salento U. and INFN, Lecce), Mario Cretì (Salento U. and INFN, Lecce), Stefano Lionetti (Salento U. and INFN, Lecce), Matteo Maria Maglio (U. Heidelberg, ITP), Riccardo Tommasi (Salento U. and INFN, Lecce) (May 31, 2023)

Published in: *PoS* CORFU2022 (2023) 099 • Contribution to: CORFU2022, 099, CORFU2022 • e-Print: 2305.19554 [hep-th]

CFT correlators and CP-violating trace anomalies #7

Claudio Corianò (INFN, Lecce and Salento U.), Stefano Lionetti (INFN, Lecce and Salento U.), Matteo Maria Maglio (Heidelberg U.) (Jul 6, 2023)

Published in: *Eur.Phys.J.C* 83 (2023) 9, 839 • e-Print: 2307.03038 [hep-th]

Atmospheric Neutrino octant from flavor symmetry #9

Paul H. Frampton (INFN, Lecce), Claudio Corianò (INFN, Lecce), Pietro Santorelli (Naples U. and INFN, Naples) (May 17, 2023)

Published in: *Mod.Phys.Lett.A* 39 (2024) 09, 2450028 • e-Print: 2305.10463 [hep-ph]

Parity-odd 3-point functions from CFT in momentum space and the chiral anomaly

Claudio Corianò (INFN, Lecce and Salento U.), Stefano Lionetti (INFN, Lecce and Salento U.), Matteo Maria Maglio (U. Heidelberg, ITP) (Mar 19, 2023)

Published in: *Eur.Phys.J.C* 83 (2023) 6, 502 • e-Print: 2303.10710 [hep-th]

Three-wave and four-wave interactions in the 4d Einstein Gauss-Bonnet (EGB) and Lovelock theories

Claudio Corianò (INFN, Lecce and Salento U.), Mario Cretì (INFN, Lecce and Salento U.), Stefano Lionetti (INFN, Lecce and Salento U.), Matteo Maria Maglio (Heidelberg U.) (Feb 4, 2023)

Published in: *Nucl.Phys.B* 998 (2024) 116420 • e-Print: 2302.02103 [hep-th]

work in preparation for the Electron-ion collider

The Gravitational Form Factors of Hadrons, the QCD Dilaton and the Non-Abelian Trace Anomaly

[1,2]Claudio Corianò, [1] Stefano Lionetti, [1] Dario Melle and [1]Riccardo Tommasi

phenomenological study of Deeply vitual Composn scattering/ Gravitational form factors of hadrons in QCD per esperimento ad LHC

richieste finanziarie : 6KE

Three-wave and four-wave interactions in the 4d Einstein Gauss-Bonnet (EGB) and Lovelock theories

Claudio Corianò (INFN, Lecce and Salento U.), Mario Cretì (INFN, Lecce and Salento U.), Stefano Lionetti (INFN, Lecce and Salento U.), Matteo Maria Maglio (Heidelberg U.) (Feb 4, 2023)

Published in: *Nucl.Phys.B* 998 (2024) 116420 • e-Print: 2302.02103 [hep-th]

work in preparation for the Electron-ion collider

EIC a BNL.
DVCS verra' misurato ed indirettamente, verra misurato il fattore di forma grav. del protone

The Gravitational Form Factors of Hadrons, the QCD Dilaton and the Non-Abelian Trace Anomaly

[1,2]Claudio Corianò, [1] Stefano Lionetti, [1] Dario Melle and [1]Riccardo Tommasi

phenomenological study of Deeply vitual Compton (DVCS) scattering/ Gravitational form factors of hadrons in QCD, per esperimento ad Brookhaven per la determinazione della distribuzone del momento angolare dei quark e gluoni protone

richieste finanziarie : 6KE

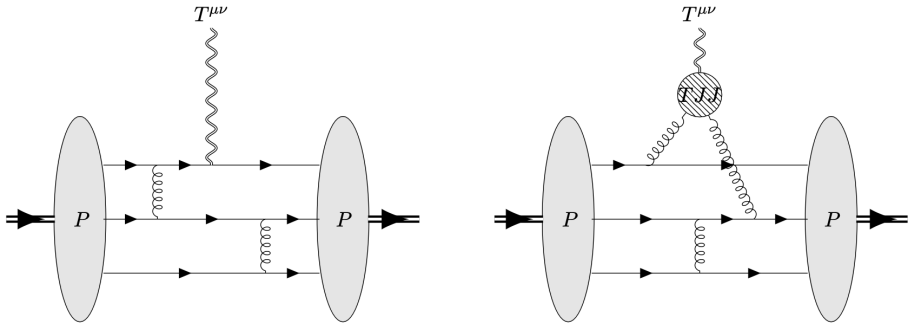


Figure 2: Typical leading (left) and NLO contributions (right) to the GFF of the proton.

fattore di forma gravitazionale del protone

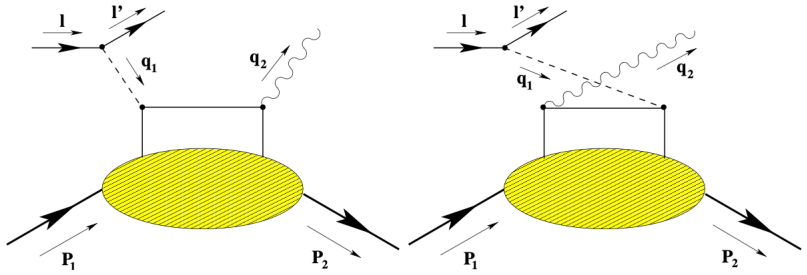
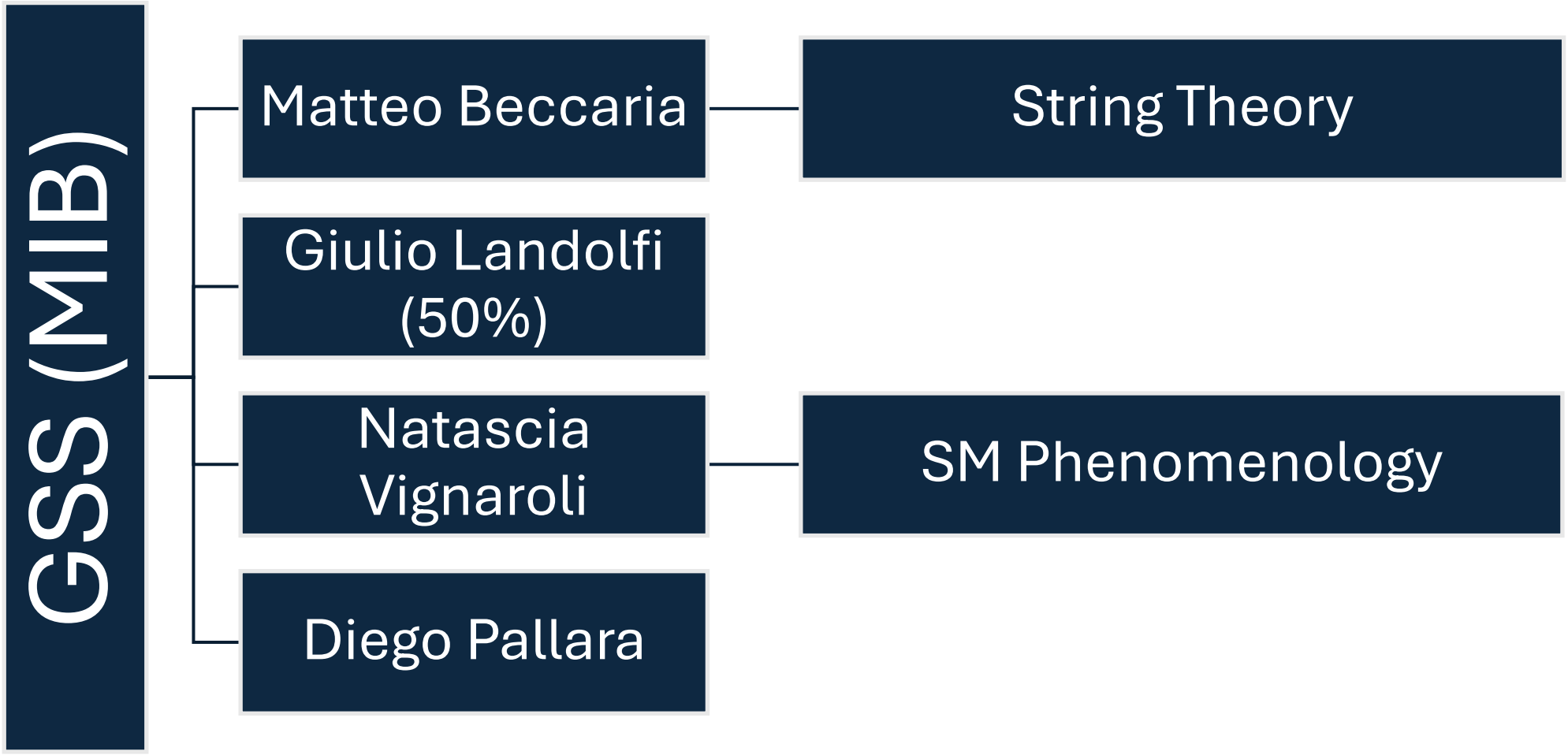


Figure 3: Leading hand-bag diagrams for the DVCS process

Le correzioni radiative introducono uno stato dilatonico in QCD che qui viene predetto da studi sull'anomalia conforme (Delle Rose, Armillis, CC) (Giannotti e Mottola)

DVCS misurato all' EIC a Brookhaven

Altre attività

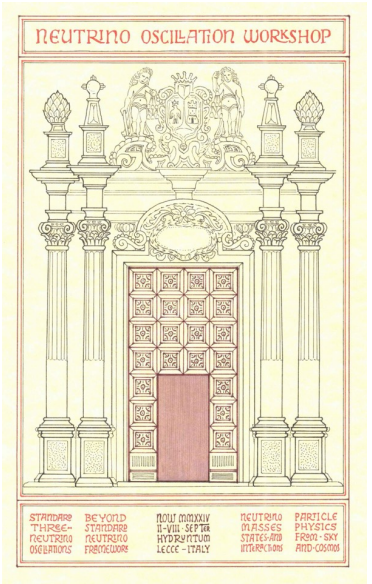


NOW 2024

Neutrino Oscillation Workshop

2-8 settembre 2024
Basiliani Hotel, Otranto

Dipartimento di Matematica e Fisica
"Ennio De Giorgi"



INFN
Istituto Nazionale di Fisica Nucleare

Dipartimento
Interateneo di
Fisica
Michelangelo Merlin

QCD@Work

International Workshop on QCD
Theory and Experiment

18-21 giugno 2024
Trani

Dipartimento di Matematica e Fisica
"Ennio De Giorgi"

Politecnico di Bari

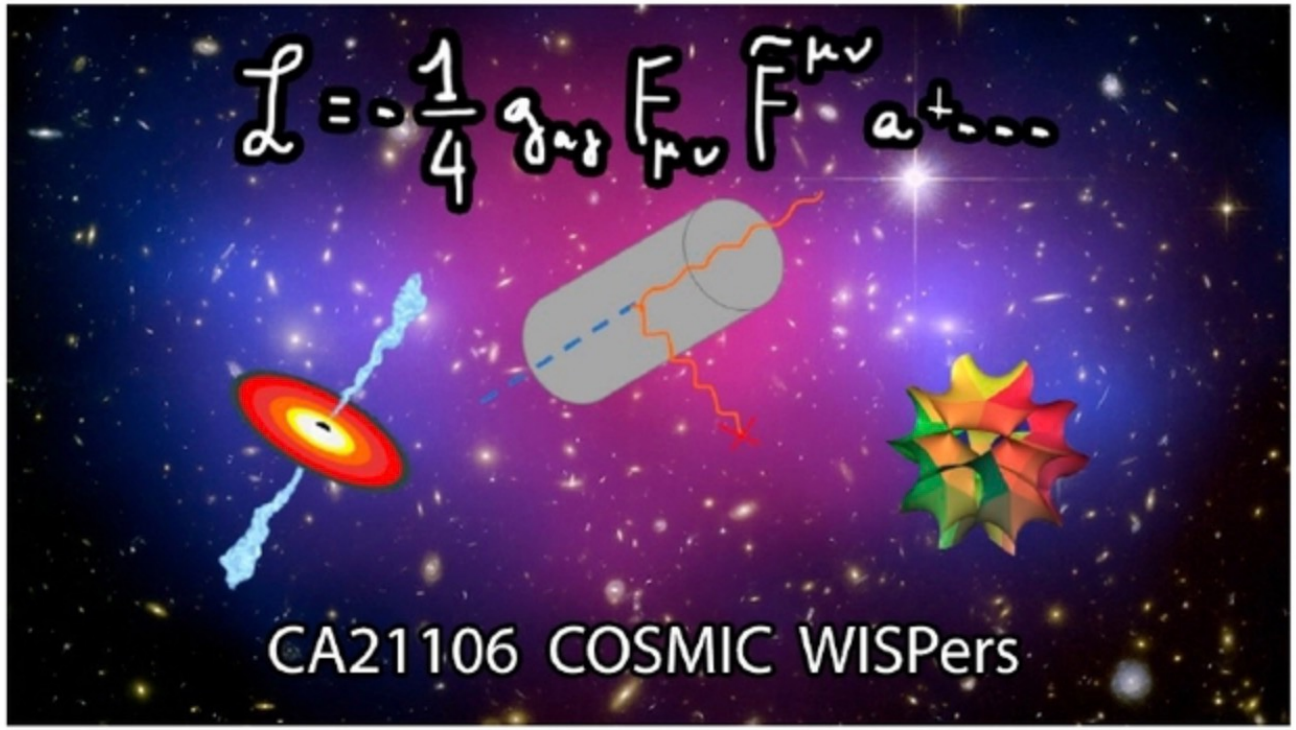
UNIVERSITÀ DEL SALENTO

UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

INFN

Istituto Nazionale di Fisica Nucleare

Dipartimento Interateneo di Fisica
Michelangelo Merlin



Funded by the European Union

1st Training School COST Action COSMIC WISPers (CA21106)

11–14 Sept 2023
Rettorato Universita' del Salento, Lecce (Italy)

The goal is to start training a generation of young scientists in the interdisciplinary expertise on WISPs, ranging from theoretical
and experimental approaches to multi-messenger astroparticle physics and cosmology

Situazione contabile 2023

Capitolo	Descrizione	Stanziato	Variato	Subjudice e Cong.	Preimpegno	Impegni	Disponib.	Proposta in corso	Disp. Teorica
U1030101002	Pubblicazioni	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
U1030102006	Materiale informatico	0,00	97,48	0,00	0,00	97,48	0,00	0,00	0,00
U1030102007	Altri materiali tecnico	0,00	18,50	0,00	0,00	18,50	0,00	0,00	0,00
U1030102008	Strumenti tecnico-speci	5.000,00	-4.970,00	0,00	0,00	30,00	0,00	0,00	0,00
U1030202001	Rimborso per viaggio e	4.500,00	6.597,15	0,00	0,00	10.363,94	733,21	0,00	733,21
U1030202002	Indennità di missione	8.000,00	-5.361,53	0,00	0,00	2.638,47	0,00	0,00	0,00
U1030202005	Organizzazione e partec	1.000,00	-340,00	0,00	0,00	660,00	0,00	0,00	0,00
U1030213003	Trasporti, traslochi e	0,00	25,00	0,00	0,00	23,08	1,92	0,00	1,92
U2020105001	Attrezzature scientific	5.000,00	13.660,55	0,00	0,00	18.660,55	0,00	0,00	0,00
Totale:		**23.500,00**	**9.727,15**	**0,00**	**0,00**	**32.492,02**	**735,13**	**0,00**	**735,13**

Richieste finanziarie 2024

TASP:	5k€ (2,7 FTE)
NUCSYS:	15k€ (5 FTE previsti)
MMNLP:	9.5k€ (4,3 FTE)
QGSKY:	6k€ (5 FTE)
FIELDTURB:	8k€ (6FTE)
DOT4: si conferma la richiesta 2023 (23k€)