PRIN NAT-NET:

Progetto di Rilevante Interesse Nazionale

Neutrino and Astroparticle Theory NETwork

Introduction to 3rd meeting

Eligio Lisi
(INFN, Bari)

Thanks to everybody, including those not present!

In particular:

to all the conveners for their generous commitment,
and to Giulia and Francesco for the local organization

1999-2012: Previous astroparticle PRINs; P.I. Fogli, Masiero, Fornengo (Uni).
Construction of a wide Italian theo-pheno community with a solid tradition,
largely in superposition with the INFN astroparticle network FA51 → TAsP.

Timeline of our PRIN NAT-NET spans ~6 years…

- **2017, Dec.:** PRIN 2017 Call, after many years waiting. Open to P.I.'s from EPR.
- 2018, Feb.: discussion & convergence on PRIN "Linea Sud" Bari-L'Aquila-Napoli
- 2018, Mar.: bureaucracy: 3 groups → 5 units: INFN+UniBa+UniNa+UnivAq+GSSI
- 2018, Mar.: submit PRIN NAT-NET, P.I. E. Lisi (INFN); ask 330 kE funding
- 2019, Mar., approved, PRIN # 2017W4HA7S; received 296 kE funding
- **2019, Aug. 29th – 2023, Aug. 28th:** **PRIN start/end dates** (including +1y Covid)

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- **2023, Oct 27th deadline: Rendicontazione Contabile**
- **2023, Nov. 26th deadline: Rendicontazione Scientifica Conclusiva**

… plus 5 years for possible MUR audits/checks.

We might be talking about NAT-NET in 2028 (not a joke)!

Reviewing/bookkeping in detail our activity is important:

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- **18/07/2023: 3rd PRIN meeting (L'Aquila): agenda.infn.it/event/36617**
- **26/11/2023: Final Scientific Report - to be submitted**

2023 group photo here!

Nice occasions to learn about each other's activity and meet old and new friends

Research topics and people in our PRIN →

NAT-NET Abstract

Neutrino and Astroparticle Physics represent rapidly evolving fields at the crossroad of particle physics, astrophysics and cosmology. In this context, the project **NAT-NET (Neutrino and Astroparticle Theory Network)** is being proposed by research groups based in Bari, Naples and L'Aquila, with a strong tradition of common interests and research activities in astroparticle theory and phenomenology. NAT-NET builds upon previous collaboration experiences involving the Universities and INFN branches of **Bari, Naples and L'Aquila** and, more recently, the Gran Sasso Science Institute.

NAT-NET aims at performing top-level **research on open problems in neutrino and astroparticle physics,** including: deeper understanding of **neutrino mass-mixing phenomena** (flavor oscillations, absolute mass observables, possible new states and interactions) in different energies ranges (from meV relic to PeV astrophysical neutrinos); studying **astrophysical neutrino sources in a multi-messenger approach**; addressing issues related to early-universe and large-scale aspects of the cosmological model, such as **matter-antimatter asymmetry, nucleosynthesis, and dark matter**. This research program will be integrated by: **exchange visits; co-tutoring of students; organization of common events; outreach activities.**

NAT–NET Working Packages

WP1 - **Standard neutrino framework**. Investigation of the remaining unknowns of the three-neutrino framework (absolute masses and their ordering, Dirac/Majorana nature, CP phases); refinement of our understanding of neutrino oscillations in vacuum, in matter and with self-interactions; neutrinoless double beta decay with light Majorana neutrinos: constraints on its nuclear model uncertainties and connections with cosmological bounds.

WP2 - **Beyond the standard neutrino framework**. Sterile neutrino oscillations in the light of upcoming laboratory and cosmological data; constraints on new neutrino interactions; neutrinoless double beta decay beyond light Majorana neutrinos; long-distance and multi-messenger tests of dispersion relations; neutrinos as components or signals of dark matter; neutrino model building and leptogenesis.

WP3 - **Sources and fluxes of neutrinos and of other messengers**. From low to high energy: relic neutrino detection prospects; axions and axion-like particles in astrophysical contexts; issues in big-bang nucleosynthesis neutrinos; improvements of solar neutrino models and low-energy flux detection; set-up of a reference geo-neutrino model; tests of core-collapse supernova physics; high-energy neutrinos: study of astrophysical sources (within a multimessenger approach) and of propagation in the Earth.

WP4 - **The standard cosmological model and beyond.** Nonstandard scenarios for the relic neutrino background and big-bang nucleosynthesis; pre-big-bang and string cosmology; effects of large-scale inhomogeneities and anisotropies; laboratory approaches to vacuum energy; warm dark matter components via heavy neutrinos.

+ Education + Events + J. Club + Outreach + Experiments (+ PC's etc…)

Will be reviewed in detail by the conveners today, and highlighted by dedicated talks

Important to converge on a comprehensive list of papers and other PRIN "products"

People →

NAT-NET initial members (14 people)

1) INFN unit: LISI (P.I., BA) + VISSANI (LNGS) + MANGANO (NA) + MIGLIOZZI (NA)
2) U. of Bari unit: MARRONE (coordinator) + GASPERINI + TEDESCO + MONTANINO + PALAZZO
3) U. of Naples unit: MIELE (coordinator) + ROSA + MORISI
4) U. of L'Aquila unit: VILLANTE (coordinator)
5) GSSI unit: PAGLIAROLI (coordinator) => Under-40 researcher.

NAT-NET contracts expected: 2y AdR INFN + 1y AdR UniNa + 1y RTDA GSSI

8. Major new contracts for staff specifically to recruit

nº	Associated or principal investigator	Number of contracts RTD expected	Number of research grants expected
1.	LISI Eligio	0	2
2.	MARRONE Antonio	0	0
3.	MIELE Gennaro	0	1
4.	PAGLIAROLI Giulia	1	0
5.	VILLANTE Francesco Lorenzo	0	0
	Total	**1**	**3**

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Changes: Mangano INFN → UniNa; Pagliaroli GSSI → INFN

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NAT-NET contracts delivered: 3y AdR INFN + 1y AdR UniNa + 2y AdR GSSI

[+ 1m RTDA GSSI]

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Delivered PRIN contracts:

Antonio Marinelli, AdR INFN-NA Senior, 02/01/2020 – 01/01/2022 (2y)
"Studio delle sorgenti di neutrini di alta energia nell'epoca dell'approccio multimessaggero"
Many papers with NAT-NET tag

Olena Torbaniuk, AdR UniNa, 01/04/2021 – 31/03/2022 (1y; **check dates!)**
"Characterization of active galactic nuclei properties for astrophysical and cosmological studies"
Paper with NAT-NET tag: 2208.10984

Samiran Roy, AdR INFN-NA Junior, 09/03/2022 - 08/06/2023 (1y, break 09/05-08/08/2022)
"Characterization of cosmological and astrophysical effects due to dark matter particles, neutrinos and axions"
Papers with NAT-NET tag: 2212.11210 and 2305.16234

Saqib Hussain, AdR GSSI, 01/09/2022 + 2y
"Theoretical-phenomenological research activities for the study of high energy astrophysical sources with a multi-messenger approach (neutrinos, gamma rays and gravitational waves)"
*Paper with NAT-NET tag: in preparation (please **keep me updated**)*

[Giulia Pagliaroli, RTDA GSSI, 23-30/06/2021, in transition from GSSI to INFN]

Increase of contract budget intended to compensate Covid decrease of travel budget

People that have joined NAT-NET or contributed to it in many ways:
(as taken from a recent mailing list, in alphabetical order)

Antonio	Ambrosone
Roberta	Calabrese
Marco	Chianese
Mattia	Cielo
Salvatore	Esposito
Damiano F.G.	Fiorillo
Ersilia	Guarini
Jacob	Gunn
Fabio	Iocco
Gaetano	Lambiase
Giuseppe	Lucente
Leonardo	Mastrototaro
Rasmi E.H.	Munoz
Ofelia	Pisanti
Ninetta	Saviano
…	…

Formal recognition can and should be given to these (& other?) colleagues.
Unit coordinators are allowed add PRIN members in their final “rendicontazione”

Comments and caveats:

People who received AdR PRIN contracts are already included by default

People who have benefited of PRIN funds (missioni or PC's etc.) should be added!

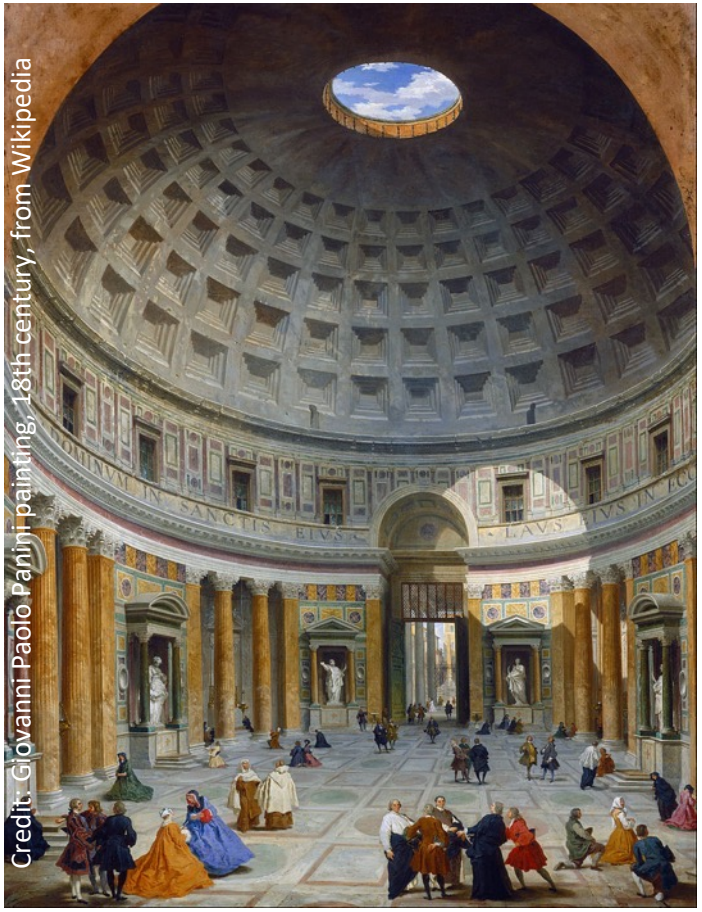
They should be added at "zero cost" (i.e. not contributing to PRIN with their salary)

People belonging to other PRINs from the same 2017 call cannot be added

In any case, unit coordinators should keep in touch with both their administration and the member(s) to be added, to see how to proceed technically.

In particular, note that there may be problems if the names are not listed by the Cineca database, e.g. for non-staff. These technicalities may require some time & effort.

PANTHEON 2022 (PRIN 2022E2J4RK) … and beyond



Perspectives in Astroparticle and Neutrino THEory with Old and New messengers

PERSONNEL AND UNITS

The 17 proponents are organized in the following units:

* INFN
Eligio Lisi, Director of Research, Bari (P.I.)
Pasquale Migliozzi, Senior Researcher - Naples
Francesco Vissani, Director of Research - Lab. Naz. Gran Sasso
Giovanni Marozzi, Associate Prof. (external, U. Pisa)

* U. of Bari
Alessandro Mirizzi, Associate Prof. (Coord.)
Antonio Marrone, Associate Prof.
Antonio Palazzo, Associate Prof.
Luigi Tedesco, Associate Prof.
Daniele Montanino, Associate Prof. (external, U. of Salento)

* U. of Naples Federico II
Gianpiero Mangano, Full Prof. (Coord.)
Fabio Iocco, Associate Prof.
Ofelia Pisanti, Associate Prof.
Luigi Rosa, Associate Prof.

* U. of Rome Sapienza
Alessandro Melchiorri, Full Prof. (Coord.)
Roberto Maoli, Associate Prof.

* U. of L'Aquila
Francesco Lorenzo Villante, Full Prof. (Coord.)
Zurab Berezhiani, Full Prof.

+ added members

PANTHEON recently approved. Funding may officially start any day.
INFN will anticipate the MUR budget to allow early contract calls.

Most urgent decision after the start:
1y AdR to INFN-Pisa. But second 1y AdR, to INFN-Napoli or to INFN-LNGS?

Second urgent problem: To buy PC's etc. as soon as possible in all units.

General constraint: Various expenses are accountable ("rendicontabili")
→ Even more book-keeping needed…

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Despite the burden, I'm happy to serve as P.I. for NAT-NET & PANTHEON.
I think that these and previous PRINs have been beneficial to our community.
For future PRIN's, it seems to me that other colleagues should take the baton.

End of Introduction - Let's talk about physics now!