CdL preventivi 2/7/2018

CSN IV

Gruppo Teorico: LNF-TH

Enrico Nardi

- Info su GR4 ed Anagrafica 2020
- Attivitá sigle locali di CSN4 (contributi)

Anagrafica 2020

	Nome	Età	Posizione	Qualifica	ENP	NEMESYS	QFT_HEP	TASP	PRIN-SIMAMI_DT	UE-BY-NANOERA	UE-SUPERFIELDS	DOT4	CSN I	CSN II	CSN III
1	Babusci Danilo		Dipendente	I Ric.		20							50	20	
2	Bellucci Stefano		Dipendente	I Ric.		100									
3	Benfatto Maurizio		Dipendente	I Ric.		50									50
4	Corcella Gennaro		Dipendente	I Ric.	100										
5	Del Duca Vittorio		Dipendente	I Ric.	100										
6	Ghoshal Anish		Associato	Dottorando				100							
7	Gionti Gabriele		Associato	Ricercatore straniero								100			
8	Nardi Enrico		Dipendente	Dir.Ric.				100							
9	Pancheri Giulia		[P] Associato	Ass.Senior	0										
10	Cataldo Antonino		Assegn./Bors.	Borsa Ente Pubblico		0									
11	Giacchino Federica		Assegn./Bors.	Assegnista				50					50		
12	Darmé Luc		Borse post doc stranieri					100							

ENP	(Exploring New Physics)	FTE 2.0
NEMESYS	(Non Equilibrium Dynamics…)	FTE 1.7
TAsP	(Theoretical Astroparticle Physics)	FTE 3.5
GR4	(Sigla: FLAG-Bologna)	FTE 1.0
TOT:		FTE 8.2

FORTHCOMING APPOINTMENTS

- Vittorio Del Duca will rejoin from April 1st, 2020

- New INFN Th. Postdoc, Luc Darmé, will join from September 2nd 2019

- Assegno PADME (50%) + GR4 (50%) reconfirmed until October 2020

- Three proposals: FELLINI MSC-COFUND fellowships (3 years) @ LNF (1st site):
  (Deadline July 16th. Beginning between February and June 2020)
  1. ALPs phenomenology, ALPs portal to DM (ALPs searches at PADME)
  2. Local DM density and velocity (Axion haloscopes, Directional DM searches)
  3. Axion cosmology and phenomenology (Axion experiments)

- **Cabibbo** postdoctoral theory fellowships (2 yrs at LNF + 1 yr in one Rome U.)
  > Draft for the call (bando) already submitted in Amm. C.le
  > Call expected to be published by mid September
  > Evaluation: late November 2019. Offer: early January 2020. Start: fall 2020
  > Starting with fall 2021: Two Cabibbo theoretical fellows at LNF

ENP

Exploring New Physics

CSN4 Linea 2 (Phenomenology of elementary particles)

R.L. Gennaro Corcella

- G. Corcella 100%
- V. Del Duca 100% (April 1st, 2020)
- G. Pancheri (senior associate)

IS Exploring New Physics (ENP) – Nodi: LNF, RM1, RM2, NA

Responsabile Nazionale: G. D'Ambrosio (NA); Responsabile LNF: G. Corcella

Afferenti LNF:

G. Corcella (FTE=1, Ric. II Livello), V. Del Duca (FTE=1, Ric. II Livello, da 04/20)

G. Pancheri (senior associate)

Attività di ricerca su vari temi di fenomenologia dei collider:

- Test di precisione del Modello Standard e ricerche di nuova fisica ai collider di alta e bassa energia, in particolare supersimmetria, produzione di bosoni pesanti Z', modelli 331, Higgs e quark esotici;

- Calcoli di precisione e simulazioni Monte Carlo per interazioni forti ed elettrodeboli a LHC e futuri collider (FCC, HL/HE-LHC): ampiezze di scattering ad alta energia e nel limite di Regge, risommazione di gluoni soffici, teorie di super Yang–Mills con $N = 4$, fisica del quark top, sezione d'urto totale non diffrattiva.

Organizzazione: joint workshops LNF/Roma (G.C.), seminari generali (G.C.), PHOTON 2019 (G.C. e G.P.), Linear and Future Colliders 2019 (G.C. e G.P.), Amplitudes 2019 (V.D.D.), Towards Accuracy at Small x (V.D.D.)

LNF Spring School (G.C.)

Gennaro Corcella:

1. Fisica del top: determinazione accurata delle incertezze perturbative e non perturbative sulla massa del top

ACE (Analysis Consultant and Expert) per l'analisi di ATLAS sulla misura della massa del top da muoni soffici $(t \to bW,\ W \to \ell\nu,\ b \to B \to X\mu)$

Incertezza nell'identificazione delle misure della massa del top ('Monte Carlo mass') con definizioni teoriche quali la 'pole mass' o massa $\overline{\rm MS}$

G.C., Front. in Phys. 7 (2019) 54 and Yellow Report on SM at HE/HL-LHC, arXiv:1902.04070

2. Modelli 331 a LHC: simmetria $SU(3)_C \times SU(3)_L \times U(1)_X$ predice bileptoni vettoriali $Y^{\pm\pm}$ e scalari $H^{\pm\pm}$ con $L = \pm 2$ in $pp \to Y^{++}Y^{--}(H^{++}H^{--}) \to (\ell^+\ell^+)(\ell^-\ell^-)$

In progress: quark esotici T di carica 5/3 in processi tipo $pp \to T\bar{T} \to (Y^{++}b)(Y^{--}\bar{b})$

G.C., A.Costantini, C.Corianò, P.Frampton, PLB785 (2018) 73; G.C., M. Ghezzi, G.M. Pruna, L. Panizzi, in progress

3. Produzione di ALPs (Axion Like Particles, a) in collisioni di positroni (550 MeV) su bersaglio fisso di elettroni (PADME)

$e^+e^- \to a\gamma$: limiti sugli accoppiamenti $g_{a\gamma}$ e g_{ae} e sensibilità di PADME alle ALPs

G.C., L. Delle Rose, F. Giacchino, M.Raggi, in progress

Gruppo di lavoro 'Simulazione di eventi a LHC: dalla generazione alla ricostruzione' a INSPYRE e IDF 2019 presso LNF (con Marianna Testa)

Talks at SUSY 2018, ATLAS top WG, workshops on HE/HL-LHC

Relazione sull'attività di ricerca

Vittorio Del Duca

Linee di ricerca

- migliorare l'accuratezza teorica nella produzione inclusiva del bosone di Higgs [2]
  e nella produzione di Higgs in associazione con 1 jet [1]
- potenziare il calcolo di ampiezze di scattering in teorie di gauge,
  mediante l'uso di concetti avanzati di algebra moderna [3]

[1] M. Becchetti, R. Bonciani, V. Casconi, V. Del Duca, F. Moriello,
"Planar master integrals for the two-loop light-fermion electroweak corrections to Higgs plus jet production,"
JHEP 1812 (2018) 019 [arXiv:1810.05138 [hep-ph]]

[2] C. Anastasiou, V. Del Duca, E. Furlan, B. Mistlberger, F. Moriello, A. Schweitzer, C. Specchia,
"Mixed QCD-electroweak corrections to Higgs production via gluon fusion in the small mass approximation,"
JHEP 1903 (2019) 162 [arXiv:1811.11211 [hep-ph]].

[3] V. Del Duca, C. Duhr, F. Dulat, B. Penante,
''All two-loop MHV remainder functions in multi-Regge kinematics,"
JHEP 1901 (2019) 162 [arXiv:1811.10398 [hep-th]].

G. Pancheri – Associato Senior

Pubblicazioni

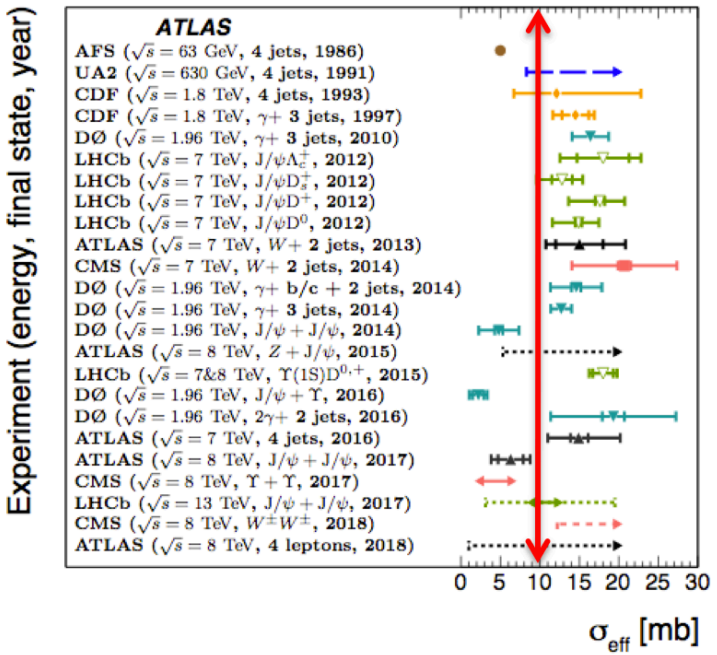
- Analysis and implication of precision near forward TOTEM data, Phys.Rev. D99 (2019) 034014
- The elastic differential pp cross-section at 13 TeV an empirical model analysis, EPJ Web Conf. 206 (2019) 06003

Relazioni su invito

- ISMD 2018 – Singapore Settembre 2018
- MultiParton Interactions 2018 – Perugia Dicembre 2018

Storia e divulgazione:

- Touschek with AdA in Orsay and the first direct observation of e+e- collisions, arXiv:1812.11847
- Bruno Touschek in Germany after the war – in preparazione



Sezione d'urto efficace per Double Parton Scattering at LHC – modello soft gluons Proceedings Perugia 2018, in preparazione

NEMESYS

Non Equilibrium dynamics Models and Excited State properties of low-dimensional SYStems

CSN4 Linea 6 (Statistical Physics and Applied Field Theory)

R.L. Stefano Bellucci

- D. Babusci 20%
- S. Bellucci 100%
- M. Benfatto 50%
- A. Cataldo (Ass. Ric.)
- A. Sorrentino (Borsista Neolaureato)

NEMESYS-Non Equilibrium dynamics Models and Excited state properties of low-dimensional SYStems- *S. Bellucci (LNF spokesperson) Resp. Naz. Unical (gruppo CS, A. Sindona), additional nodes: RM2 (G. Stefanucci), TIFPA (S. Taioli)*

Main research issues

Spectroscopies, Electron correlations, Density Functional Theory, Modeling-Simulations and low-dimensional systems

Richiesta 2019 11 KE Missioni

NEMESYS started 2017 (closing end 2020) evaluated AAA by referees

NEMESYS-Non Equilibrium dynamics Models and Excited state properties of low-dimensional SYStems- *S. Bellucci (LNF spokesperson) A. Sindona (Resp. Naz.), continued*

LNF activities in 2019

Transport phenomena in carbon based nanostructures

The thermal motion of graphene atoms was investigated using angular distributions of transmitted protons. The static proton-graphene interaction potential was constructed applying the Doyle-Turner's expression for the proton-carbon interaction potential. The effects of atom thermal motion were incorporated by averaging the stati proton-graphene interaction potential over the distribution of atom displacements. The covariance matrix of graphene displacements was modeled according to the Debye theory, and calculated using Molecular Dynamics approach. Proton trajectories were used for construction of angular yields. We have found that there are lines, called rainbows, along which the angular yield is very large.

We employed Green's function method for describing multiband models with magnetic impurities and applied the formalism to the problem of chromium impurities adsorbed onto a carbon nanotube. Density functional theory is used to determine the bandstructure, which is then fit to a tight-binding model to allow for the subsequent Green's function description. Electron–electron interactions, electron–phonon coupling, and disorder scattering are all taken into account (perturbatively) with a theory that involves a cluster extension of the coherent potential approximation. We show how increasing the cluster size produces more accurate results and how the final calculations converge as a function of the cluster size.

NEMESYS-Non Equilibrium dynamics Models and Excited state properties of low-dimensional SYStems- *S. Bellucci (LNF spokesperson), A. Sindona (Resp. Naz.), continued*

Collaborations in 2020

NATO Emerging Security Challenges Division, SPS Programme projects "Nanocomposite based photonic crystal sensors of biological and chemical agents" 2018-2021, directed by S. Bellucci, with Fraunhofer Institute Goelm, Germany and Ukraine Nat. Acad. Sciences, Kiev.

Publications 2019 (I)

X-ray Absorption and Magnetic Circular Dichroism in CVD Grown Carbon Nanotubes
S Bellucci, A Cataldo, A Tagliaferro, M Giorcelli, F Micciulla
Materials 12 (7), 1073

Investigation of the graphene thermal motion by rainbow scattering
M Ćosić, M Hadžijojić, R Rymzhanov, S Petrović, S Bellucci
Carbon 145, 161-174

Thermodynamic Geometry of Yang–Mills Vacua
S Bellucci, BN Tiwari
Universe 5 (4), 90.

NEMESYS-Non Equilibrium dynamics Models and Excited state properties of low-dimensional SYStems- *S. Bellucci (LNF spokesperson), A. Sindona (Resp. Naz.), continued*

Publications 2019 (II)

Electron Transport in Carbon Nanotubes with Adsorbed Chromium Impurities
S Repetsky, I Vyshyvana, Y Nakazawa, S Kruchinin, S Bellucci
Materials 12 (3), 524

Transmittance and Reflectance Effects during Thermal Diffusivity Measurements of GNP Samples with the Flash Method
S Bellucci, G Bovesecchi, A Cataldo, P Coppa, S Corasaniti, M Potenza
Materials 12 (5), 696

Preparation of Few-Layer Graphene Dispersions from Hydrothermally Expanded Graphite
C Vacacela Gomez, T Tene, M Guevara, G Tubon Usca, D Colcha, H Brito, ...
Applied Sciences 9 (12), 2539

Recent Progress on Novel Ag–TiO2 Nanocomposites for Antibacterial Applications
J Prakash, BS Kaith, S Sun, S Bellucci, HC Swart
Microbial Nanobionics, 121-143

Novel non-destructive evaluation technique for the detection of poor dispersion of carbon nanotubes in nanocomposites
A Pantano, N Montinaro, D Cerniglia, F Micciulla, S Bistarelli, A Cataldo, ...
Composites Part B: Engineering 163, 52-58

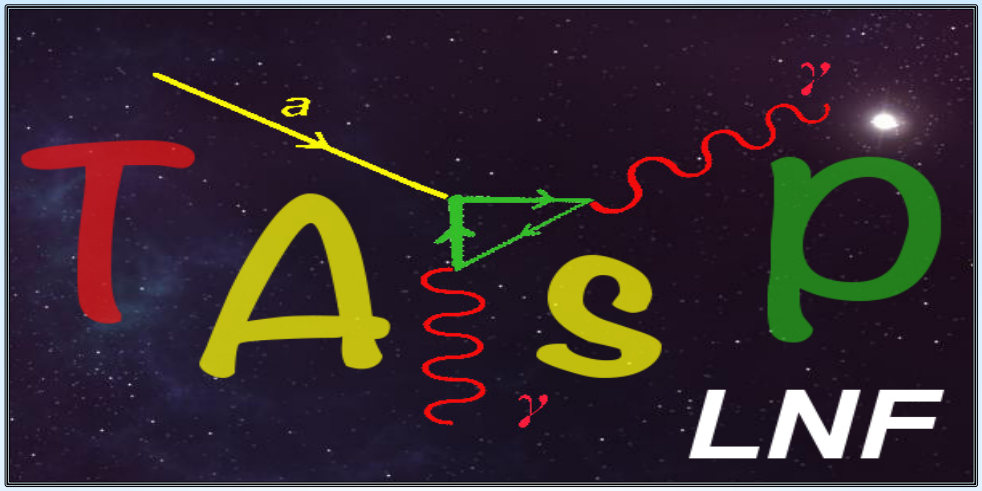
NEMESYS-Non Equilibrium dynamics Models and Excited state properties of low-dimensional SYStems- *S. Bellucci (LNF spokesperson), A. Sindona (Resp. Naz.),*

Talks in 2019

LNF, 4 April 2019, INSPYRE
S. Bellucci: **Nanomaterials for Bio-Medicine**

LNF 19 March 2019, U.Cassino@LNF Lectures
S. Bellucci: **Graphene in high-frequency electronics: microwave-photonic devices, biosensors and e.m. compatibility.**

MATINEE LNF 18 Gennaio 2019
S. Bellucci: **Nanomateriali per la Bio-Medicina: cosa sono e dove si trovano?**



Theoretical Astroparticle Physics

CSN4 Linea 5 (Astroparticle Physics)

R.L. Enrico Nardi

- F. Bjorkeroth 100% (Bors. Postdoc INFN, until Oct. 2019)
- L. Darmé 100% (Bors. Postdoc INFN, from Sept. 2019)
- A. Ghoshal 100% (Ph.D. Stud. RM3, until April 2020)
- F. Giacchino 50% (Assegno Ric, until Oct. 2020)
- E. Nardi 100%

TAsP-LNF: Argomenti di Ricerca

Well established lines of research:

- Cosmological matter/antimatter asymmetry (Leptogenesis)
- Dark Matter (models & properties)
- Masses and mixings of quarks and leptons (Flavour models)

New lines of research:

- Axion phenomenology, astrophysical/cosmological implications
- Dark Sectors: (Searches for Dark Photons/ALPs at PADME)

Axion physics and PQ symmetries:

Astrophobic Axions

Luca Di Luzio,[1] Federico Mescia,[2] Enrico Nardi,[3] Paolo Panci,[4] and Robert Ziegler[4]

PHYSICAL REVIEW LETTERS **120,** 261803 (2018)

In progress: *The electrophobic side of Astrophobic Axions* *(same authors + F.Bjorkeroth)*
Study of axion-electron decoupling conditions: important for WD & RG

Accounting for hints of extra cooling in WD/RG with axion emission *(models)*
F. Bjorkeroth, M. Fedele, L. Di Luzio, F. Mescia, EN

U(1) flavour symmetries as Peccei-Quinn symmetries

Fredrik Björkeroth,[a] Luca Di Luzio,[b] Federico Mescia[c] and Enrico Nardi[a]

JHEP 1902 (2019) 133

In progress: *Covert symmetries and minimal models for lepton flavour*
(we obtain predictions for ν-mass scale & CP phases from a very simple idea)
F. Bjorkeroth, L. Di Luzio, F. Mescia, EN

Contribution to the KLASH Conceptual Design Report: The KLASH Physics Case

Fredrik Björkeroth,[a] Maurizio Giannotti,[b] Enrico Nardi,[a] Luca Visinelli [c,d]

In progress: *The landscape of axion models* **(Review article for Physics Reports)**
L. Di Luzio, M. Giannotti, EN, L. Visinelli

Collaboration accepted for a 2019 Working Group at the Aspen Center for Physics (CO) (July 15-28)

Resonant production of dark photons in positron beam dump experiments

Enrico Nardi,[1,*] Cristian D. R. Carvajal,[2] Anish Ghoshal,[1,3] Davide Meloni,[3,4] and Mauro Raggi[5]

PHYSICAL REVIEW D **97,** 095004 (2018)

In progress: *Axion-like particle production in e+e- annihilation (focus on PADME reach)*
G. Corcella, L. Delle Rose, F. Giacchino, EN, M. Raggi

RIASSUMENDO:

- *Per quanto nel 2018/19 le risorse umane (FTE) del Gruppo Teorico siano rimaste ancora piuttosto limitate, la produzione scientifica di tutte e tre le sigle di CSN4 (ENP, NEMESYS, TAsP) ha continuato ad essere intensa e sempre di ottimo livello*

- *Collaborazioni, interazioni e cross-breeding con i colleghi sperimentali LNF sono in continuo sviluppo. Contatti ed incontri con i teorici delle Università romane avvengono su base regolare, con frequenti visite a Frascati soprattutto di giovani RTDA, RTDB e postdocs. Collaborazioni nazionali ed internazionali continuano a svilupparsi e consolidarsi*

- *Il gruppo ha recentemente ricevuto importanti riconoscimenti sia verbali sia di natura più concreta. L'impressione è che l'ipotesi di un rafforzamento sia ora vista con favore dal managment. In termini di TD la via sembra sia ben delineata e percorribile. Un rafforzamento in termini di numero di TI rimane ovviamente l'obiettivo fondamentale*

- *Alla Div. Ric. chiediamo la disponibilità per supporto di segreteria anche per qualche Workshop organizzato con preavviso limitato (RJW)*