Consiglio di Sezione INFN Pavia

10 Giugno 2014

Relazione Gruppo IV

Fulvio Piccinini, INFN Pavia

OUTLINE

- Resoconto riunione CSN4 9-10 Aprile 2013

- Consuntivi 2013 IS PV → nuove IS 2014

TS11	Resp. Loc. M. Carfora	Resp. Naz. L. Bonora
PR21	Resp. Loc. O. Nicrosini	Resp. Naz. P. Nason
AD31	Resp. Loc. M. Radici	Resp. Naz. M. Radici
MB31	Resp. Loc. C. Giusti	Resp. Naz. O. Benhar
GE41	Resp. Loc. G.M. D'Ariano	Resp. Naz. G. Cassinelli
MI41	Resp. Loc. I. Guarneri	Resp. Naz. R. Artuso
FA51	Resp. Locl. M. Roncadelli	Resp. Naz. G. Fogli

IS dal 01/01/2014

BELL	(4)	R.L. G.M. D'Ariano	R.N. P. Zanghì	(GE)
DYNSYSMATH	(4)	R.L. I. Guarneri	R.N. R. Artuso	(MI)
GEOSYM_QFT	(4)	R.L. A. Marzuoli	R.N. F. Lizzi	(NA)
MANYBODY	(3)	R.L. C. Giusti	R.N. O. Benhar	(RM)
NINPHA	(3)	R.L. M. Radici	R.N. . Radici	(PV)
QFT@COLLIDERS	(2)	R.L. O. Nicrosini	R.N. F. Piccinini	(PV)
TasP	(5)	R.L. M. Roncadelli	R.N. E. Lisi	(BA)

Riunione CSN4

9-10 Aprile 2014

https://agenda.infn.it/conferenceDisplay.py?confId=7197

riporto nel seguito alcune slides presenti sul sito

Linee scientifiche

- Linea 1: Teoria dei Campi e di Stringa
- Linea 2: Fenomenologia delle Particelle
- Linea 3: Fisica Nucleare e Adronica
- Linea 4: Metodi Matematici
- Linea 5: Fisica Astro-particellare
- Linea 6: Fisica Statistica e
  Teoria di Campo Applicata
- DOT4:

Comunicazioni

FINAL INFN CVI Report 2013

Members of the CVI Panel:
N. Amodio, Confindustria, Italy
P. Binétruy, APC Laboratory, France
P. Drell, SLAC, USA
A. Frey, University of Göttingen, Germany
M.N. Harakeh, KVI Groningen, Netherlands
C. Spiering, DESY, Germany
E. Zaninotto, Università di Trento, Italy

CSN4

The Italian theoretical physics program remains among the best in the world. It is very strong both quantitatively (989 FTE) and qualitatively, as testified by the number of publications and impact factors. The difficulties in hiring young theorists remain very worrying. Neighboring countries are exploiting the hiring difficulties in INFN to their own benefit and INFN's detriment.

Comunicazioni

The Committee was very pleased to see that the convergence towards a smaller number of larger groups, a consolidation that had been started last year and which the Committee fully supported in its report last year, was actively pursued: the number of “Initiative Specifiche” has significantly decreased from 50 to 39, as well as the number of local groups, from 220 to 170. In a similar spirit of convergence, the Committee praises the upgrade of the CSN4 cluster “zefiro” which serves the computing needs of some 16 research groups.

A noteworthy infrastructure for the theory community is the Galilleo Galilei Institute in Florence which has succeeded through a careful choice of its programs during its 7 years of existence, to become one of the major institutions in the world hosting long-term workshops. The full support to this institution should be continued, since this is a precious window of the Italian theory community to the world.

Premi Fubini 2013

Estratto dal verbale della commissione:

La Commissione si compiace dell'alto livello di molte fra le tesi presentate, benché questo renda assai difficile la scelta di sole tre tesi da premiare. Dopo un attento esame e un'approfondita discussione, tenendo conto della rilevanza e originalità dei risultati ottenuti, della chiarezza dell'esposizione, dell'organizzazione dei temi trattati nelle tesi, nonché di parametri oggettivi (prestigio delle riviste internazionali su cui sono stati pubblicati i relativi lavori e numero di citazioni ricevute), la Commissione seleziona le seguenti tre tesi, in ordine alfabetico di autore, per l'assegnazione del premio:

Luca Barzè (Università di Pavia)
"Single vector boson production at QCD and EW NLO with POWHEG"

Andrea Marini (Università di Perugia)
"Thermal Brane Probes"

Massimo Taronna (Scuola Normale Superiore - Pisa)
"Higher-Spin Interactions: Three-point functions and beyond"

Premi Fubini 2013

La Commissione ritiene inoltre opportuno segnalare le seguenti tesi di dottorato come meritevoli di menzione speciale:

Claudio Cremaschini (SISSA - Trieste)
"Foundations of Kinetic Theory for Astrophysical Plasmas with Applications to Accretion Discs and Electromagnetic Radiation-reaction"

Andrzej Hryczuk (SISSA - Trieste)
"Loop and non-perturbative effects in dark matter phenomenology"

Cesare Nardini (Università di Firenze)
"Energy landscapes, equilibrium and out of equilibrium physics of long and short range uberacting systems"

Francesco Vincenzo Pepe (Università di Bari)
"Bose-Einstein condensation: static and dynamical aspects"

- I coordinatori di Bari, Firenze e Trieste sono invitati a informare gli interessati di questa "menzione speciale".

Borse Post-doc 2013/14

Sede	IS	Linea Scientifica	# domande
Bologna	PI14	1	111
Firenze	FI11	1	32
Milano Bicocca	MI11	1	40
Roma 2	TV12	1	126
Lecce	BA21	2	69
Roma 3	RM21	2	125
Pavia	AD31	3	51
Padova	PI32	3	30
Napoli	NA41	4	80
LNGS	FA51	5	74
Trieste	PD51	5	122
Parma	TO61	6	18

Borse post-doc 2014/15

Proposta di ripartizione per linee:

	% FTE	# IS in fascia 1	# medio di domande per borsa nel biennio scorso	**# Borse proposte per il 2014**
Linea 1	30.1	6 su 10	95	**4**
Linea 2	16.7	8 su 9	90	**3**
Linea 3	11.8	3 su 5	40	**2**
Linea 4	12.0	5 su 5	45	**1**
Linea 5	17.4	4 su 5	73	**2**
Linea 6	12.1	1 su 5	15	**0**
				12

La proposta di suddivisione tiene conto di vari fattori, fra cui il peso della linea scientifica, i risultati della valutazione delle IS, il numero di domande pervenute negli ultimi due anni….

Consuntivi e assegnazioni

- **Consuntivi 2011**

	Assegnati	Dopo storni	Spesi	Avanzati	% di residuo
missioni	1390	1331	**1179**	152	11%

- **Consuntivi 2012**

	Assegnati	Dopo storni	Spesi	Avanzati	% di residuo
missioni	1490 (1040+350)	1450	**1297**	153	10.6%

- **Consuntivi 2013**

	Assegnati	Dopo storni	Spesi	Avanzati	% di residuo
missioni IS	1100	1070	**979**	91	8.5%
missioni dot	400	430	**403**	27	6.3%
Totale missioni	1500	1500	**1382**	118	7.9%

Budget 2014

- Per il 2014 la GE ci ha assegnato 2.750 KE:

Missioni	«Fondo Indiviso»
1450 KE	1300 KE

- A Ottobre abbiamo assegnato

	Missioni	«Fondo Indiviso»
I.S.	1100 KE	
Dotazioni	250 KE	1050 KE

- Ci restano quindi

Missioni	«Fondo Indiviso»
100 KE	250 KE

- Ho chiesto l'autorizzazione per assegnare adesso **100 KE su missioni e 100 KE su fondo indiviso** (i restanti 150 KE di fondo indiviso li potremo assegnare a giugno)

MANYBODY

Carlotta Giusti

Matteo Vorabbi

Franco Pacati

Andrea Meucci

ELECTROWEAK REACTIONS ON STABLE AND EXOTIC NUCLEI

- quasielastic (QE) electron and neutrino-nucleus scattering
- elastic and QE electron scattering on exotic nuclei
- parity-violating electron scattering (PVES)

QUASIELASTIC ELECTRON AND NEUTRINO-NUCLEUS SCATTERING

- electron scattering: electron is a probe to investigate nuclear properties
- neutrino experiments aimed to determine neutrino properties
- high precision determinations of the neutrino oscillation parameters require a deep understanding of neutrino interactions with matter
- nuclear effects must be well under control
- models developed for electron scattering and tested in comparison with electron scattering data have been applied to neutrino scattering
- the relativistic Green's function (RGF) model describes final-state interactions in the inclusive QE lepton-nucleus scattering
- RGF successfully tested in comparison with (e,e') data
- RGF extended to neutrino scattering and compared with available CCQE and NCE data

QUASIELASTIC ELECTRON AND NEUTRINO-NUCLEUS SCATTERING

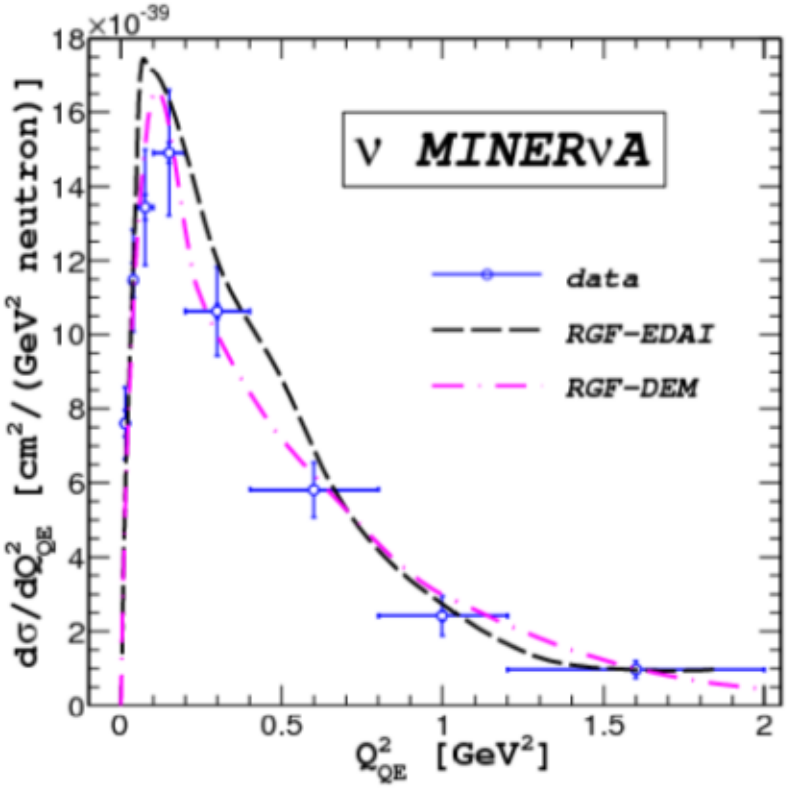
A. Meucci, C. Giusti, M. Vorabbi, PRD 88 013006 (2013)

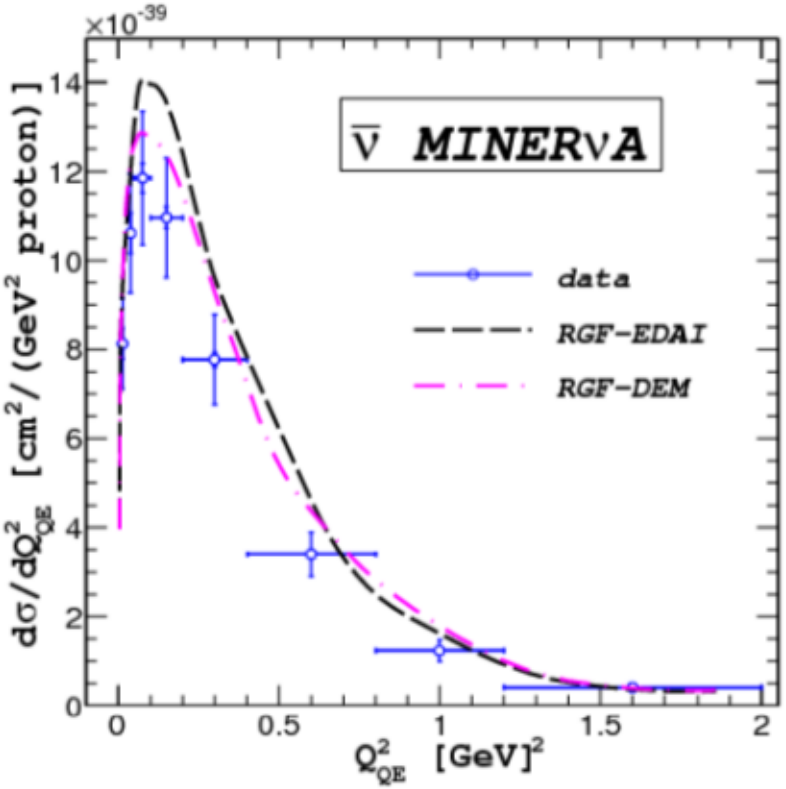
R. Gonzalez Jimenez, J.A. Caballero, A. Meucci, C. Giusti, M.B. Barbaro, M.V. Ivanov, J.M. Udias, PRC 88 025502 (2013)

A. Meucci, C. Giusti PRD 89 057302 (2014)

A. Meucci, C. Giusti PRD to be published

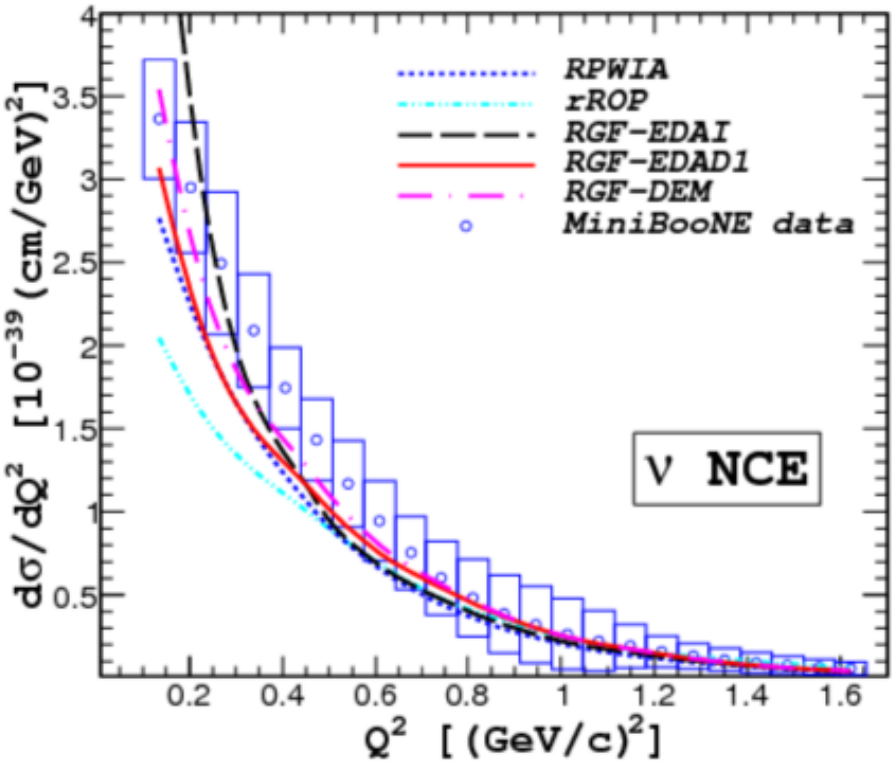
Comparison MINERvA CCQE neutrino-antineutrino scattering

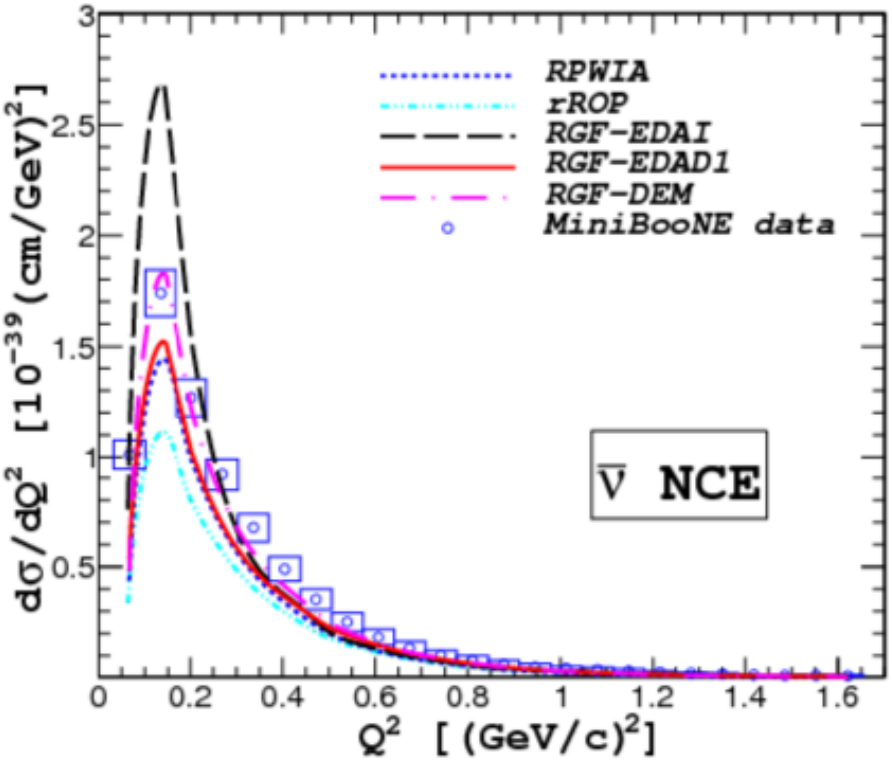




A. Meucci and C.Giusti PRD in press

Comparison with MiniBooNE NCE data





A. Meucci and C.Giusti PRD 89 (2014) 057302

ELECTRON SCATTERING ON EXOTIC NUCLEI

- Elastic and Quasi-Elastic Electron Scattering off Nuclei with Neutron Excess: A. Meucci, M.Vorabbi, C. Giusti, P. Finelli, F.D. Pacati PRC 87 054620 (2013)
- Elastic and Quasi-Elastic Electron Scattering off the N = 14,20, and 28 isotonic chains: : A. Meucci, M.Vorabbi, C. Giusti, P. Finelli, F.D. Pacati PRC 89 034604 (2014)

MOTIVATION

- understanding the evolution of nuclear properties as a function of N/Z
- nuclear reactions main source of information on nuclear properties
- direct reactions give insight into the s.p. properties
- advantages of the elm probe can be extended to study exotic nuclei
- in the next years advent of RIB facilities will provide data on unstable nuclei
- electron RIB colliders that use storage rings under construction (GSI, RIKEN) will offer unprecedented opportunities to study exotic nuclei with electron scattering (ELISe at FAIR, SCRIT at RIKEN)
- elastic scattering: global properties nuclear density distributions
- quasi-elastic: dynamical properties

Elastic and Quasielastic Electron Scattering on Isotopic and Isotonic Chains

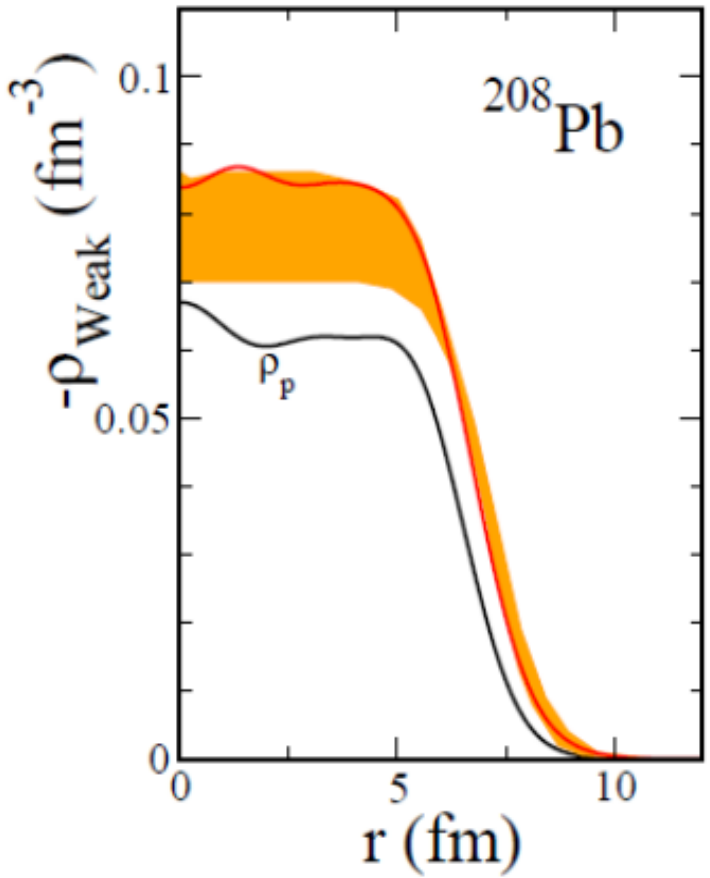
Results are presented for the elastic and QE cross sections and for the parity-violating (PV) asymmetry. The calculations are performed within the framework of the DWBA and the proton and neutron density distributions are evaluated with different relativistic models. The results of the models are tested in comparison with some of the elastic electron scattering available on different nuclei. Then, the evolution of some nuclear properties is investigated on isotopic and isotonic chains.

The PV asymmetry gives access to the neutron distribution.

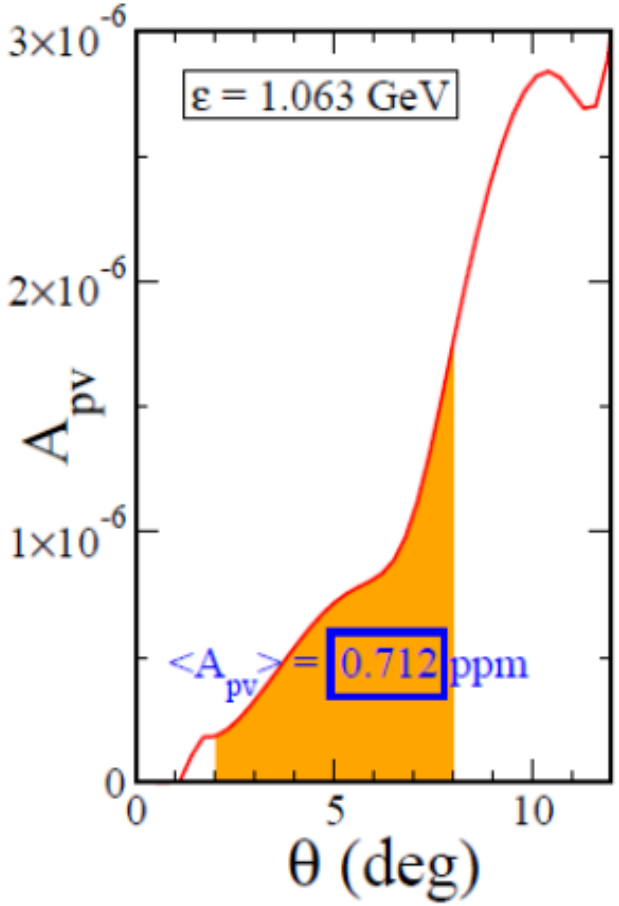
A comparison with the PV asymmetry parameter obtained by the PREX Collaboration on ^{208}Pb and a prediction for the future experiment CREX on ^{48}Ca are presented.

COMPARISON WITH PREX DATA

weak charge density



A_{PV}



our results

exp. uncertainties

charge density

GOOD AGREEMENT WITH PREX DATA

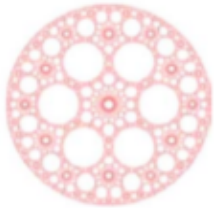
A. Meucci, M. Vorabbi, C.Giusti, F.D. Pacati, P. Finelli PRC 87 054620 (2013)

INFN – Pavia- SysDynMath

Fausto Borgonovi, Giuseppe Celardo
Dip. di Mat. e Fisica, Univ. Cattolica BS

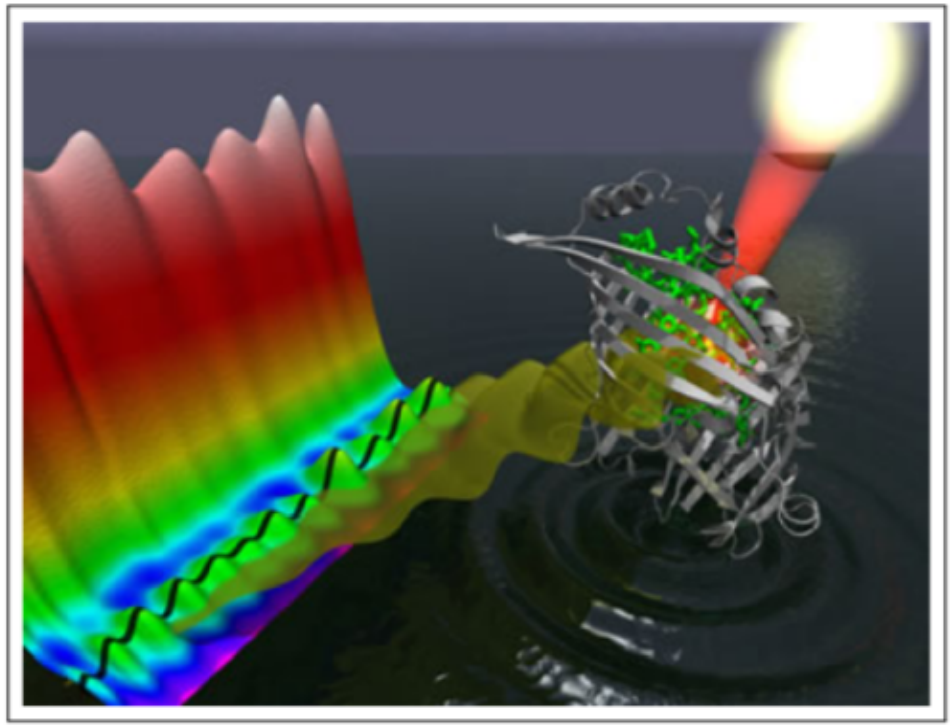
Is Energy Transfer in Photosynthetic complexes Superradiant phenomenon?

Italo Guarneri , Laura Rebuzzini
Center For Nonlinear and Complex Systems
Univ. Insubria, Como



Exponential Instabilities In Quantum Dynamics With Cold Atoms

Evidence of Quantum Coherent Effects in Light Harvesting systems



Evidence for wavelike energy transfer through quantum coherence in photosynthetic complexes,
G.S. Engel et all., Nature **446**, 782 (2007).

Coherently wired light-harvesting in photosynthetic marine algae at ambient temperature,
E. Collini et all., Nature Lettre **463**, 644 (2009).

Long-Lived Quantum Coherence in Photosynthetic Complexes at Physiological Temperature,
G. Panitchayangkoon et all., PNAS, **107**, 12766 (2010).

Light Harvesting Systems in the first stage of photosynthesis (few ps) have very high efficiency (up tp 99%)

Despite the hot (300 K) and wet (water) environment they can do the job preserving quantum coherence.

We used the formalism of non-hermitian hamiltonian to model the open quantum system, and the mechanism of superradiance to describe its transport properties.

We have found that maximal efficiency of transport occurs at the superradiant transition.

We developed a quantum device (switch) able to discriminate quantum from classical transport.

THE JOURNAL OF PHYSICAL CHEMISTRY C

Article

pubs.acs.org/JPCC

Quantum Biological Switch Based on Superradiance Transitions

D. Ferrari,[†] G.L. Celardo,[†,‡] G.P. Berman,[§] R.T. Sayre,[∥] and F. Borgonovi*[,†,‡]

[†]Department of Mathematics and Physics and Interdisciplinary Laboratories for Advanced Materials Physics, Catholic University of Sacred Heart, via Musei 41, 25121 Brescia, Italy

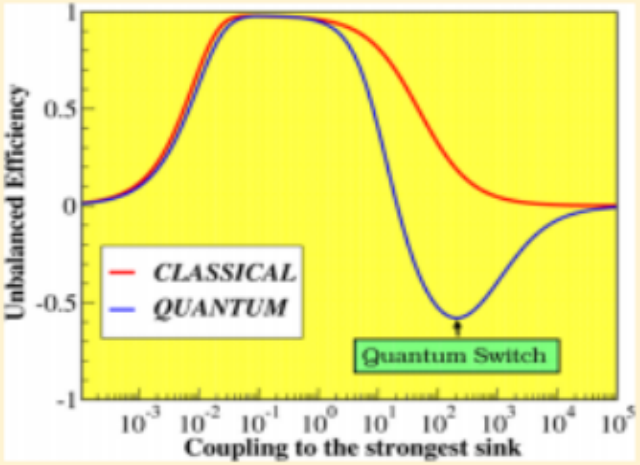
[‡]Istituto Nazionale di Fisica Nucleare, Sez. di Pavia, via Bassi 6, I-27100 Pavia, Italy

[§]Theoretical Division, MS-B213, Los Alamos National Laboratories, Los Alamos, New Mexico 87545, United States

[∥]Los Alamos National Laboratory and New Mexico Consortium, 100 Entrada Drive, Los Alamos, New Mexico 87544, United States

Supporting Information

ABSTRACT: A linear chain of connected sites with two asymmetric sinks, one attached to each end, is used as a simple model of quantum (excitonic and/or electron) transport in photosynthetic biocomplexes. For a symmetric initial population in the middle of the chain, it is expected that transport is mainly directed toward the strongly coupled sink. However, we show that quantum effects radically change this intuitive "classical" mechanism so that transport can occur through the weakly coupled sink with maximal efficiency. Using this capability, we show how to design a quantum switch that can transfer energy or charge to the strongly or weakly coupled branch of the chain, by changing the coupling to the sinks. The operational principles of this quantum device can be understood in terms of superradiance transitions and subradiant states. This switching, being a pure quantum effect, can be used as a witness of wavelike behavior in molecular chains. When realistic data are used for the photosystem II reaction center, this quantum biological switch is shown to retain its reliability, even at room temperature.



THE JOURNAL OF PHYSICAL CHEMISTRY C

Article

pubs.acs.org/JPCC

Superradiance Transition in Photosynthetic Light-Harvesting Complexes

Giuseppe L. Celardo,*[,†,⊥] Fausto Borgonovi,[†,⊥] Marco Merkli,[‡] Vladimir I. Tsifrinovich,[§] and Gennady P. Berman[∥]

[†]Dipartimento di Matematica e Fisica and Interdisciplinary Laboratories for Advanced Materials Physics, Università Cattolica, via Musei 41, 25121 Brescia, Italy

[⊥]Istituto Nazionale di Fisica Nucleare, Sezione di Pavia, via Bassi 6, I-27100, Pavia, Italy

[‡]Department of Mathematics and Statistics, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1C 5S7

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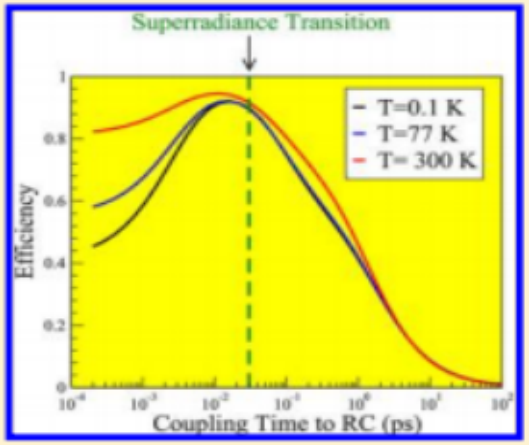
[∥]Theoretical Division, MS B213, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, United States

ABSTRACT: We investigate the role of long-lasting quantum coherence in the efficiency of energy transport at room temperature in Fenna-Matthews-Olson photosynthetic complexes. The excitation energy transfer due to coupling of the light-harvesting complex to the reaction center ("sink") is analyzed using an effective non-Hermitian Hamiltonian. We show that, as the coupling to the reaction center is varied, maximal efficiency in energy transport is achieved in the vicinity of the superradiance transition, characterized by a segregation of the imaginary parts of the eigenvalues of the effective non-Hermitian Hamiltonian. Our results demonstrate that the presence of the sink (which provides a quasi-continuum in the energy spectrum) is the dominant effect in the energy transfer which takes place even in the absence of a thermal bath. This approach allows one to study the effects of finite temperature and the effects of any coupling scheme to the reaction center. Moreover, taking into account a realistic electric dipole interaction, we show that the optimal distance from the reaction center to the Fenna-Matthews-Olson system occurs at the superradiance transition, and we show that



For fundamental reasons, and apart from abstractions like inverted oscillators, exponential Instability is as rare in Quantum Mechanics as it is common in Classical Dynamics . Here is a purely quantal example, that is experimentally realizable with Cold Atoms over observable scales, by appropriately tuning parameters .

PHYSICAL REVIEW E 88, 052919 (2013)

Exponential quantum spreading in a class of kicked rotor systems near high-order resonances

Hailong Wang,[1] Jiao Wang,[2] Italo Guarneri,[3] Giulio Casati,[3] and Jiangbin Gong[1,4,*]
[1]*Department of Physics and Centre for Computational Science and Engineering, National University of Singapore, Singapore 117546, Republic of Singapore*
[2]*Department of Physics and Institute of Theoretical Physics and Astrophysics, Xiamen University, Xiamen 361005, China*
[3]*Center for Nonlinear and Complex Systems, Università degli Studi dell' Insubria, Via Valleggio 11, 22100 Como, Italy*
[4]*NUS Graduate School for Integrative Science and Engineering, Singapore 117597, Republic of Singapore*
(Received 20 August 2013; published 27 November 2013)

GEOmetry and **SYM**metry in **Q**uantum **F**ield **T**heory

GEOSYM-QFT *2014 →*

- Coordinatore nazionale: F. Lizzi (Napoli)
- Sezioni di Firenze, Napoli, Pavia, Pisa, Salerno

- **Pavia**
  - Coordinatore A. Marzuoli
  - M. Carfora, C. Dappiaggi, G. Jug
  - Dottorandi: M. Benini (XXVII); G. Nosari, S. Rutili (XXIX)
    Laureando: J. Fumagalli

CS INFN Sezione di Pavia, 10 Giugno 2014

Attività della IS gennaio-maggio 2014

- Incontro di alcuni dei partecipanti in occasione del convegno *Problemi Attuali di Fisica Teorica* (Vietri, aprile 2014), giornata coordinata da M. Carfora
- Meeting della IS programmato entro la fine dell' anno

- Comitato organizzatore del convegno *Algebraic quantum field theory: its status and its future* - Erwin Schroedinger Institute (Vienna) 19-24 Maggio 2014 (C. Dappiaggi)

- Richiesta di una posizione di postdoc straniero sulla IS per la sezione di Pavia

Overview delle tematiche della IS a Pavia

The Pavia team plans to investigate geometric (Ricci) flows, renormalization group and QFT landscaping as well as several aspects and applications of Topological Quantum Field Theory such as: **i)** the structure of the moduli space of polyhedral surfaces and its connection with 2D quantum gravity and matrix models, quantum observables in 3D TQFT of the BF-type and associated Turaev-Viro SU(2)q state sum models and (quantum) algorithmic questions related to such items; **ii)** the physical properties -related to the onset of topologically-protected phases and quasi-particles excitations- of the new forms of condensed matter (graphene mono- and multilayers, graphene cones and other carbon allotropic curved surfaces).

At the same time, in constructive and algebraic QFT, there is no unanimous consensus on how topological effects should be included in an axiomatic framework. Hence an additional goal of our investigation will be to tackle these problems particularly for gauge theories. Furthermore we shall focus our attention on comparing our approach to the standard BRST and BV techniques which emphasize the role of the local algebra of symmetries and their action on the Lagrangian dynamics.

Pubblicazioni –preprint (gennaio-maggio 2014)

1. M. Benini, C. Dappiaggi and A. Schenkel, ``Quantum field theory on affine bundles" Annales Henri Poincare **15** (2014) 171

2. K. Sanders, C. Dappiaggi and T.-P. Hack, ``Electromagnetism, Local Covariance, the Aharonov-Bohm Effect and Gauss' Law" Commun. Math. Phys. **328** (2014) 625

3-4. M. Benini, C. Dappiaggi and A. Schenkel, ``Quantized Abelian principal connections on Lorentzian manifolds," and ``Quantized Abelian principal connections on Lorentzian manifolds,'' Commun. Math. Phys. **329** (2014) to appear

5. M. Benini, C. Dappiaggi and S. Murro, ``Radiative observables for linearized gravity on asymptotically flat spacetimes and their boundary induced states", arXiv:1404.4551 [gr-qc].

6. M. Benini, ``Optimal space of linear classical observables for Maxwell k-forms via spacelike and timelike compact de Rham cohomologies" , arXiv:1401.7563 [math-ph]

7. V Aquilanti, D Marinelli, A Marzuoli " Symmetric coupling of angular momenta, quadratic algebras and discrete polynomials"
J. Phys: Conf. Ser. **482** (2014) 012001

8. A Marzuoli, F A Raffa, M Rasetti ''Where do bosons actually belong?''
J. Phys. A: Math. Theor. (2014) to appear

9. G Jug, M Paliienko, S Bonfanti "The glassy state – Magnetically viewed from the frozen end", J. Non-Cristalline Solids Online Jan 2014

10. M. Carfora '' The Wasserstein geometry of non-linear sigma models and the Hamilton-Perelman Ricci flow'', arXiv:1405.0827 [math-ph]

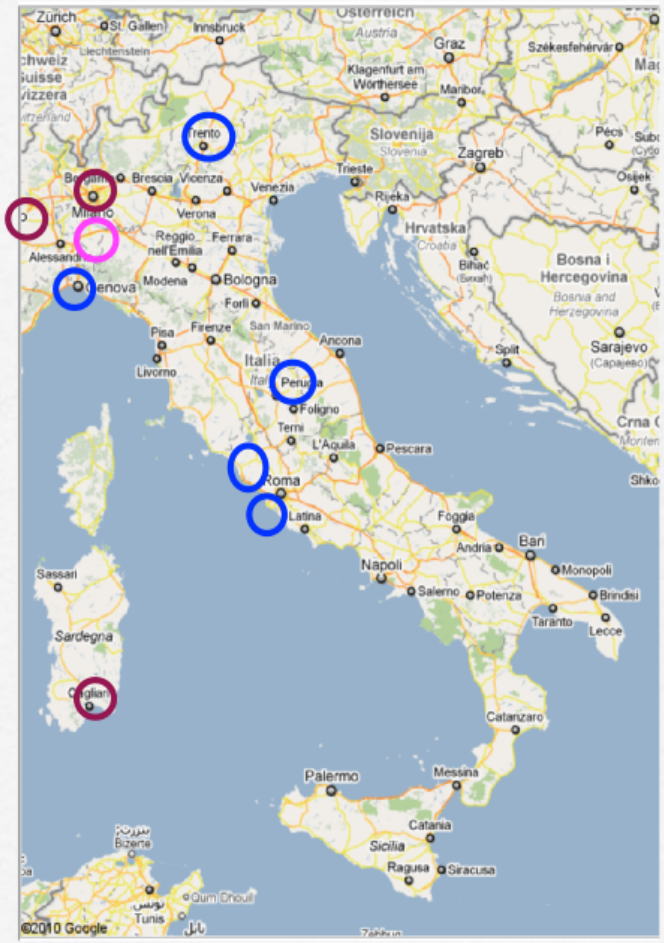
AD31 → dal 2014 NINPHA (= AD31+TO31)

National INitiative in Physics of HAdrons

Responsabile nazionale: M. Radici
Sedi: PV, GE, TN, PG, RM1, RM2
TO, CA, MiB

PV : gruppo di Fisica Adronica
HAdronic Structure and QCD (HAS QCD)

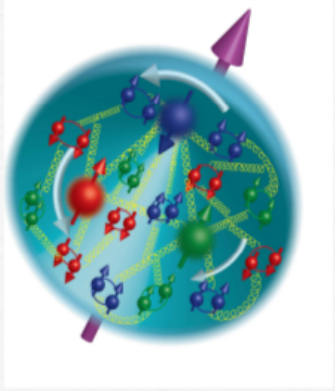
INFN	**I ric.**	**M. Radici**
	ric.	**M. Guagnelli**
Univ.	**1 P.A.**	**A. Bianconi (70% Gr.III)**
	2. R.U.	**B. Pasquini, A. Bacchetta**
	1 post-doc	**X. Xiong (da settembre)**



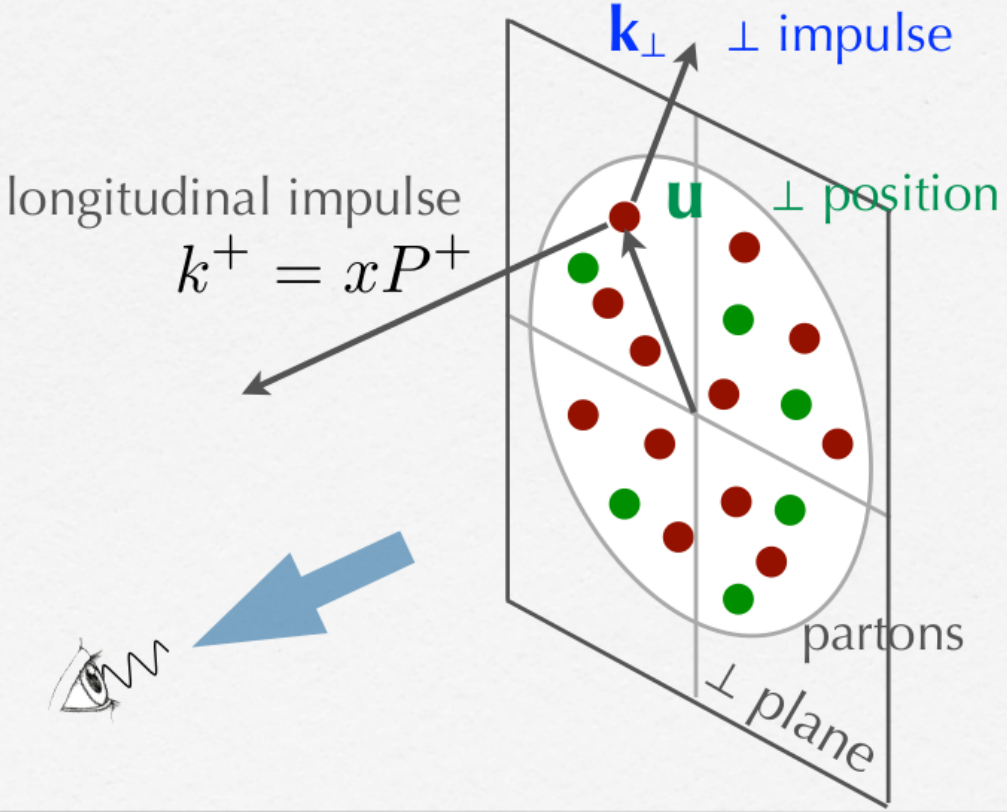
~ 9 MeV

938 MeV

QCD confinement ⇒ proton mass



parton contribution to proton spin?
orbital angular momentum (OAM) of partons?
internal structure of proton?



Multi-dimensional analysis

PDF(x) $F_{1,2}(t)$

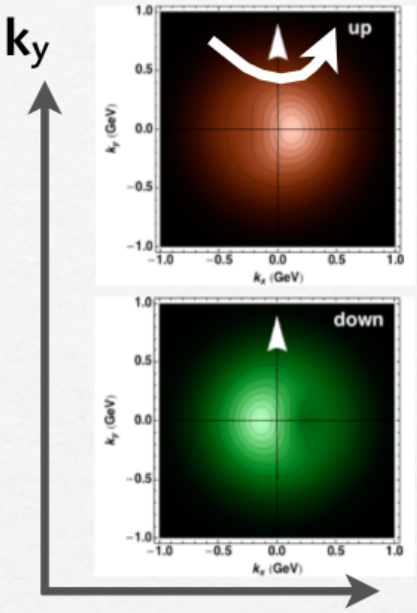
k space

TMD(x,$k_\perp$) GPD(x,ξ,t↔û)

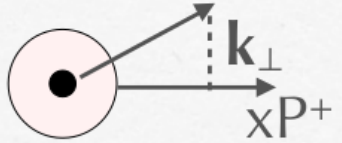
u space

WD(x, $k_\perp$,u)

Wigner distributions



explore properties of TMD $(x,k_\perp)$

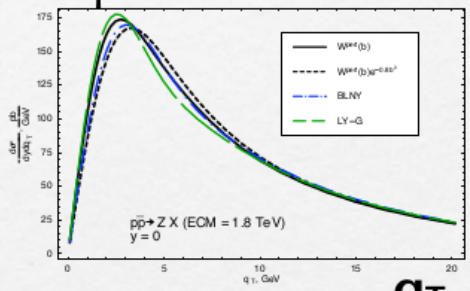
$f_1 =$ 

Signori, Bacchetta, Radici, Schnell, JHEP **1311** (13) 194

- explore flavor dependence of $\langle k_\perp \rangle$
- explore x dependence $\langle k_\perp \rangle(x)$
- complicated evolution kernel
  unknown nonperturb. part

Bacchetta, Prokudin, N.P. **B875** (13)

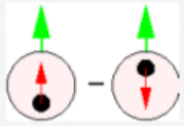
impact on
Z^0 peak → W mass



P. Nadolski, hep-ph/0412146

q_T

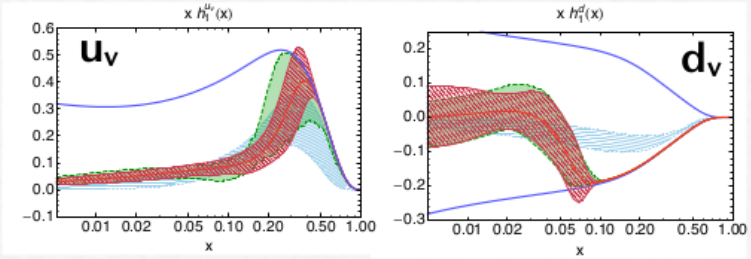
first extraction of valence $h_1(x)$ in collinear kin.



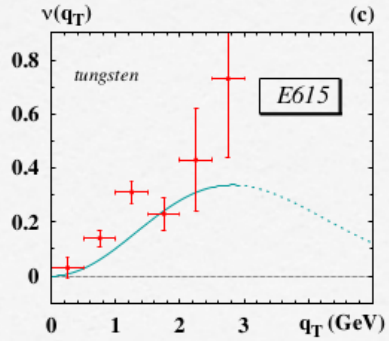
combined fit of

$eN^\uparrow \to e'(\pi^+\pi^-)X$

$e^+e^- \to (\pi^+\pi^-)(\pi^+\pi^-)X$



Bacchetta, Courtoy, Radici, JHEP **1303** (13) 119

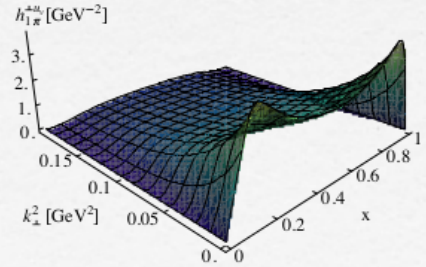


Drell-Yan: violation of Lam-Tung s.r.

$\nu \sin^2\theta \cos 2\varphi$

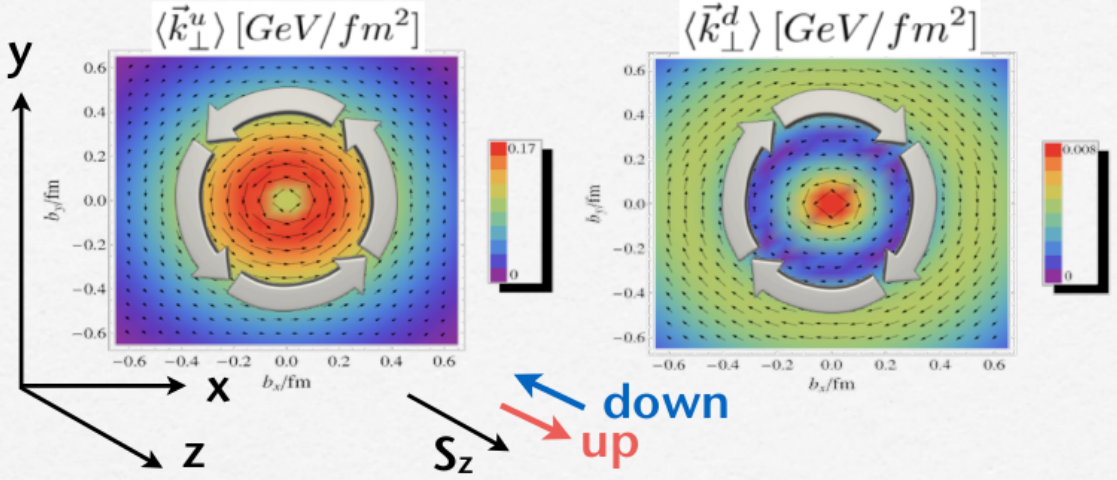
$\nu(q_T) \sim h_1^\perp \otimes h_1^\perp$ Boer-Mulders TMD

Compass: $\pi N^\uparrow \to \mu^+\mu^-$



Pasquini, Schweitzer, in preparation

L^q (OAM) from model-dep. WD($x,k_\perp,u_\perp$)

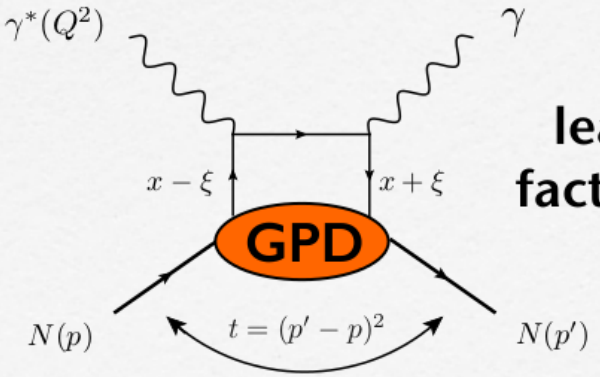


$$\langle \mathbf{k}_\perp \rangle(\mathbf{u}_\perp) = \int d\mathbf{k}_\perp\, \mathbf{k}_\perp \int dx \Big[\mathrm{WD}_{S_z}(x, \mathbf{k}_\perp, \mathbf{u}_\perp) - \mathrm{WD}_{-S_z}(x, \mathbf{k}_\perp, \mathbf{u}_\perp) \Big]$$

$$L^q_z \equiv \int d\mathbf{u}_\perp \Big(\mathbf{u}_\perp \times \langle \mathbf{k}^q_\perp \rangle(\mathbf{u}_\perp) \Big)_z$$

Lorcè, Pasquini, Xiong, Yuan, P.R.D**85** (12) 114006

Deeply-Virtual Compton Scatt. (DVCS) → GPD

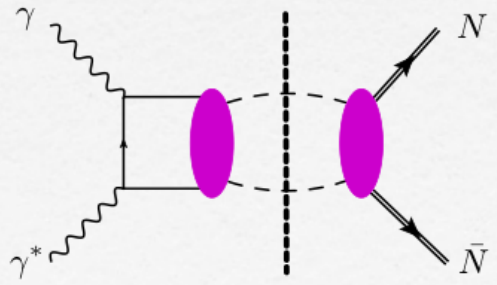


leading twist factorization th.
$t \ll Q^2$

DVCS tensor

$$T^{\mu\nu} = \sum_{i=1}^{4} A_i(\nu, t, Q^2)\, O_i^{\mu\nu}$$

dispersion relations on A_i



Pasquini, Polyakov, Vanderhaeghen, in preparation

Also:

- 26 invited talks (8 with proceedings)
- co-organiz. of 4 workshops (ECT*, CentroVolta@Como, INFN2014@PD, INT-Seattle)
- member of Progr.Comm. INPC2013
- convener DIS2013, LC2014
- member of IAC at MENU13, PSHP2013
- all A grade in CSN4 evaluation 2013 → 1 INFN post-doc

Collaborations

- JLab Hall A & B collab.'s
- Univ. Mainz ; Univ. Tuebingen
- Univ. Liège ; Univ. Paris-Sud & CNRS- IN2P3
- Univ. Connecticut ; Univ. Temple
- VU Amsterdam

Other funds

- FP7: HadronPhysics3 (HP3)
- Horizon2020: HadronPhysicsHorizon (HPH)
  coordinator of "TMD-neXt" network

HadronPhysicsHORIZON

- ERC consolidator

PR21
Teoria di Campo delle Interazioni Fondamentali

Responsabile nazionale: P. Nason (MIB)
Responsabile locale: O. Nicrosini

Partecipanti 2013(2014)

L. Barzè*, S. Boselli, M. Chiesa,
G. Montagna, O. Nicrosini,
F. Piccinini, V. Prosperi

Da gennaio 2014:

➔ QFT@COLLIDERS

RN F. Piccinini, RL O. Nicrosini
Altre sedi: Bologna (G.P. Vacca), Cosenza (A. Papa),
Firenze (S. Catani), Milano B. (P. Nason)

Collaboratori

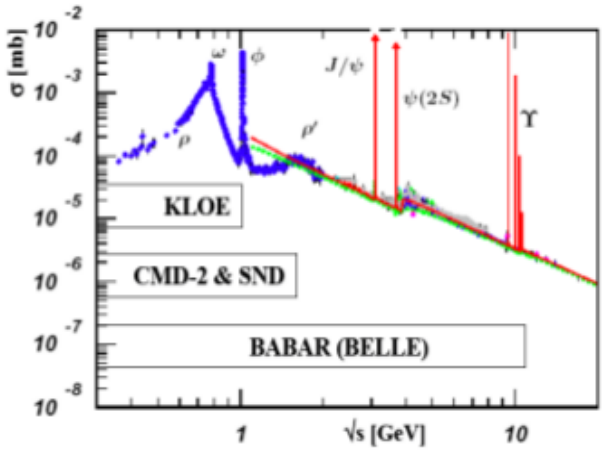
C.M. Carloni Calame (PRIN2010)
H. Martinez (LHCPhenoNet)
M. Moretti (Ferrara)
A. Vicini (Milano)
P. Nason (CERN&Mib)
F. Tramontano (Napoli)

Keywords: Monte Carlo generators, NLO/NNLO QCD calculations, Electroweak Radiative Corrections, perturbative resummations, QCD in the high-energy limit

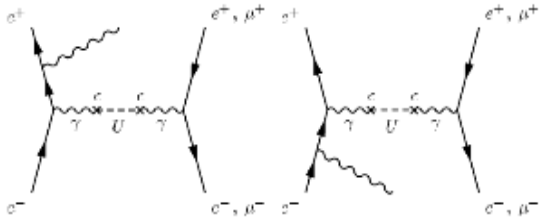
Consiglio di Sezione INFN

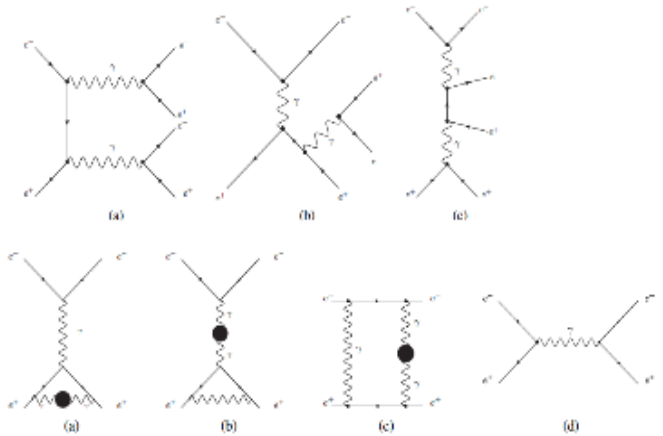
Pavia, 10 giugno 2014

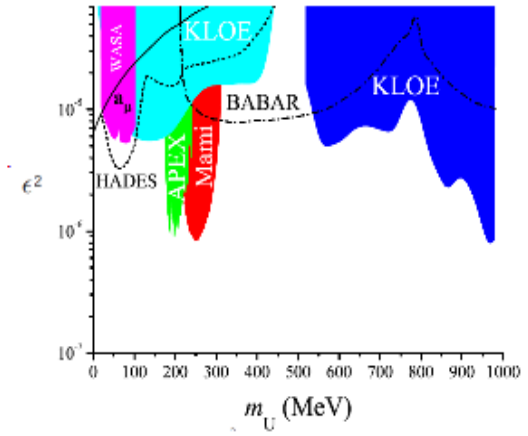
BabaYaga@NLO at flavour factories and dark matter searches



Improved BabaYaga with 0.1% precision used by KLOE, BES, CLEO, BABAR... for Bhabha, gamma gamma, mu^+ mu^- and Dark Photon simulations







Continuous collaboration with experimental groups:
- BESIII for luminosity (and other studies)
- KLOE2 for searches and limits on Dark Forces

L. Barzè, G. Balossini, C.M. Carloni Calame, C. Bignamini, G. Montagna, O. Nicrosini, F. Piccinini
Radiative Events as a Probe of Dark Forces at GeV-Scale e^+e^- Colliders
Eur.Phys.J. C71 (2011) 1680

HORACE → POWHEG: Merging EW corrections into a QCD generator for Drell-Yan (the POWRACE project, Pavia + P. Nason); re-computing NLO EW corrections in terms of scalar integrals ('t Hooft-Veltman) in mixed dim. reg./ mass schemes. State-of-the-art for Drell-Yan Physics

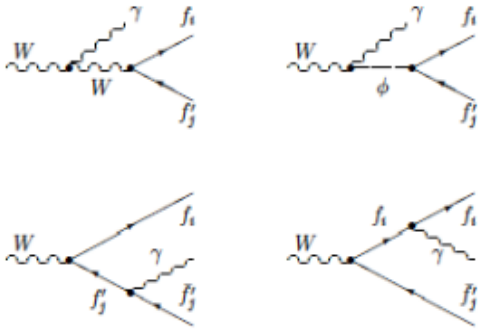


Figure 9.2: Bremsstrahlung Feynman diagrams for $W \to f_i \bar{f}'_j \gamma$.

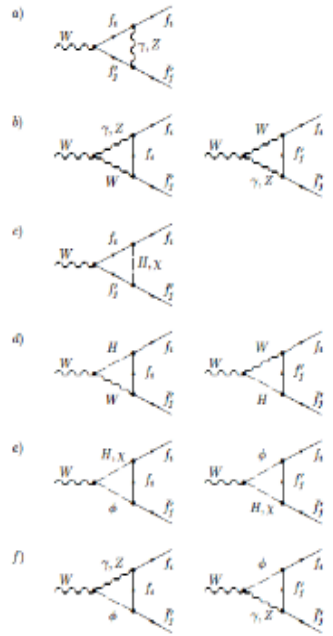


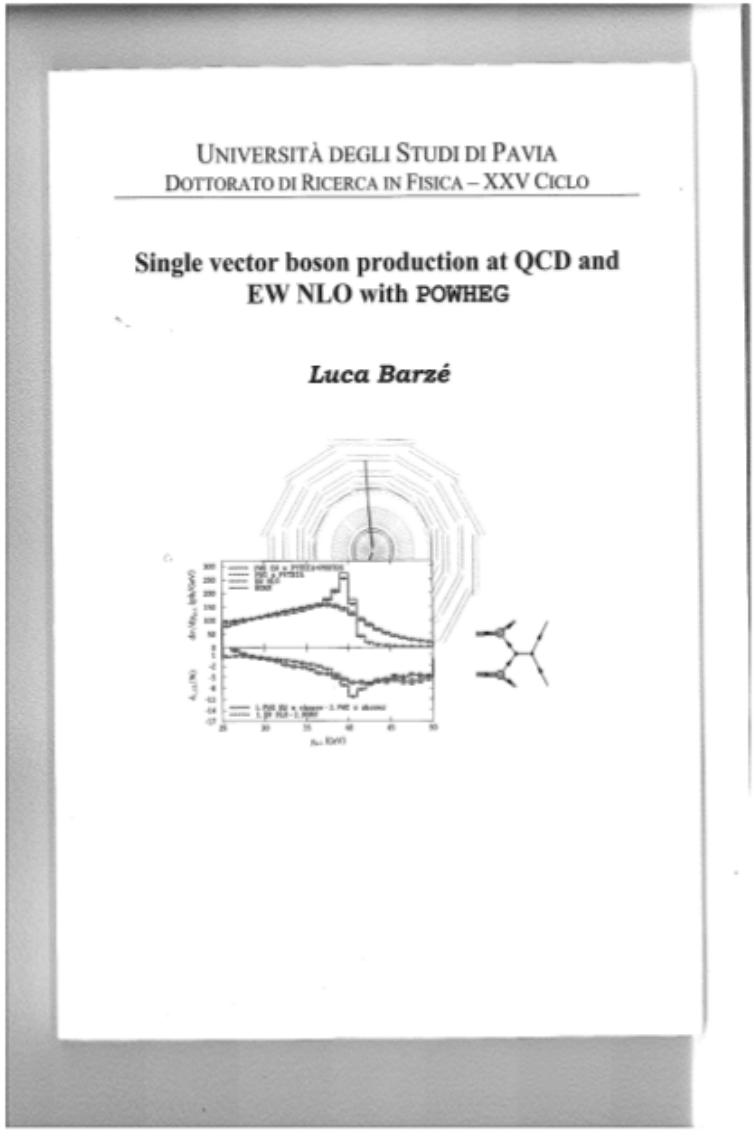
Figure 9.1: One-loop diagrams for $W \to f_i \bar{f}'_j$.

- Luca Barzè, Guido Montagna, Paolo Nason, Oreste Nicrosini, Fulvio Piccinini, Alessandro Vicini

Neutral current Drell-Yan with combined QCD and electroweak corrections in the POWHEG BOX

Eur.Phys.J. C73 (2013) 2474 (arXiv:1302.4606 [hep-ph])

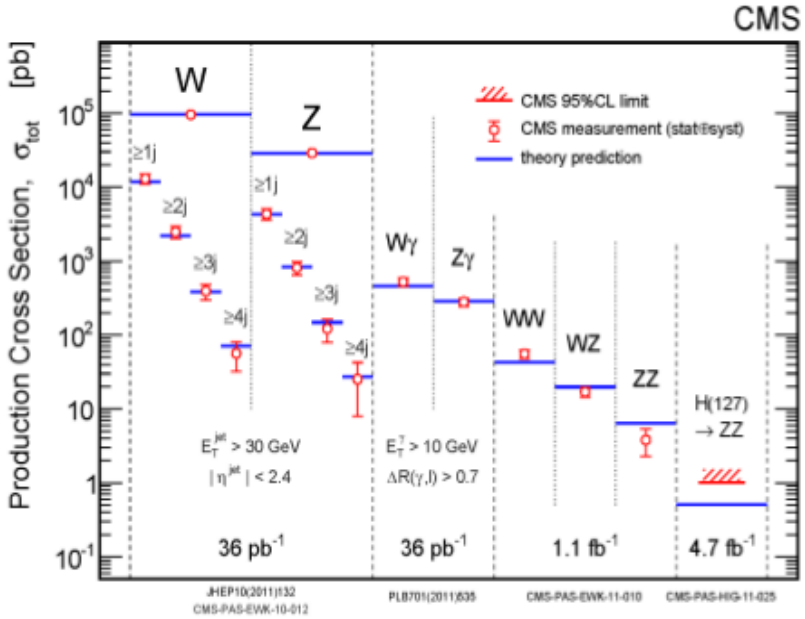
Premio Fubini 2013 assegnato a Luca Barzè per la tesi di Dottorato



UNIVERSITÀ DEGLI STUDI DI PAVIA
DOTTORATO DI RICERCA IN FISICA – XXV CICLO

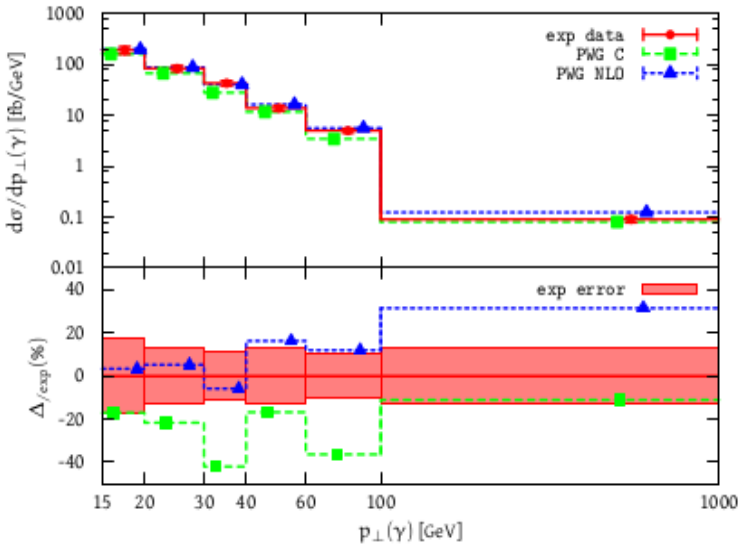
Single vector boson production at QCD and EW NLO with POWHEG

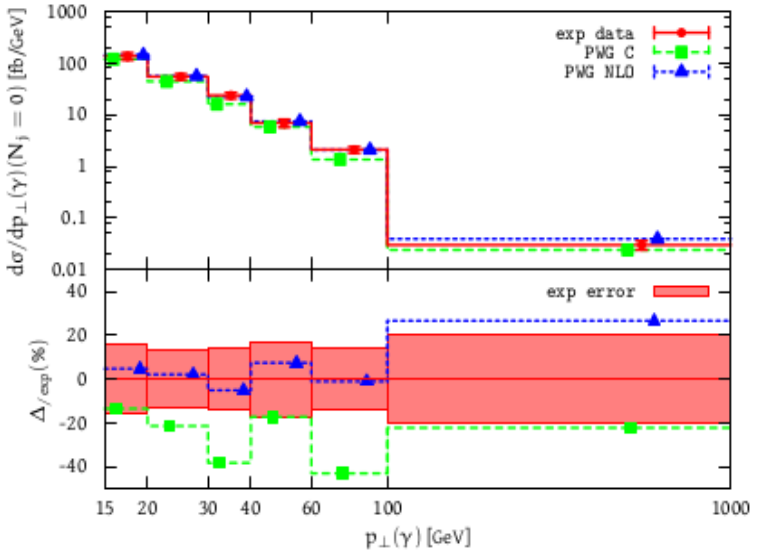
Luca Barzé



In progress (with V. Prosperi, L. Barzè and M. Chiesa):

- NLO QCD corrections to Wγ and Zγ and implementation in POWHEG
- Inclusion of fragmentation processes in PS language
- Comparison with MCFM
- Paper in preparation

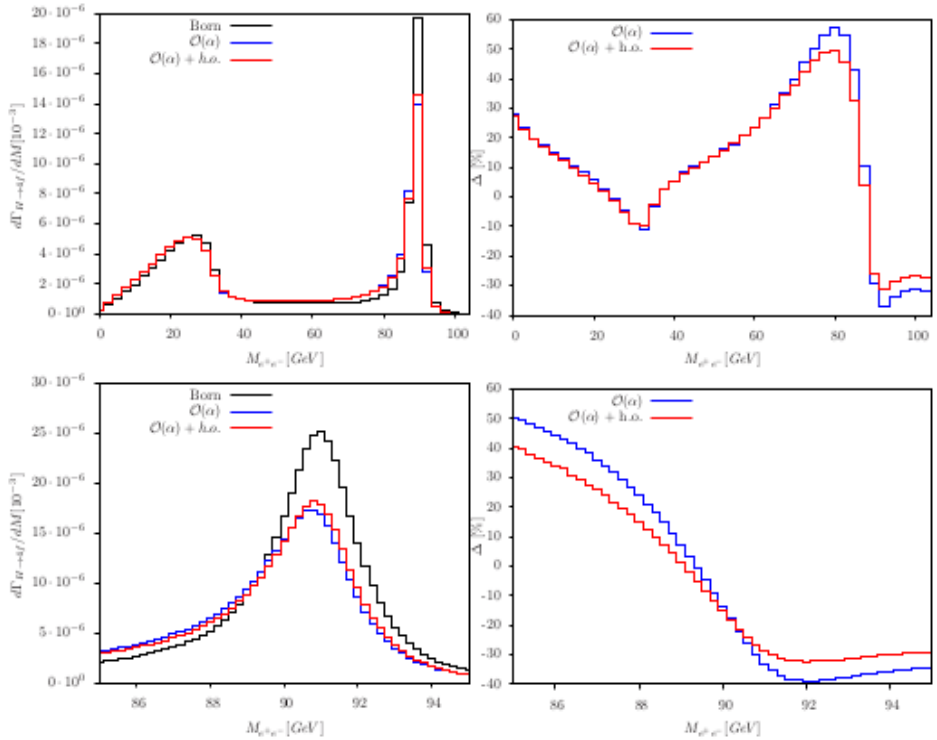




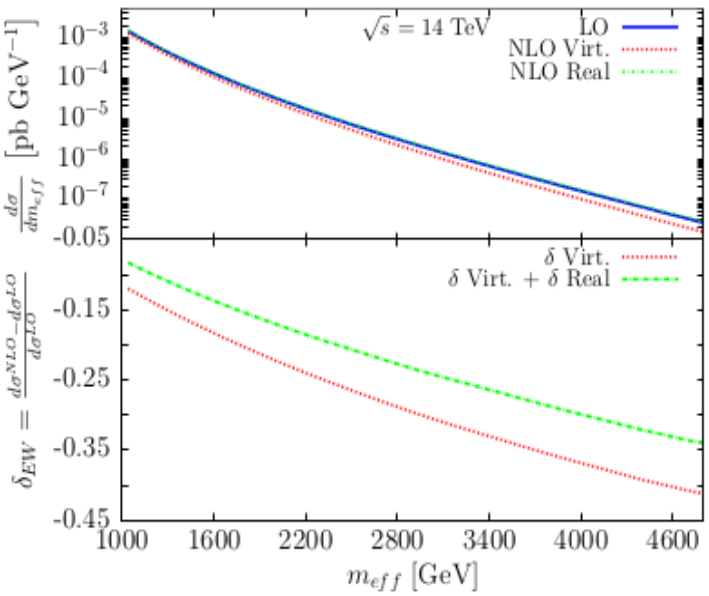
In progress (with C.M. Carloni Calame and S. Boselli):

$H \to e^+e^-\mu^+\mu^-$ ($M_H = 125$ GeV)

- MC for $H \to 4\ell$, matching exact $\mathcal{O}(\alpha)$ EW corrections with multiple photon emission, important for precise M_H measurement



- QED done, full EW in progress

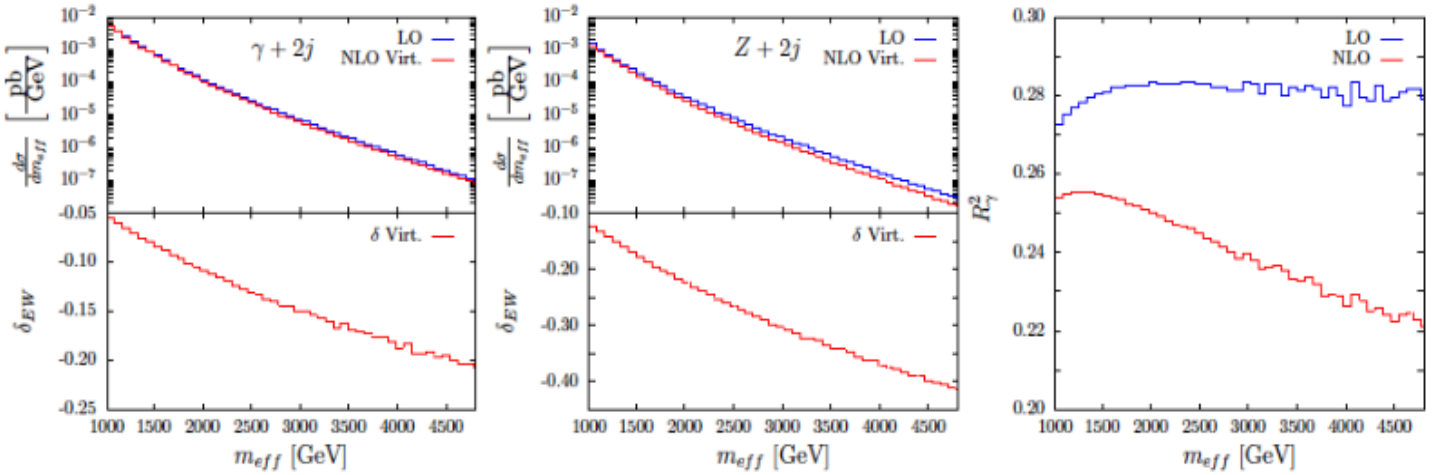


M. Chiesa, L. Barzè, G. Montagna, M. Moretti,
O. Nicrosini, F. Piccinini, F. Tramontano
Electroweak Sudakov Corrections to New Physics Searches at the CERN LHC
Phys.Rev.Lett. 111 (2013) 12, 121801 (arXiv:1305.6837 [hep-ph])

Kalanand Mishra et al.
Electroweak Corrections at High Energies
FERMILAB-CONF-13-514-CMS
arXiv:1308.1430 [hep-ph] (SNOWMASS)

J.M. Campbell et al.
Working Group Report: Quantum Chromodynamics
ANL-HEP-CP-13-48, FERMILAB-FN-0967-CMS-T
arXiv:1310.5189 [hep-ph] (SNOWMASS)

J. Butterworth et al.
Les Houches 2013: Physics at TeV Colliders: Standard Model Working Group Report
arXiv:1405.1067 [hep-ph]



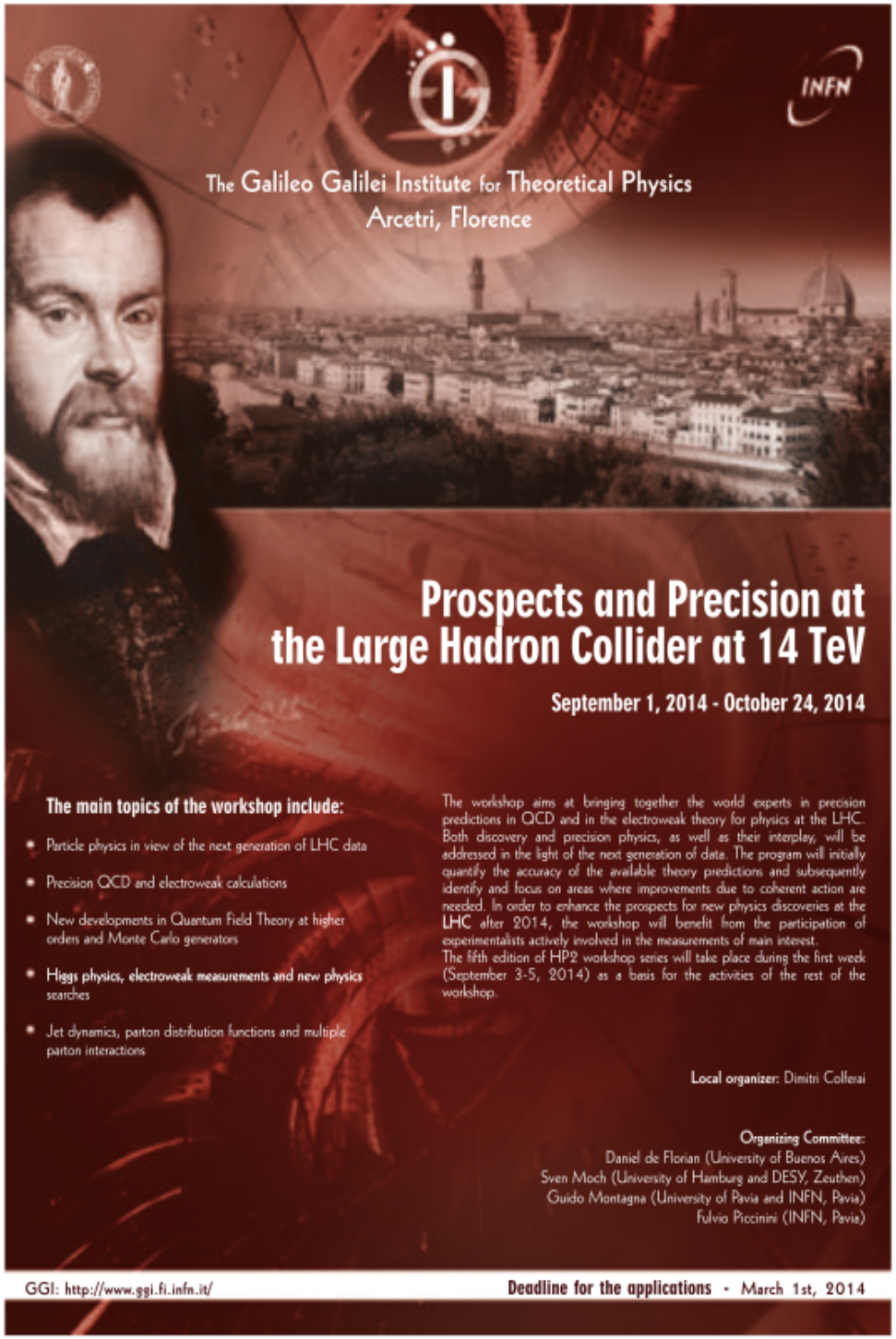
Finanziamenti

LHCPhenonet: network EU in 7th Framework Program "Advanced Particle Phenomenology in the LHC era"; 48 mesi, started January 2011; tra i nodi INFN e UNIPV; coordinatore G. Rodrigo (Valencia)
→ Homero Martinez

PRIN 2010 - *Simmetrie, masse e misteri: rottura della simmetria elettrodebole, mescolamento dei sapori e violazione di CP e materia oscura nell'era di LHC*

SNS Pisa, Roma "La Sapienza", Firenze, Padova, Milano, INFN LNF, Pavia, Roma 3, SISSA Trieste, Torino, Genova (Febbraio 2013 – Gennaio 2016)
→Carlo M. Carloni Calame

- LHCPhenoNet expires next December – New proposal submitted for H2020 calls
- HPrecisionNet within HPH network of Horizon 2020 Framework Programme submitted to EC



Organizing Committee:
Daniel de Florian (Univ. Buenos Aires)
Sven Moch (Univ. Hamburg and DESY)
Guido Montagna (Univ. & INFN Pavia)
Fulvio Piccinini (INFN Pavia)

- **Talks:**

M. Chiesa
- "EW corrections in the Sudakov limit at LHC"
  LC13: exploring QCD from the infrared regime to heavy flavour scales at
  B-factories, the LHC and a Linear Collider, Trento, 16-20 September 2013
- "Electroweak corrections in the Sudakov limit at the LHC and at future pp colliders"
  1st Future Hadron Collider Workshop
  CERN, 26-28 Maggio 2014

G. Montagna
- "W/Z production at the LHC: state of the art of radiative corrections",
  SM@LHC 2013, Friburgo, 9-12 Aprile 2013

F. Piccinini
- "Theoretical overview of (some issues on) XYZ exotic states", 7th International
  Workshop on Pion-Nucleon Partial Wave Analysis and the Interpretation of
  Baryon Resonances, Camogli, 23-27 September 2013
- "Final states with photons and missing energy"
  Sixth TLEP Workshop, CERN, 16-18 October 2013
- "NLO EWxQCD corrections to Drell-Yan in POWHEG"
  QCD@LHC 2013, Hamburg, 2-6September 2013

- **Tesi**:
L. Barzè (dottorato, O. Nicrosini), “Single vector boson production at QCD and EW NLO with POWHEG” (January 2013)

S. Boselli (specialistica, F. Piccinini), “Weak boson emission in Drell-Yan processes at the LHC”

5 triennali

- **Borse post-doc INFN per stranieri**
  In seguito a 5A rating ottenuto da QFT@colliders nella valutazione u.s. da parte di referee internazionali, proposta assegnazione di borsa biennale da ususfruire in Pavia/MiB

FA51 → TAsP

- M. Roncadelli R. Loc. 50%
- P. Caraveo 50% (INAF)
- A. De Luca 50% (INAF)
- R. Tiengo 50% (IUSS)

Attività: Astrofisica delle alte energie

(punto di vista teorico e osservazionale)

- Atività di M. Roncadelli:

  E continuato lo studio della rilevanza delle axion-like particles (ALPs) per l'astrofisica delle alte energie. In particolare è proseguita la collaborazione con G. Galanti e F. Tavecchio riguardo alla modellizzazionedei BL Lac e dei Flat Spectrum Radio Quasar al fine di calcolare la probabilità di conversino fotone-ALP sia all'interno della sorgente che nella galassia ellittica che la ospita al suo centro

Atività di Caraveo, De Luca e Tiengo:

Il lavoro del gruppo è focalizzato sull'osservazione e relativa interpretazione dell'emissione a multilunghezza d'onda da parte di stelle di neutroni isolate e della loro interazione con il mezzo interstellare

- E` continuata la campagna osservativa difollow-up dei pulsar a raggi gamma scoperti dal satellite Fermi con telescopi aterra della classe di 8 metri (ESO/VLT, GranTeCan, Gemini) al fine di scoprirne la controparte ottica. E` stata rivelata la probabile controparte ottica del pulsar giovane ed energetico J0205+6449. Questa controparte mostra uno spettro di potenza nella regione ottica/vicino infrarosso, con una pendenza simile a quella osservata nella banda X benché il flusso nell'ottico/vicino infrarosso sia molto inferiore all'estrapolazione dalla banda X, il che suggerisce un doppio break spettrale nell'ultravioletto

- E` stata anche osservata la controparte del pulsar tipo-Vele PSRJ0007+7303, il primo pulsar radio quieto scoperto da Fermi. Questo pulsar non è presente nella nostra immagine ottenuta con GranTeCan fino ad un limite inferiore di r' = 27.6, che corrisponde ad un'emissione ottica con efficienza minore di 9.4 10^{- 8}.Tale efficienza è molto bassa, ma consistente con quella misurata peril pulsar delle Vele, finora supposto essere sottoluminoso nella banda ottica.
- Abbiamo effettuato uno studio in risoluzione temporale della polarizzazione del pulsar della nebulosa del Granchio e di altri pulsar-wind nebulae usando dati raccolti dallo Hubble Space Telescope. E` stata prodotta per la prima volta una mappa ad alta risoluzione del vettore di polarizzazione della regione interna della nebulosa del Granchio, del suo grado di polarizzazione lineare ed angolare.Nessuna delle principali proprietà della nebulosa evidenzia una significativa evoluzione della polarizzazione durante il periodo osservato.

- Un altro argomento riguarda un'analisi dettagliata risolta in fase che ha condotto alla scoperta di una riga di assorbimento nello spettro X della magnetar SGR 04181+5729. Questa è la prima riga sottile rivelata nello spettro di una magnatar e la riga maggiormente variabile mai osservata in una stella di neutroni. La sua interpretazione come riga di ciclotrone protonica implica l'esistenza di un campo magnetico estremamente intenso variabile -- in differenti regioni della magnetosfera – da 2 10^{14} G a 10^{15} G. Questa costituisce la dimostrazione che le magnetar contengono i campi magnetici presenti nell'intero universo.