

Fabrizio Nesti

Curriculum Vitæ

Contact Address: University of L'Aquila (Italy)
via Vetoio, I-67010 loc. Coppito, L'Aquila (AQ), Italy
E-mail address: nesti@aquila.infn.it
Web: <http://www.fisica.aquila.infn.it/homepages/nesti/>

My interests belong to the field of high energy physics, phenomenology beyond the standard model, touching upon gravity and astroparticle physics.

My research in phenomenology started from unification setups, Supersymmetric GUT and Flavour symmetries; more recently focused on Left-Right symmetry and the possibility that parity is restored at low scales, accessible at LHC, as hinted by neutrinoless double-beta decay.

In the gravitational and astroparticle arena, I studied large distance modifications of gravity; finding the first exact Black-Hole solutions that deviate from the Schwarzschild one.

I introduced also models of gravity with enlarged (Lorentz) gauge group, towards including other interactions, and studied their fermionic sector.

Previous and Ph.D. activity has been on matrix models and the nonperturbative formulation of string theory.

Personal data: Born on: February 21, 1967 in Pontedera (Pisa), Italy
Citizenship: Italian
Foreign languages: English, French.

Education: Pisa, October 1986, won a fellowship, at *Scuola Normale Superiore* in Pisa (**SNS**). At SNS I remained until 1989.

Degree in Physics obtained in July 1992 at University of Pisa with full marks. Title of thesis: “*New Method for the determination of the Gluonic condensate*”. Supervisor prof. A. Di Giacomo.

Ph.D. in Physics obtained in October 1996 at SISSA/ISAS, Trieste. Title of thesis: “*Aspects of Large N Yang-Mills/Higgs theory and Matrix Models*”. Supervisors: prof. L. Bonora, D. Boulatov.

Positions: 2010–2011: at University of Ferrara: Research fellow
 2007–2009 at University of L’Aquila & LNGS: Research fellow
 2004–2006 at University of L’Aquila: Research fellow
 2000–2003 at SISSA’s MediaLab: Coordinator position (EP4)
 1998–1999 at SISSA: Research fellow

Selected publications:

BEYOND THE STANDARD MODEL

- **First Limits on Left-Right Symmetry Scale from LHC Data**
 M. Nemevšek, FN, G.Senjanović, Y. Zhang hep-ph/1103.1627
- **Three Extra Mirror or Sequential Families: A Case for Heavy Higgs and Inert Doublet**
 H. Martinez, A. Melfo, FN, G. Senjanović, *Phys. Rev. Lett.* 106 (2011) 191802
- **Left-Right Symmetry: from LHC to Neutrinoless Double Beta Decay**
 V.Tello, M.Nemevšek, FN, G.Senjanović, F.Vissani, *Phys. Rev. Lett.* 106 (2011) 151801
- **Left-Right symmetry at LHC**
 A. Maiezza, M. Nemevšek, FN, G. Senjanović *Phys. Rev. D* 82 (2010) 055022
- **Supersymmetric SO(10) for Fermion Masses and Mixings: Rank-1 Structures of Flavour**
 Z. Berezhiani, FN, [hep-ph/0510011] *JHEP* 0603:041 (2006)

GRAVITY AND ASTROPARTICLE PHYSICS

- **The dark matter density at the Sun’s location**
 P. Salucci, FN, G. Gentile, C. F.Martins, *A&A* 523 (2010) A83
 - **Chirality in unified theories of gravity**
 FN, R. Percacci, [hep-th/0909.4537] *Phys. Rev. D* 81 (2010) 025010
 - **Exact spherically symmetric solutions in massive gravity**
 Z. Berezhiani, D. Comelli, FN, L. Pilo, [hep-ph/0803.1687] *JHEP* 0807:130 (2008)
 - **Standard Model and Gravity from Spinors**
 F. Nesti, [hep-th/0704.3304] *Eur. Phys. J. C* 59 (2009) 723–729
 - **Spontaneous Lorentz breaking and massive gravity**
 Z. Berezhiani, D. Comelli, FN, L.Pilo, *Phys. Rev. Lett.* 99 (2007) 131101
-

Invited talks at conferences:

- ‘*Left Right @ LHC*’:
 - ‘The role of heavy fermions in fundamental physics’, Portorož, 2011
 - ‘LCH days in SPLIT’, Split, 2010
 - ‘A Look from the past into the future of High Energy Physics’, Split, 2010
 - (plenary talk) ‘Convegno Nazionale di Fisica Teorica’, Cortona, 2010
 - (review talk) ‘Interplay of Collider and Flavour Physics’, CERN, 2009
- ‘*Exact solutions in massive gravity*’:
 - ‘Contemporary problems in theoretical physics’, Vietri, 2011
 - ‘Hot topics in Modern Cosmology’, SW2, Cargese, 2008
 - ‘Workshop on consistent infrared modifications of Gravity’, Paris, 2008
- ‘*Graviweak/GraviGUT unifications*’:
 - ‘Hot topics in Modern Cosmology’, SW3, Cargese, 2009
 - ‘Workshop on the origin of C, P, T violations’, CPT@ICTP, 2008
- ‘*Soft SUSY-breaking and proton decay*’:
 - ‘Grand Unification’, GUT’07, Trieste, 2007
- ‘*SO(10) fermion masses from rank-one structures of flavour*’:
 - ‘Workshop on Neutrino Oscillations’ NOW-2003, Otranto, 2003

Invited seminars:

- ‘*Exact black hole solutions in massive gravity*’ Ljubljana, 2011
- ‘*Low scale Left Right symmetry and first LHC limits*’ ICTP, 2011
- ‘*Unified models of Gravity*’ Marseille, 2009
- ‘*Flavour symmetry and LR-symmetry prospects at LHC*’ Oslo, 2009
- ‘*Exact black hole solutions in massive gravity*’ Lausanne, 2008
- ‘*Massive gravity and lorentz breaking*’ SISSA, Trieste, 2007
- ‘*Soft SUSY breaking and Proton Decay*’ ICTP, 2007 and Padova, 2007

Other talks:

- ‘*Left Right @ LHC*’: PLANCK’10, CERN, 2010
- ‘*Graviweak unification*’ ‘Quantum Gravity/Geometry conf.’, QG2, Nottingham, 2008
- PLANCK-2007, Warsaw, 2007
- ‘*Fermion masses and mixings in SO(10) GUT*’ ICTP, 2006
- QUARKS-2006, S. Pietroburgo, 2006
- PLANCK-2005, Trieste, 2005
- *Older talks*: Invited seminar at the workshop “Extended workshop in string theory”, ICTP, June 1999. Talks at conferences of the TMR EU network “Integrability, non-perturbative effects, and symmetry in quantum field theory”, Durham, Tel Aviv, Trieste; at meetings on “Current problems in Theoretical Physics”, Vietri.

Organization activities:

- Organizer, in the last five years, of the “Gran Sasso Summer Institute” on astroparticle and phenomenology of high energy physics, held at the Gran Sasso National Laboratories (e.g. <http://summerinstitute.lngs.infn.it/2008>).

Refereeing:

- Referee for international scientific journals: Nucl. Phys. B, JHEP, Phys. Lett. B.

Teaching:

- 1997/98: “Istitutions of Mathematical Analysis”, Università di Milano Bicocca (Environmental Sciences) including examination and grading.
- 2004/06: lectures for the course “Theoretical Physics”, at University of L’Aquila.
- 2007: Evaluator for MS degree theses in (theoretical) Physics at University of L’Aquila.
- 2008: tutor on “Experimental tests of Gravity and the PPN formalism” (M. Crisostomi).
- 2008: tutor of MS degree on “CP violation and new contributions in Left-Right symmetric models” (A. Maiezza).
- 2009-present: PhD advisor on “Left-Right symmetric models and LHC” (A. Maiezza).

Personal attitude: My background and activity are quite wide and this proves useful both when facing new problems in the currently broadening field of (astro)particle physics, and when interacting with students and people approaching topics for the first time.

I have a good attitude to group work, and I have collected experience in coordinating local and distributed working groups.

I have also acquired experience in the submitting and running projects funded by the European Commission.

• Other Activities:

- Summer 1989: At Fermilab (Chicago), in the CDF group, I developed the first **Neural Networks** approach for triggering 'Beauty' and 'Top' processes out of the background events [1].
- 1997–1998: for a year teaching assistant for “Istituzioni di Analisi Matematica” at the Università di Milano Bicocca – Scienze Ambientali.
- 1997–1999: I participated in starting the JHEP project (<http://jhep.sissa.it>). First by designing and programming its typesetting style, then setting up the *typesetting office* (as well as programming its software tools) [10].
- 1999–2001: Administrator of the JHEP system, and of the italian site of the **arXiv** world preprint service (aka babbage.sissa.it).
- 2000–2003: **Senior system manager** at the SISSA's MediaLab, the SISSA laboratory for initiatives on electronic scientific publishing (<http://medialab.sissa.it>).
There I organized the laboratory development and production environment, and managed the relative system and users.
- 2000–2002, worked for the **European Project TIPS** (Tools for Innovative Publishing in Science) in the design, coordination and installation of a new portal evolution of the preprint archives, toward the integration of journals.
- 2001–2003: **Applied for the EU grant InDiCo** (Integrated Digital Conferences) from SISSA as main node, with M. Fabbrichesi as general coordinator. The project was approved and started in 2002. I coordinated its development. This involved designing the architecture of the system together with University of Udine, Amsterdam, Netherland's TNO and CERN, and coordinating the local and distributed working groups.

The main result now is the worldwide-adopted system of conferences <http://indico.cern.ch>.

• Computer-Science Expertise:

- Operating system administration: yearly experience in: Solaris (server, workstation, SunRay, load balancing clusters); HP-UX and Linux systems; Mac OS X, OS X-Server; basic Windows.
 - Good knowledge of network protocols and administration. Database management and tuning. Experience in storage (NAS or large RAID arrays). Web administration and security auditing.
 - Yearly experience of users management, both developers/programmers and administrative. (Administration for collaborative work: mailing lists, CVS, video conferences).
 - Software development: UML modeling for software analysis and architecture, Web development using DHTML, cgi, servlet/jsp, SSI, XML. Software modularization and integration via XML.
 - Programming: Fortran, C, Perl, Java. Long practice with symbolic computer calculus (e.g. Mathematica).
-

List of all Publications (date order)

- [1] **Neural Networks for Triggering**
F. Bedeschi, C. Bowers, M. Campbell, N. Chriss, B. Denby, F. Nesti,
IEEE Trans. Nucl. Sci. 37 (1990) No. 2, 248.
- [2] **Multimatrix Models: Integrability Properties and Topological Content**
L. Bonora, F. Nesti, E. Vinteler,
Int. J. Mod. Phys. A11 (1996) 1797 [hep-th/9506124]
- [3] **The Drin'feld Twist for $sl_q(2)$**
L. Dabrowski, F. Nesti, P. Siniscalco,
Proceedings of the "12th Italian Conference on General Relativity and Gravitational Physics", Roma 1996; World Sci. 1997 [q-alg/9610012]
- [4] **A Finite Quantum Symmetry for $M(3,C)$**
L. Dabrowski, F. Nesti, P. Siniscalco,
Int. J. Mod. Phys. A13 (1998) 4147-4162 [hep-th/9705204],
- [5] **3-Dimensional Large N Monopole Gas**
F. Nesti,
hep-th/9610127, *SISSA-143-96-EP, Oct 1996*.
- [6] **Aspects of Large N Analysis for Yang-Mills-Higgs and Matrix Models**
F. Nesti,
SISSA, Ph.D. thesis, Trieste, 1996.
- [7] **Matrix String Theory, 2D SYM Instantons and Affine Toda Systems**
G. Bonelli, L. Bonora, F. Nesti,
Phys. Lett. B435 303-311 (1998) [hep-th/9805071]
- [8] **String Interactions from Matrix String Theory**
G. Bonelli, L. Bonora, F. Nesti,
Nucl. Phys. B538 100-116 (1999) [hep-th/9807232]
- [9] **Matrix String Theory and its Moduli Space**
G. Bonelli, L. Bonora, F. Nesti, A. Tomasiello,
Nucl. Phys. B554 103-135 (1999) [hep-th/9901093]
- [10] **Heterotic Matrix String Theory and Riemann Surfaces**
G. Bonelli, L. Bonora, F. Nesti, A. Tomasiello,
Nucl. Phys. B564 86-102 (2000) [hep-th/9905092]
- [11] **The Journal of High Energy Physics: Scientific Publishing On The Web**
F. Asnicar, P. Dall'Aglio, S. Cerrato, A. de Felice, M. Di Fant, M. Mizzaro,
F. Nesti, M. Candusso, M. Miculan,
WebNet (2) 1999: 1482
- [12] **Perspectives in Neutrino Physics**
B. Bajc, F. Nesti, G. Senjanović, F. Vissani
In Proceedings of the "17th Rencontres de Physique de la Valle d'Aoste: Results and Perspectives in Particle Physics", La Thuile, Mar 2003

- [13] **SO(10) Fermion Masses from Rank-1 Structures of Flavour**
F. Nesti
Bari, Ottobre 2004, Nucl. Phys. (Proc Suppl), 145 (2005) 258–262
- [14] **Mirror World, Supersymmetric Axion and Gamma Ray Bursts**
L. Gianfagna, M. Giannotti, F. Nesti
JHEP 0410:044 (2004) [hep-ph/0409185]
- [15] **Nucleon-Nucleon Bremsstrahlung Emission of Massive Axions**
M. Giannotti, F. Nesti
Phys. Rev. D 72, (2005) 069801 [hep-ph/0505090]
- [16] **Supersymmetric SO(10) for Fermion Masses and Mixings: Rank-1 Structures of Flavour**
Z. Berezhiani, F. Nesti
JHEP 0603:041 (2006) [hep-ph/0510011]
- [17] **Soft SUSY breaking contributions to Proton Decay**
Z. Berezhiani, F. Nesti, L. Pilo
JHEP 0610:030 (2006) [hep-ph/0607303]
- [18] **Fermion Masses at intermediate $\tan\beta$: Unification of Yukawa Determinants**
F. Nesti
Proceedings of QUARKS'06 [hep-ph/0610307]
- [19] **Spontaneous Lorentz breaking and massive gravity**
Z. Berezhiani, D. Comelli, F. Nesti, L. Pilo
Phys. Rev. Lett. 99 (2007) 131101 [hep-th/0703264].
- [20] **Graviweak Unification,**
F. Nesti, R. Percacci,
J. Phys. A, Math. Theor. 41 (2008) 075405 [hep-th/0706.3307].
- [21] **Standard Model and Gravity from Spinors,**
F. Nesti,
Eur. Phys. J C59 (2009) 723–729 [hep-th/0704.3304].
- [22] **Flavour physics of leptons and dipole moments**
M. Raidal *et al.*,
Eur. Phys. J. C57 (2008) 13–182, (CERN WG on Flavour Symmetries) [hep-ph/0801.1826].
- [23] **Exact spherically symmetric solutions in massive gravity**
Z. Berezhiani, D. Comelli, F. Nesti, L. Pilo,
JHEP 0807:130 (2008), [hep-ph/0803.1687].
- [24] **Gravity Modification with Yukawa-type Potential: Dark Matter and Mirror Gravity**
Z. Berezhiani, F. Nesti, L. Pilo and N. Rossi,
JHEP 0907:083 (2009), [hep-ph/0902.0144]
- [25] **Lorentz Breaking Massive Gravity in Curved Space**
D. Blas, D. Comelli, F. Nesti and L. Pilo,
Phys. Rev. D 80 (2009) 044025 [hep-th/0905.1699]
- [26] **Chirality in unified theories of gravity**
F. Nesti, R. Percacci,
Phys. Rev. D81 (2010) 025010, [hep-th/0909.4537]
- [27] **The dark matter density at the Sun's location**
P. Salucci, F. Nesti, G. Gentile, C.F. Martins,
Astronomy & Astrophysics 523 (2010) A83, [astro-ph/1003.3103]

- [28] **Left-Right symmetry at LHC**
A. Maiezza, M. Nemevšek, F. Nesti, G. Senjanović
Phys. Rev. D 82 (2010) 055022, [hep-ph/1005.5160]
- [29] **Stars and (furry) Black Holes in Lorentz Breaking Massive Gravity**
D. Comelli, F. Nesti, L. Pilo
Phys. Rev. D 83 (2011) 084042, [hep-th/1010.4773]
- [30] **Left-Right Symmetry: from LHC to Neutrinoless Double Beta Decay**
V. Tello, M. Nemevšek, F. Nesti, G. Senjanović, F. Vissani,
Phys. Rev. Lett. 106 (2011) 151801, [hep-ph/1011.3522]
- [31] **Three Extra Mirror or Sequential Families: A Case for Heavy Higgs and Inert Doublet**
H. Martinez, A. Melfo, F. Nesti, G. Senjanović,
Phys. Rev. Lett. 106 (2011) 191802, [hep-ph/1101.3796]
- [32] **First Limits on Left-Right Symmetry Scale from LHC Data**
M. Nemevšek, F. Nesti, G. Senjanović, Y. Zhang
Phys. Rev. D, to appear, [hep-ph/1103.1627]
- [33] **Pearson's random walk in the space of the CMB phases. Evidence for parity asymmetry**
M. Hansen, A.M. Frejsel, J. Kim, P. Naselsky, F. Nesti,
Phys. Rev. D 83 (2011) 103508, [astro-ph/1103.6135]
- [34] **Finite Energy of Black Holes in Massive Gravity**
D. Comelli, M. Crisostomi, F. Nesti, L. Pilo
hep-th/1105.3010
- [35] **Inert Higgs Dark Matter and Extra/Mirror Families, after Xenon100**
A. Melfo, M. Nemevšek, F. Nesti, G. Senjanović, Y. Zhang
hep-ph/1105.4611

In preparation

- **Signals of left-right symmetry in accelerators and low energy leptonic processes**
(with M. Nemevšek, G. Senjanović, V. Tello, F. Vissani)
- **Magnetic anomaly in the UCN losses: signal for neutron oscillation?**
(with Z. Berezhiani, A. Serebrov)

Work in progress

- **A Higgs sector in unified models of gravity**
- **The MW rotation curve and indirect DM detection** (with P. Salucci)
- **Let there be Light, Dark Matter** (with A. Melfo et al)
- **Cosmological perturbations in massive gravity** (with D. Blas, D. Comelli, L. Pilo)