Consiglio di Sezione INFN Pavia

11 Giugno 2015

Relazione Gruppo IV

Fulvio Piccinini, INFN Pavia

OUTLINE

- Resoconto riunione CSN4 13-14 Aprile 2015

  → CdS 6 Maggio 2015

- Consuntivi 2014 Iniziative Specifiche

  (grazie ai RL per la collaborazione)

Iniziative Specifiche a PV

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)

presentate in ordine di linea

QFT@COLLIDERS

Responsabile nazionale: F. Piccinini
Responsabile locale: O. Nicrosini

Partecipanti 2014(2015)

S. Boselli, M. Chiesa, H. Martinez,
G. Montagna, M. Moretti (FE),
O. Nicrosini, F. Piccinini
(+ post-doc premiale INFN da settembre)

Collaboratori

C.M. Carloni Calame (PRIN2010)
A. Vicini (Milano)
P. Nason (CERN&Mib)
F. Tramontano (Napoli)

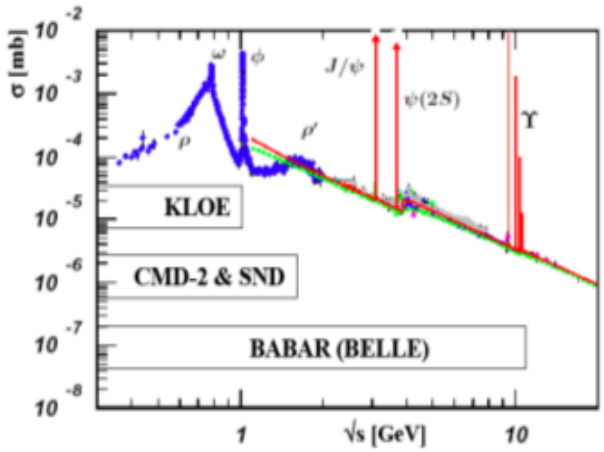
Altre sedi: Bologna (G.P. Vacca), Cosenza (A. Papa),
Firenze (S. Catani), Milano B. (P. Nason)

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

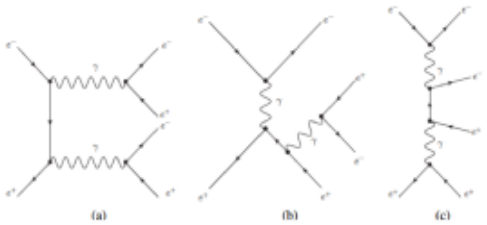
Consiglio di Sezione INFN

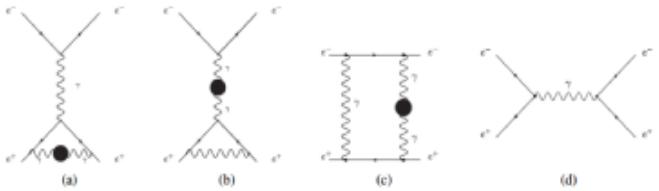
Pavia, 11-12 giugno 2015

BabaYaga@NLO at flavour factories



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





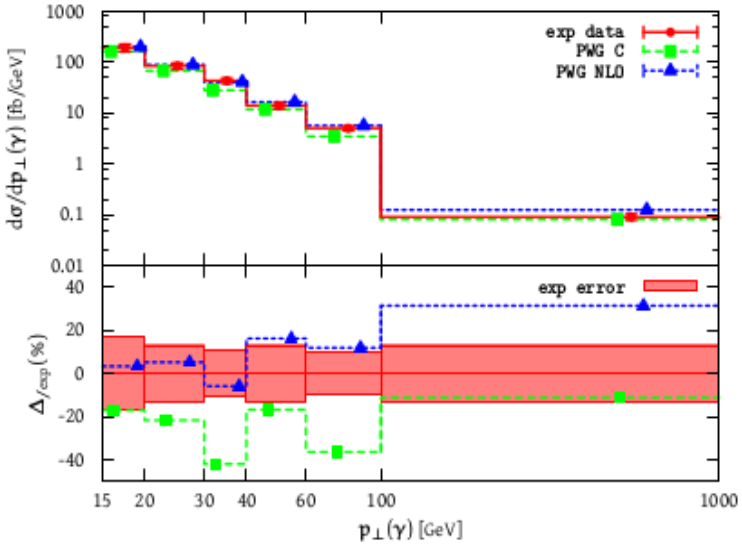
- New parameterization of Vac-pol included;
- Improved treatment of narrow resonances
- Proposal of measurement of α(t)

Continuous collaboration with experimental groups:
- BESIII/Belle for luminosity (and other studies)

"A new approach to evaluate the leading hadronic corrections to the muon *g*-2"
C.M. Carloni Calame, M. Passera, L. Trentadue, G. Venanzoni
Phys.Lett. B746 (2015) 325-329 (arXiv:1504.02228)

Wγ/Zγ

(V. Prosperi, M. Chiesa)



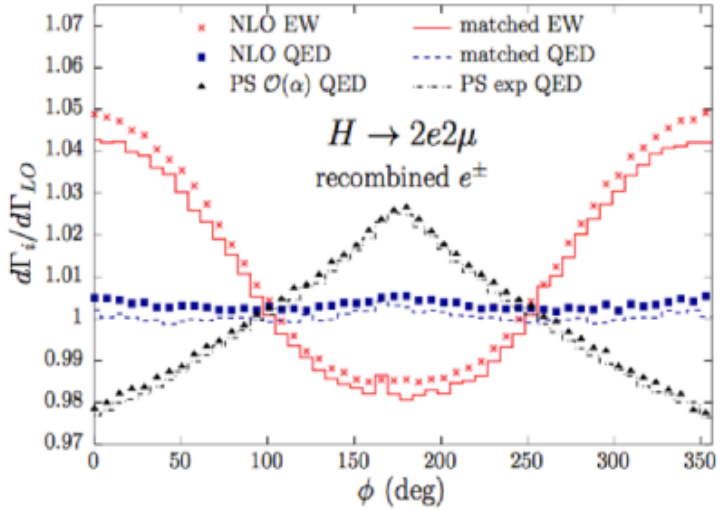
- NLO QCD corrections to Wγ and Zγ and implementation in POWHEG
- Inclusion of fragmentation processes in PS language
- Comparison with LHC data

"Wγ production in hadronic collisions using the POWHEG+MiNLO method"
L. Barze, M. Chiesa, G. Montagna, P. Nason, O. Nicrosini, F. Piccinini, V. Prosperi
JHEP 1412 (2014) 039 (arXiv:1408.5766)

h → 4l

(S. Boselli, C.M. Carloni Calame)

- MC for h → 4l matching exact NLO EW plus QED PS completed (HTO4L)
- Important for precision Higgs boson Physics (mass, couplings, spin-parity)
- Possible to interface HTO4L to any Higgs production tool



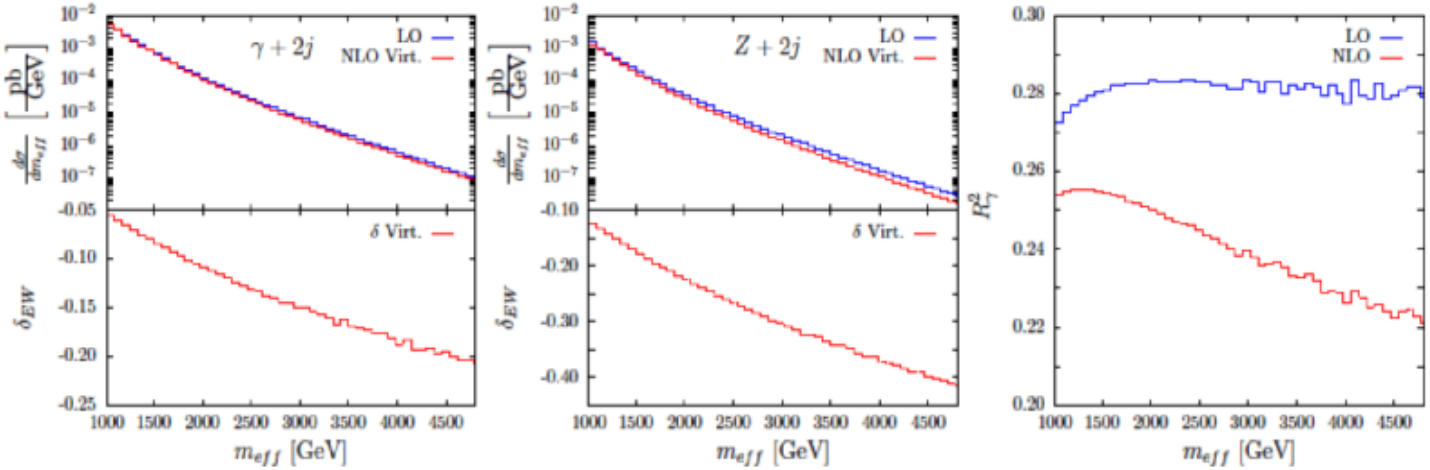
"Higgs boson decay into four leptons at NLOPS electroweak accuracy"
S. Boselli, C.M. Carloni Calame, G. Montagna, O. Nicrosini, F. Piccinini
arXiv:1503.07394 (to appear in JHEP)

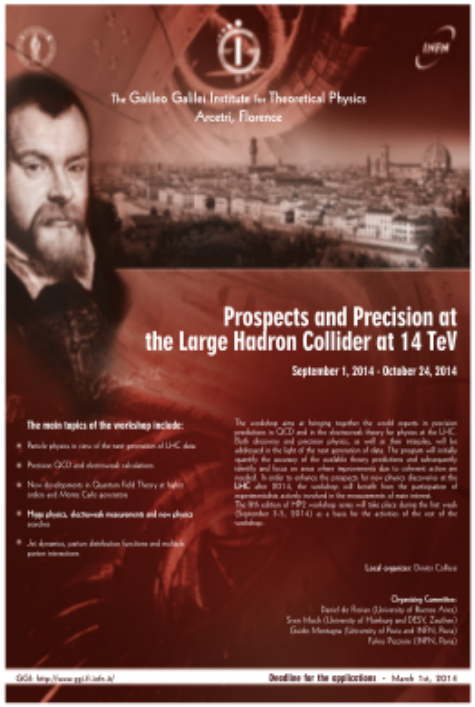
W-boson mass
(H. Martinez, C.M. Carloni Calame)

- Development of interface between POWHEG QCD+EW and PYTHIA/PHOTOS generators (under test at ATLAS and CMS)
- Assesment of EW, mixed QCD/EW and higher order (pairs) uncertainties in W-mass measurement
- Preliminary results shown at the workshop W Mass Measurement at the LHC (CERN)
- Paper in preparation

EW physics in the Sudakov limit
(M. Chiesa)

- Implementation in ALPGEN of Sudakov corrections to V+n jets (V = γ, W, Z), jet production, diboson production...
- Phenomenological analysis in the Sudakov zone of vector boson fusion and Higgs boson pair production (compositness)
- Papers in preparation





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

- 30 participants/week on the av.
- HP2 Conference (3-5 Sept. '14, ~60 parts.)
- Training week (29 Sept. – 3 Oct. '14)
- Joint ATLAS-CMS-Theory Meeting on W mass (20-21 Oct. '14, ~30 parts.)

What Next?

Participation to the subgroup GRIV

"The Standard Model from the LHC to future colliders: a contribution to the Workshop "What Next" of INFN"
arXiv:1505.01279

Part of above in

"What Next: White Paper of CSN1"
Proposal for a long term strategy for accelerator based experiments

MANYBODY

Carlotta Giusti

Matteo Vorabbi

Franco Pacati

Andrea Meucci

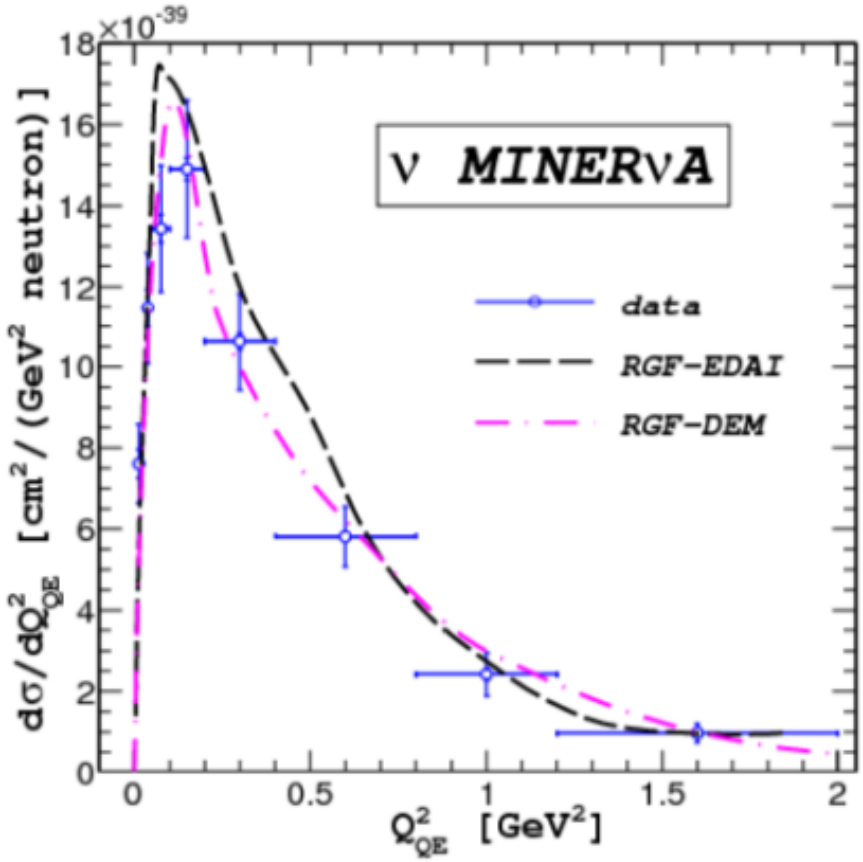
ELECTROWEAK REACTIONS ON STABLE AND EXOTIC NUCLEI

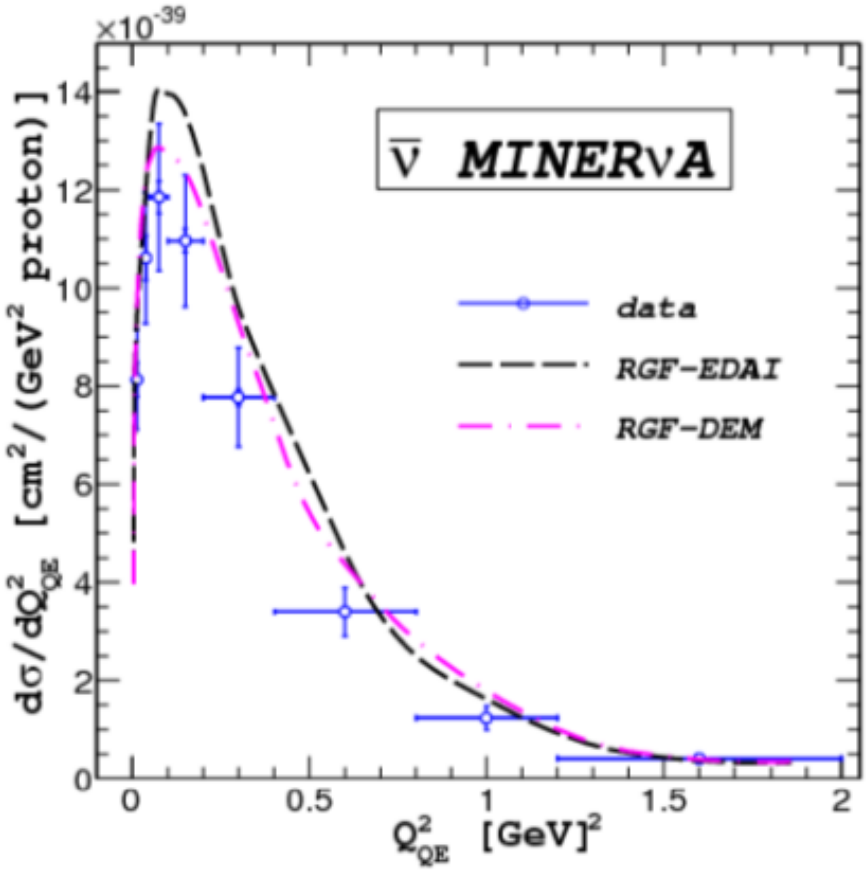
- quasielastic (QE) electron and neutrino-nucleus scattering
- elastic and QE electron scattering on exotic nuclei
- parity-violating electron scattering (PVES)

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

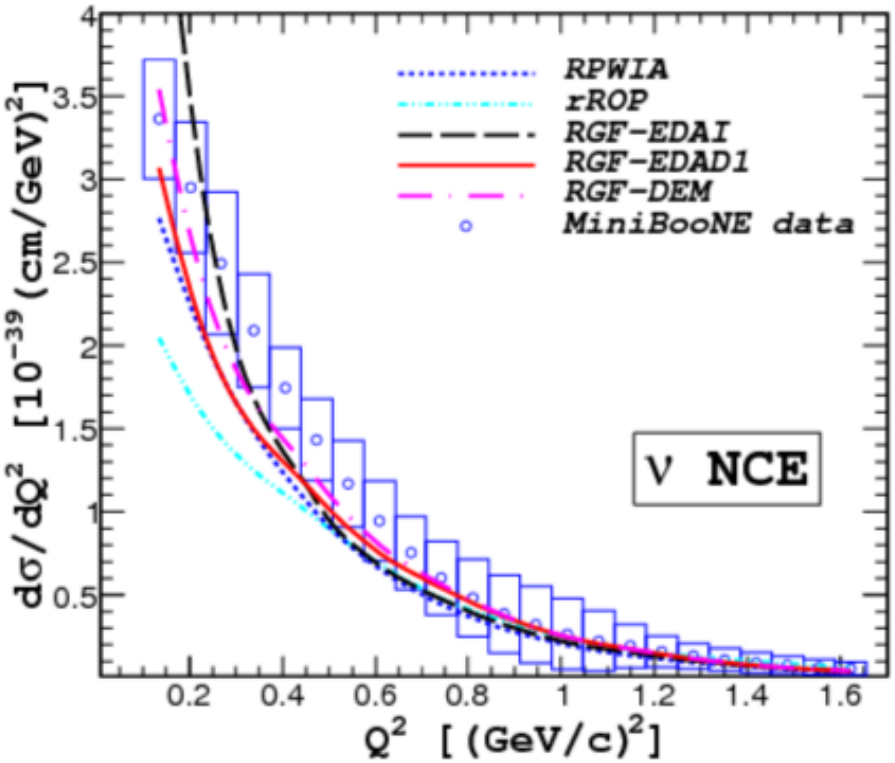
Comparison RGF - MINERvA charged-current quasielastic data

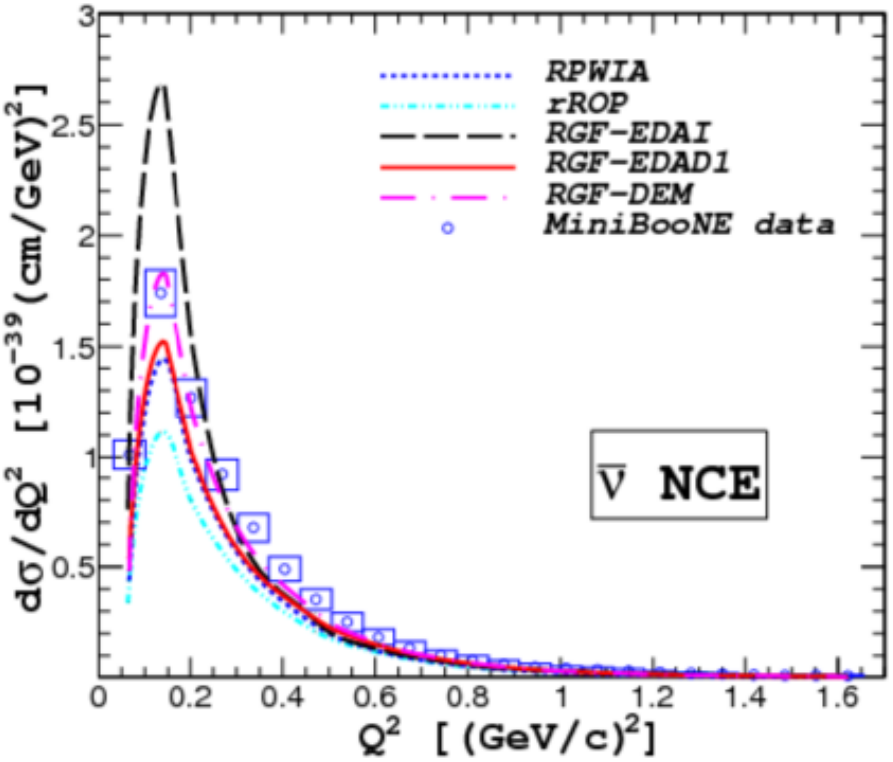




A. Meucci and C.Giusti PRD 89 117301 (2014)

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

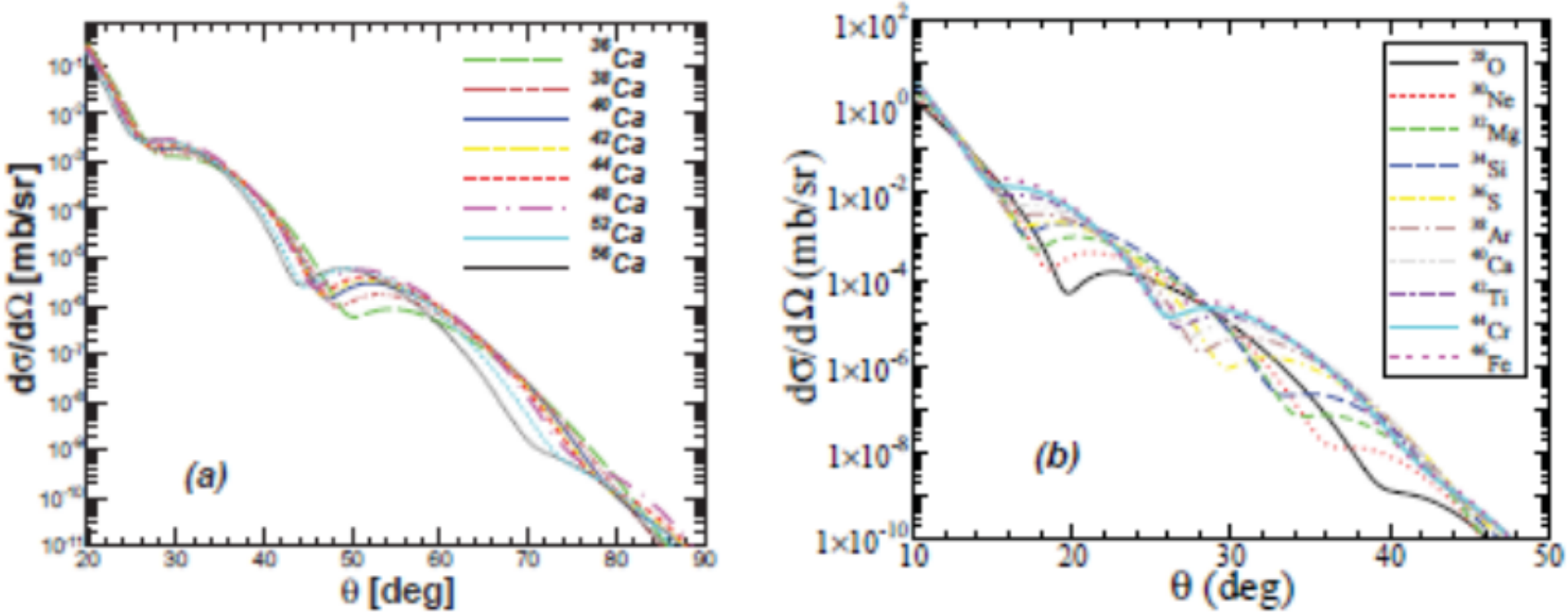
Elastic and Quasielastic Electron Scattering off Isotopic and Isotonic Chains

Results are obtained for the elastic and QE cross sections and for the parity-violating (PV) asymmetry. 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 elastic electron scattering data 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 weak charge density and PV asymmetry parameter obtained by the PREX Collaboration on ^{208}Pb is presented.

Elastic Electron Scattering off Isotopic Z=20 and Isotonic N=20 Chains

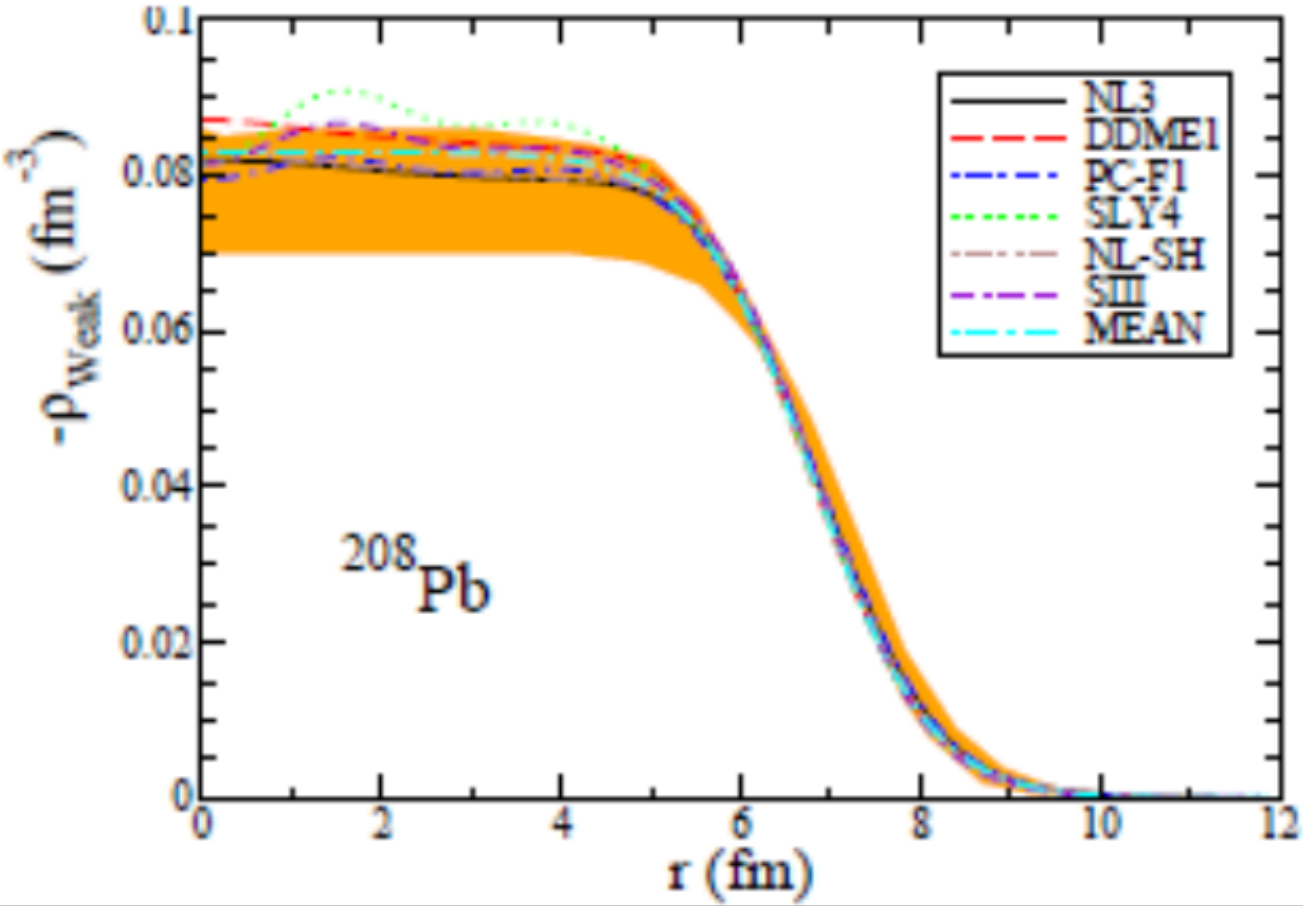
Evolution of nuclear properties with respect to the N/Z asymmetry
Calculations: relativistic mean-field model + DWBA



M. Vorabbi, A. Meucci, C. Giusti, P.Finelli, F.D. Pacati Journal of Physics, Conference Series 527 012024 (2014) ; PRC 89 034604 (2014)

COMPARISON WITH PREX DATA: WEAK CHARGE DENSITY

theoretical predictions for different mean-field models.
The shaded area gives experimental error bands



M. Vorabbi, A. Meucci C.Giusti, F.D. Pacati, P. Finelli PRC 90 027301 (2014)

ELECTROWEAK REACTIONS ON STABLE AND EXOTIC NUCLEI

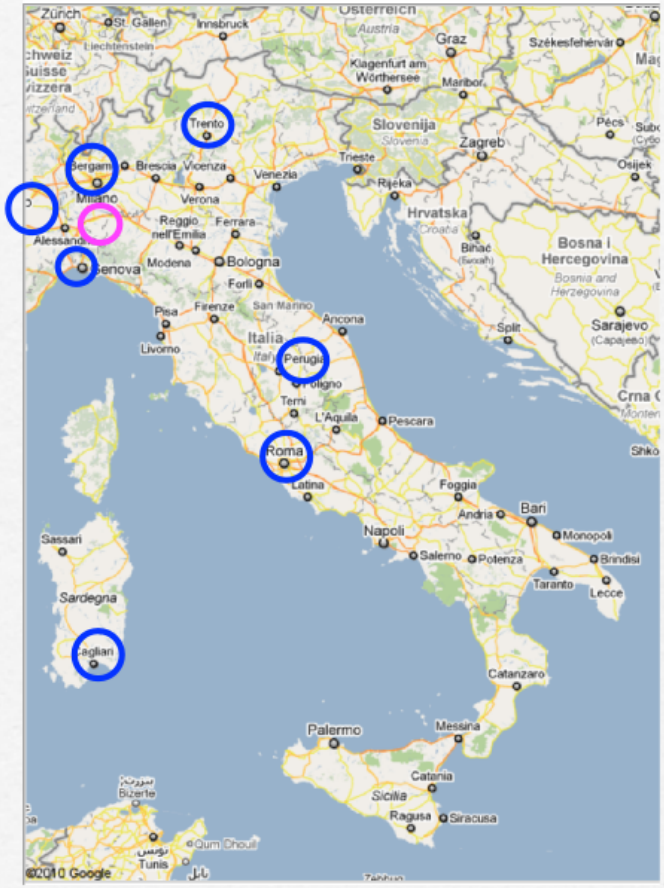
- Elastic and Quasi-Elastic Electron Scattering off the N = 14,20, and 28 isotonic chains: A. Meucci, M.Vorabbi, C. Giusti, P. Finelli, F.D. Pacati PRC 89 034604 (2014)
- Elastic and Quasi-Elastic Electron Scattering off Isotopic and Isotonic Chains: M. Vorabbi, A. Meucci, C. Giusti, P. Finelli, F.D. Pacati Journal of Physics, Conference Series 527 012024 (2014)
- Neutron Density Distribution and Neutron Skin Thickness of ^{208}Pb: M. Vorabbi, A. Meucci, C. Giusti, P. Finelli, F.D. Pacati PRC 90 027301 (2014)
- Final-State Interactions Effects in Neutral-Current Neutrino and Antineutrino Cross Sections at MiniBooNE Kinematics: A. Meucci, C. Giusti PRD 89 057302 (2014)
- Relativistic Green's Function Model in Charged-Current Quasielastic Neutrino and Antineutrino Scattering at Minerva Kinematics: A. Meucci, C. Giusti PRD 89 0117301 (2014)
- Quasielastic Scattering with the Relativistic Green's Function Approach: A. Meucci, C. Giusti AIP Conf. Proc. 1663 080004 (2015)
- Relativistic Green's Function Model and Charged-Current Inclusive Neutrino-Nucleus Scattering at T2K Kinematics: A. Meucci, C. Giusti PRD 91 093004 (2015)
- Neutral-Current Quasielastic (Anti)Neutrino Scattering beyond the Fermi Gas Model at MiniBooNE and BNL Kinematics: M.V. Ivanov, A.N. Antonov, M.B. Barbaro, C. Giusti, A. Meucci, J.A. Caballero, R. Gonzalez-Jimenez, E. Moya de Guerra, J.M. Udias, PRC 91 034607 (2015)

NINPHA National INitiative in Physics of HAdrons

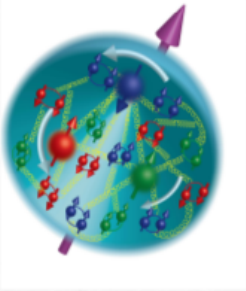
Responsabile nazionale: M. Radici
Sedi: PV, TO, CA, PG, RM1, GE, TN, MiB

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

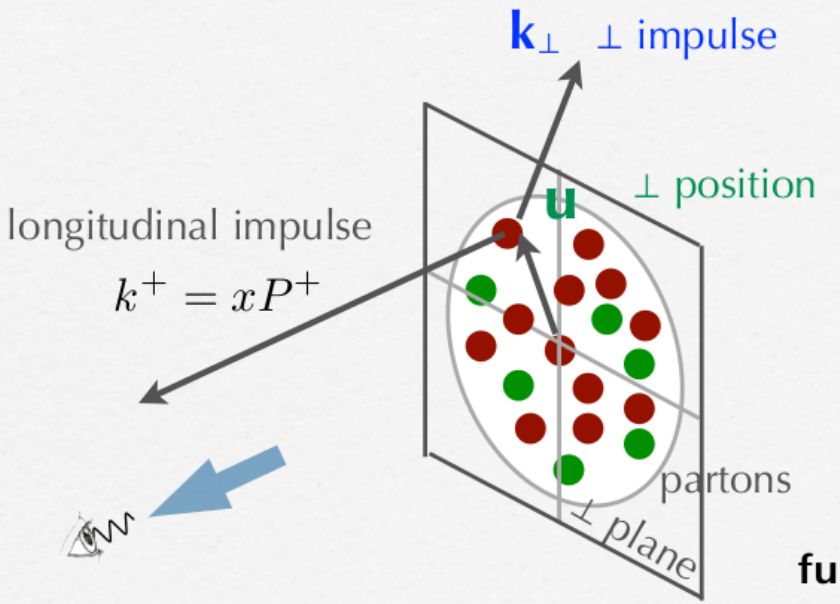
INFN	I ric.	M. Radici
	ric.	M. Guagnelli
Univ.	2 P.A.	A. Bianconi (30%), B. Pasquini
	1 R.U.	A. Bacchetta
	1 post-doc	X. Xiong
	2 Ph.D.	B. De Palma, L. Mantovani



QCD confinement ⇒ internal structure of proton ?



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



Multi-dimensional analysis

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

k space

TMD(x,$\mathbf{k}_\perp$) GPD(x,ξ,t↔û)

u space

WD(x, $\mathbf{k}_\perp$,u)
Wigner distributions

full mom. space

Generalized TMD **GTMD(x, $\mathbf{k}_\perp$, $\mathbf{P}_\perp$)**

model-indep. connection between the GTMD $F_{1,4}$ and the quark OAM

$$\mathcal{L}_z^q = -\int dx d\mathbf{k}_\perp \frac{\mathbf{k}_\perp^2}{M^2} F_{1,4}^q(x, 0, \mathbf{k}_\perp^2, 0, 0; \eta)$$

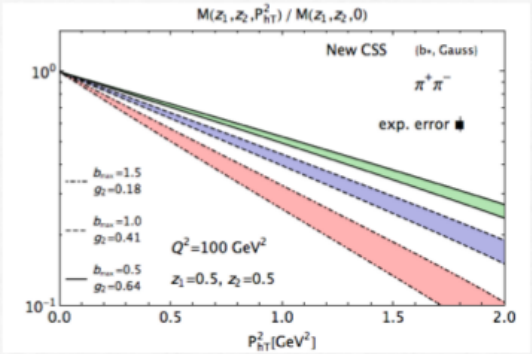
Kanazawa, Lorcè, Metz, Pasquini, Schlegel, P.R.D**90** (14) 014028

explore TMD evolution

$f_1 =$ 

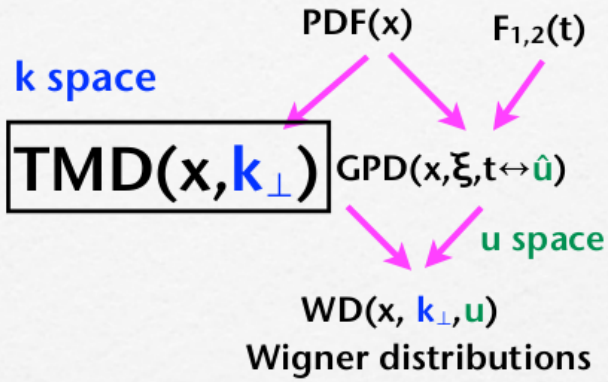
sensitivity to different schemes for nonperturb. effects in e+ e- → π+ π- X

impact on P_T spectrum of $p\bar{p} \rightarrow Z_0$ X and W mass



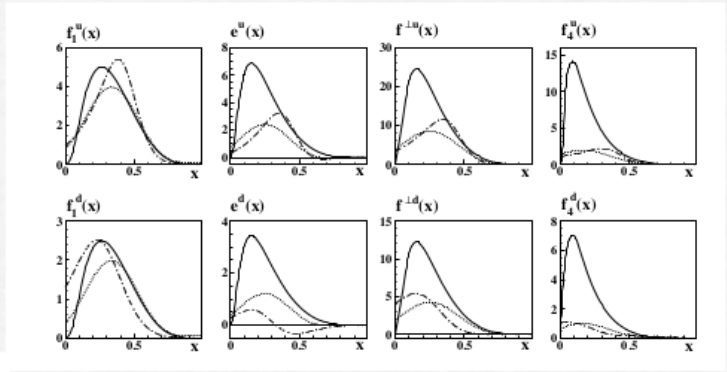
Bacchetta, Echevarria, Mulders, Radici, Signori, in preparation

Multi-dimensional analysis



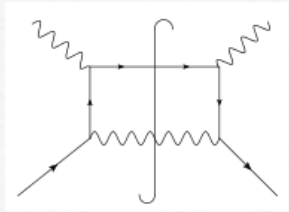
explore higher-twist TMD in models

Lorcé, Pasquini, Schweitzer, JHEP **1501** (15) 103

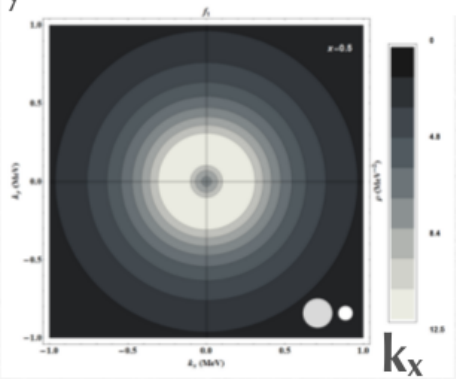


explore TMD of e- in QED

TMD of e- in a dressed e-

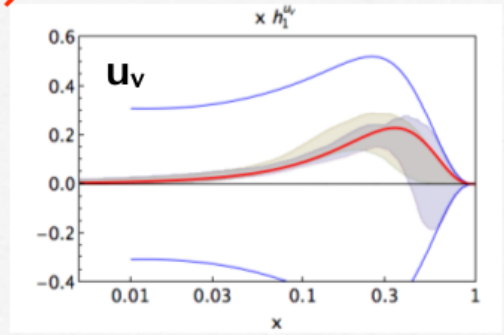


k_y $f_1^e(x=0.1,k_\perp)$



Bacchetta, Mantovani, Pasquini, in preparation

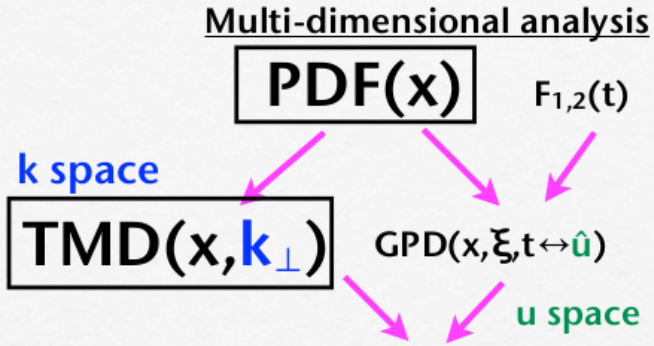
current best determination of valence transversity $h_1^q(x)$



combined fit of 2-hadron semi-incl. production in SIDIS and e+e- via di-hadron fragm. funct.

Gliske, Radici, Bacchetta, P.R. D**90** (14) 114027
Radici, Courtoy, Bacchetta, Guagnelli, JHEP **1505** (15) 123

Multi-dimensional analysis



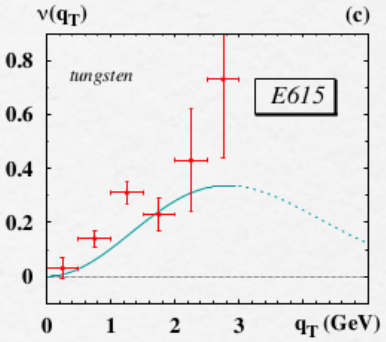
Drell-Yan: violation of Lam-Tung s.r.

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

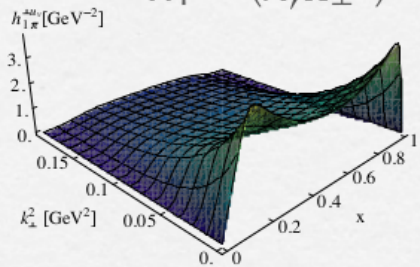
$\nu(q_T) \sim h_1^\perp \otimes h_1^\perp$ Boer-Mulders TMD

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

evaluation of Boer-Mulders in quark models



$h_1^{\perp u}(x,k_\perp^2)$



Pasquini, Schweitzer, P.R. D**90** (14) 014050

light-cone PDF, TMD, GPD from quasi-PDF, quasi-TMD, quasi-GPD on Euclidean lattice

Ji, Sun, Xiong, Yuan, P.R. D91 (15) 074009
Ji, Schaefer, Xiong, Zhang, arXiv:1506.00248
Bacchetta, Pasquini, Radici, Xiong, in preparation

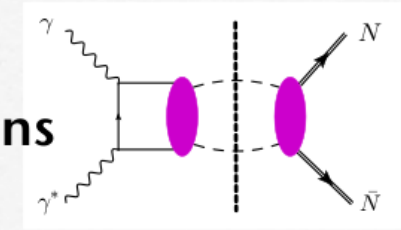
calculate time-indep. space-like q-q correlator at finite P_z on Euclidean lattice;
recover true results on light-cone for $P_z \to \infty$
predict PDF(x) using quasi-PDF for $x<x_C$ and Mellin moments from lattice for large x

Pasquini, Polyakov, Vanderhaeghen,
P.L. **B739** (14) 133

evaluation of D-term form factor in DVCS via disper. relations

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

disper. relations on A_i



Also:

- 20 invited talks (9 with proceedings)
- co-organiz. of 2 workshops (INFN2014, INT-Seattle)
- convener DIS2014, LC2014, SPIN2014
- member of SAC at LC2014, of LOC at Transversity 2014
- member of IAC at Transversity 2014, QNP2015

Collaborations

- JLab Hall A & B collab.'s
- Univ. Mainz ; Univ. Tuebingen
- Univ. Liège
- Univ. Connecticut ; Univ. Temple ; SLAC
- VU Amsterdam

Other funds

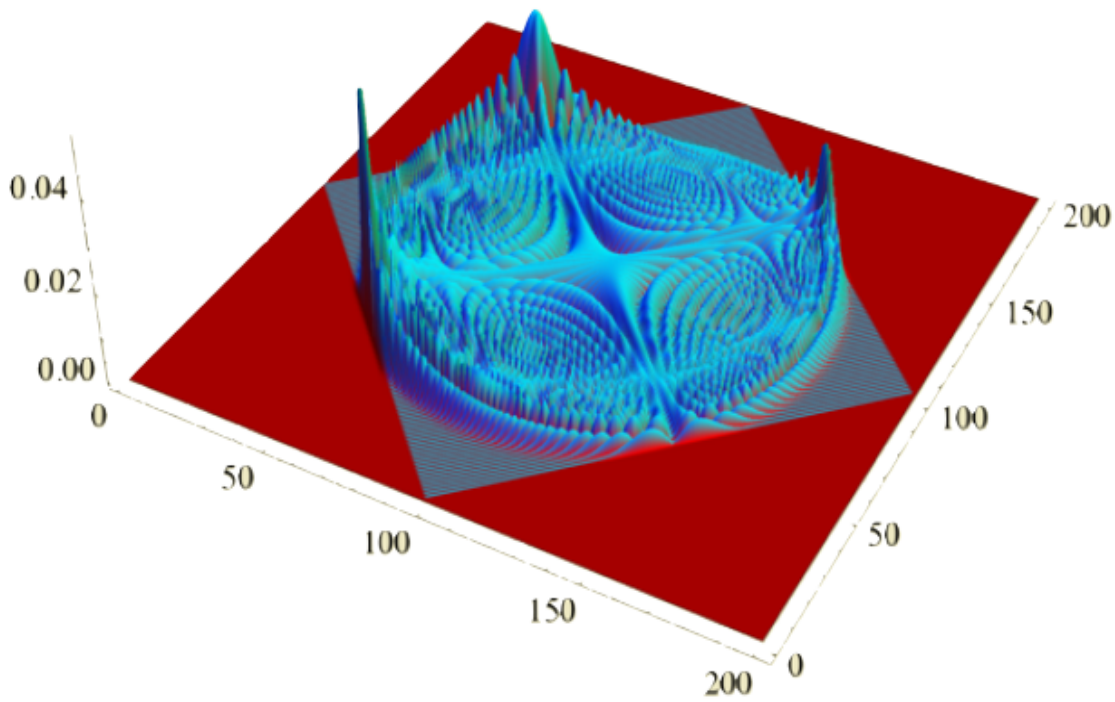
- FP7: HadronPhysics3 (HP3) till Dec. 2014

- ERC consolidator

GE41

Quantum Cellular Automaton extension of Quantum Field Theory
free field theory

Giacomo Mauro D'Ariano, PO
Lorenzo Maccone, PA
Chiara Macchiavello, PA
Paolo Perinotti, RU
Alessandro Bisio, AS
Alessandro Tosini, AS
Nicola Mosco, DOTT
Marco Erba. DOTT



MAIN RESULTS

The Free QFT in 3 space-dimensions emerges from the large-scale dynamics of the minimal nontrivial quantum cellular automaton satisfying:

1. unitariety
2. locality
3. homogeneity
4. isotropy

without using SR, without using mechanics.
Theory quantum *ab initio* (no quantization rules).
1+2+3 lead to a quantum cellular automaton on the Cayley graph of a group *G*

Restrict to *G* Abelian (corresponding to QFT on flat space).
Restrict to linear (free theory): quantum walk .

Results

- *Relativistic regime* (wave-vectors $k \ll 1$): Weyl, Dirac and Maxwell recovered with high precision.
- *Ultra-relativistic regime* $k \sim 1$
  - Lorentz covariance is distorted in the(nonlinear Lorentz)
  - Maxwell distorted: dispersion and birefringence in vacuum, …
  - *m* bounded by 1 with dispersion relation becoming flat interpreted as mini black-hole -> m=1 Planck mass
- The automaton to be regarded as a theory unifying Fermi with Planck scales.

Recent result

- New non-kinematical definition of reference frame and invariance leading to nonlinear Lorentz for *G* Abelian and $k \ll 1$.

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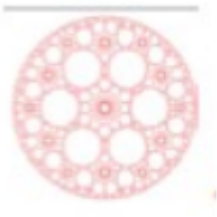

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Pubblicazioni *2014*

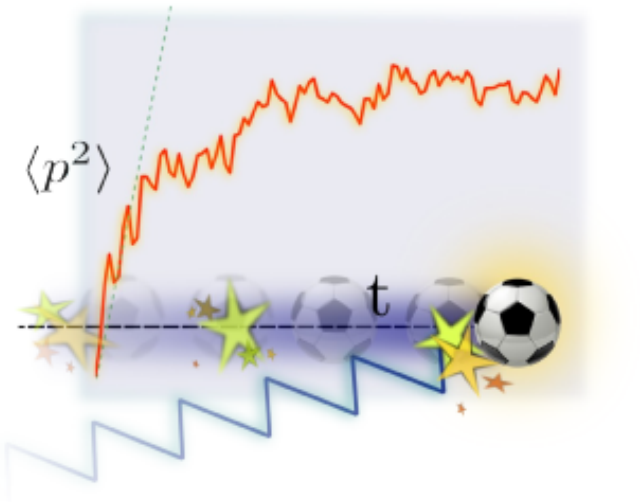
1 . Fausto Borgonovi and G. Luca Celardo
A superradiance-based biological switch
AIP Conference Proceedings 1619, **54** (2014); doi: 10.1063/1.4899218
2. G. Luca Celardo, Paolo Poli, Luca Lussardi, and Fausto Borgonovi
Cooperative robustness to dephasing: Single-exciton superradiance in a nanoscale ring to model natural light-harvesting systems
Phys. Rev. B **90**, 085142 (2014)
3 G. Luca Celardo, Giulio G. Giusteri, and Fausto Borgonovi
Cooperative robustness to static disorder: Superradiance and localization in a nanoscale ring to model light-harvesting systems found in nature
Phys. Rev. B **90**, 075113 (2014)
4 D. Ferrari, G.L. Celardo, G.P. Berman, R.T. Sayre and F. Borgonovi
Quantum Biological Switch Based on Superradiance Transitions
Jour. Phys. Chem. C, **118**, 20-26 (2014)
5. I. Guarneri, G. Casati, K. Karle,
Classical Dynamical Localization
Phys. Rev. Lett. **113**, 174101 (2014)

Attivita': in corso, & future

BS:

Quantum Coherent effects in Light-Harvesting Systems
Collective Cooperative Shielding in Long range interacting systems

Thermalization in isolated quantum systems



Classical Dynamical Localization

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We consider classical models of the kicked rotor type, with piecewise linear kicking potentials designed so that momentum changes only by multiples of a given constant. Their dynamics display quasilocalization of momentum, or quadratic growth of energy, depending on the arithmetic nature of the constant. Such purely classical features mimic paradigmatic features of the quantum kicked rotor, notably dynamical localization in momentum, or quantum resonances. We present a heuristic explanation, based on a classical phase space generalization of a well-known argument, that maps the quantum kicked rotor on a tight-binding model with disorder. Such results suggest reconsideration of generally accepted views that dynamical localization and quantum resonances are a pure result of quantum coherence.

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Editors' Suggestion

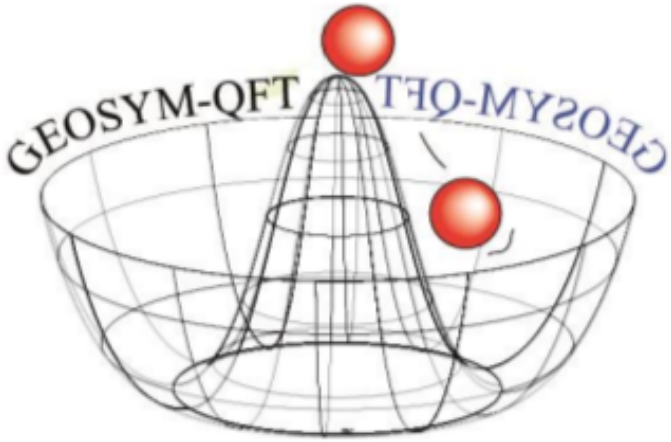
Classical Dynamical Localization

Italo Guarneri, Giulio Casati, and Volker Karle

Phys. Rev. Lett. 113, 174101 (2014) – Published 20 October 2014

Features thought to be unique to quantum dynamical systems, such as localization of momentum, are found in a classical kicked rotor - where particles move in a ring and are 'kicked' periodically by an external field that changes the particle's momentum.

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



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

- **Pavia**
  - A. Marzuoli (cordinatore)
  - M. Carfora, C. Dappiaggi, G. Jug
  - Dottorandi: G. Nosari, S. Rutili (XXIX)
  - Post-doc: H. Ferreira (da ottobre 2015)
  - Laureando: J Fumagalli

Consuntivo attività GEOSYM_QFT gennaio-dicembre 2014

- Incontro in occasione del convegno *Problemi Attuali di Fisica Teorica* (Vietri, aprile 2014), coordinato da M. Carfora
- Procedura di selezione per una posizione di postdoc (Nov 2014)
- 2 tesi di dottorato in Fisica (D. Marinelli XXVI e M. Benini XXVII)
- 7 tesi di Laurea in Fisica (Triennali e Magistrali)
- Attività editoriali: M. Carfora: Editor in Chief of "Geometric Flows" (De Gruyter); C. Dappiaggi: Editor of "Advances in Mathematical Physics" (Hindawi) and "Frontiers in Mathematical Physics"

- Pubblicazioni:

- 10 lavori agganciati; + G Cusin, J Fumagalli, M Maggiore *Non-local formulation of ghost-free bigravity theory* , JHEP 09 (2014) 181
- Preprint 2014 (ancora in corso di stampa): M Carfora *Einstein Constraints and Ricci Flow*, Pp.1-128. Chapter in "Aspects of Mathematical Relativity" MSRI Publications, Cambridge Univ. Press, to appear; M Carfora *The Wasserstein geometry of non-linear sigma models and the Hamilton-Perelman Ricci flow* (94 pp.) arXiv:1405.0827v1

Tematiche di ricerca della IS a Pavia

General Relativity, Geometric flows and renormalization group techniques ; Algebraic quantum field theory; Topological quantum field theory; Applications to quantum many-body and condensed matter systems

(A) Quantum field theory landscaping and geometric flows; structure problems for the Einstein constraint equations; backreaction issues in Relativistic Cosmology (M Carfora, T. Buchert, G.F.R. Ellis et al): arXiv:1505.07800 [gr-qc]

(B) Quantization of linearized gravity on globally hyperbolic, asymptotically flat vacuum spacetimes and characterization of radiative observables; curvature fluctuations on asymptotically de Sitter spacetimes via the semiclassical Einstein's equations. Systematic characterization of the Casimir effect from the viewpoint of algebraic QFT.

(C) Quadratic and q-deformed symmetry algebras in topological QFT and gravity models. Characterization of general Bose-Einstein systems in terms of the Lie-Hopf structure of su(1,1).

(D) Applications of methods from QFT in condensed matter systems

TASP – Pavia – 2015

Marco Roncadelli

INFN – Pavia, Italy

COMPOSIZIONE DEL GRUPPO

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Andrea De Luca, INAF (MI), ricercatore, docente a contratto Università di PV, FTE $= 0.5$.

Andrea Tiengo, IUSS (PV), ricercatore, docente a contratto Università di PV, FTE $= 0.5$.

Attività di M. Roncadelli

Un gruppo di astrofisici coordinato da G. W. Fraser ha pubblicato in ottobre 2014 un articolo secondo il quale è stato scoperto un nuovo fondo diffuso X con modulazione annuale usando il satellite XMM-Newton dell'ESA. Questi autori hanno anche proposto una interpretazione di tale risultato. La regione interna del sole emetterebbe assioni, che si convertirebbero in fotoni X nel campo geomagnetico, che – avendo una morfologia estremamente complicata – non conservebbe l'impulso. Ne segue che la conversione $\mathrm{assione} \to \mathrm{fotone}$ non sarebbe collineare. Con abbastanza fantasia si può immaginare che il flusso di assioni uscente radialmente dal sole si trasformi alla fine in un flusso isotropo di raggi X. Dato che XMM-Newton si muove intorno alla terra con frequenza annuale, questo spiegherebbe il fondo diffuso X con modulazione annuale osservato. E dato che la massima sensibilità di XMM é intorno a $2.3 \cdot 10^{-6}\,\mathrm{GeV}$, questa sarebbe la massa dell'assione. Non solo l'assione sarebbe stato scoperto, ma sarebbe un candidato ideale per la cold dark matter!

Anche se tutto ciò fosse vero, si avrebbe un'enorme riduzione del flusso osservato per due motivi distinti. Il primo è che la supposta isotropizzazione dei raggi X farebbe diminuire drasticamente il flusso potenzialmente osservabile da qualunque satellite che non punti verso il sole. Il secondo è che il campo di vista di XMM è estremamente piccolo, di appena 30 arcominuti, per cui potrebbe osservare solo una frazione pari a 10^{-5} del flusso isotropo.
Al fine di chiarire la situazione, in collaborazione con Fabrizio Tavecchio (INAF, Brera) abbiamo ricalcolato tutto. Come ipotesi di partenza, abbiamo supposto che XMM puntasse direttamente il sole, cosa fisicamente assurda perchè i suoi sensibilissimi rivelatori – fatti per osservare oggetti celesti a distanze cosmiche – verrebbero istantaneamente distrutti. Con nostra sorpresa, il nostro risultato ottenuto in questo modo coincide perfettamente con quello di Fraser e collaboratori. Quindi non è stato osservato alcun assione solare nè tanto meno alcun candidato per la cold dark matter!

Attività di P. Caraveo, A. De Luca e A. Tiengo

La nostra attività si è focalizzata sull'osservazione e l'interpretazione dell'emissione a multifrequenza delle stelle di neutroni isolate e della loro interazione con il mezzo intergalattico. Abbiamo continuato la nostra campagna osservativa nei raggi X riguardante i pulsar a raggi gamma radio-quieti rivelati da Fermi-LAT. L'analisi di un'osservazione fatta con XMM-Newton del pulsar PSR J1741-2054 ci ha permesso di ottenere una completa caratterizzazione della sua fenomenologia nella banda 0.3-8 keV. Abbiamo rivelato pulsazioni termiche e non termiche nella banda X, modulate al livello del 40 % aventi una forma simile ed allineate in fase. I picchi X sono sfasati di 90° rispetto a quelli gamma. Gli attuali modelli della magnetosfera non sono in grado di spiegare questo fatto. La spettroscopia ha mostrato una significante evoluzione della componente X nontermica in funzione della fase. È stata osservata una struttura elongata costituita da un'emissione X che ha origine nella posizione del pulsar e si estende per alcuni arcominuti, avente uno spettro termico.

È possibile che questa coda sia una "bow-shock nebula" associata al moto supersonico del pulsar attraverso il mezzo interstellare.

Una osservazione combinata di XMM and Chandra del pulsar radio quieto PSR J1813-1246 ha fornito risultati molto interessanti. L'emissione di raggi X soffici è risultata essere completamente non termica e totalmente pulsata, con due picchi stretti, separati di 0.5 nella fase di rotazione. Cosa ancor più interessante è che gli impulsi X sono separati di 0.25 nella fase di rotazione rispetto ai due picchi netti osservati nella curva di luce gamma da Fermi-LAT. Tale comportamento non può essere spiegato dai modelli attuali riguardanti la magnetosfera dei pulsar. Abbiamo proposto un nuovo modello geometrico, secondo il quale l'emissione gamma proviene – come nei modelli usuali – dalla regione esterna della magnetosfera, mentre i raggi X sono prodotti da una cascata al disopra delle "polar caps" in una configurazione di campo magnetico in cui e' presente un plasma tale da annullare le forze magnetiche.