
Scientific Activity:

My research activity has been mostly focused on the study of the non-perturbative dynamics of strong interacting particles (QCD) starting from the formulation of this theory on the lattice (LQCD). In particular, in collaboration with several leading scientists (see the list of publications below),

- I got interested in the study of the chiral regime of QCD by performing numerical simulation of the two dynamical flavour formulation of the theory on physical volumes of the order of 2.5 fm. As a result of these simulations we have extracted some of the low energy constants that characterise the low energy dynamics of the pions, as predicted within the context of Chiral Perturbation Theory. By starting from the results obtained in the papers published in collaboration with the CERN group, we have built an international initiative, CLS (Collaborative Lattice Sharing), involving researchers from several institutions (Rome, Milan, CERN, DESY Zeuthen, Mainz, Madrid).

- I have studied processes relevant in order to establish the current theory of flavour interactions and CP violation within the Standard Model of Fundamental Interactions (CKM paradigm) by calculating from first principles observables like the bottom quark mass, the heavy-light decay constants of the B and D mesons, the differential decay rate as a function of the transferred square momentum of the semileptonic processes $B \rightarrow D^{(*)} \ell \nu$. To this end I have worked to the definition of a computational method to reconcile the two largely separated energy scale characterising heavy-light mesons (the heavy and light quark masses respectively) with the ultraviolet cutoff (lattice spacing) and the infrared cutoff (finite volume) both present in lattice simulations.

- Concerning flavour physics on the lattice I have worked out a method to calculate leading isospin breaking effects on hadronic observables. The method consists in expanding the lattice path-integral with respect to the QED coupling constant and the up-down quark mass difference. The resulting correlators are then calculated by starting from isosymmetric (standard) QCD simulations. The method has been applied in order to calculate from first principles the mass splitting of the charged and neutral pions, of the charged and neutral kaons, the quark mass difference $m_d - m_u$ and the QCD isospin breaking effects on the K_{l2} decay rate.

- I have introduced a method to cope with the problem of the discretization of spatial momenta on a finite volume. The method is based on particular boundary conditions for the quark fields, periodic up to a generic phase. This method is by now widely used thus representing the standard numerical approach whenever one is interested in calculating phenomenologically relevant observables that require a momentum transfer between initial and final states.

- My interest for the physics of complex system lead me to the study, performed by using numerical techniques, of biological systems of medical relevance like amyloid fibrils formed by the protein Abeta, responsible of the neurodegenerative pathology known as Alzheimer's disease.

Thanks to my scientific skills in the field of large scale numerical simulations and parallel computations, I have been a member of the scientific board of the project "Problemi Interdisciplinari riconducibili a Simulazioni Numeriche su Larga Scala" of the "Museo Storico della Fisica e Centro Studi e Ricerche E. Fermi". Within this project I have installed and directed, under the supervision of Prof. R. Petronzio, a large computing centre with several super-computers (PC clusters). Thanks to these computing resources, several research groups from international institutions have been able to perform state-of-the-art numerical simulations in research fields ranging from particle physics to biological and medical systems. For example, the website Madgraph that allows to perform Montecarlo calculations of hadronic cross-sections of processes relevant for LHC physics has been developed by the authors within this initiative and it has been running for five years on the E. Fermi PC clusters.

For personal reasons and thanks to the opportunities that I had in my country, I have decided to develop my career in Italy. At the same time, the results obtained and the knowledges I gained over the years are the outcome of the collaborations with several international research groups. In particular I had the possibility to collaborate with CERN within the group led by Martin Lüscher, within the ETH of Zurich with the group led by Prof. Michele Parrinello, with DESY Zeuthen within the group led by Prof. Rainer Sommer but also with the Italian research groups led by Prof. Nicola Cabibbo, by Prof. Roberto Petronzio and by Prof. Guido Martinelli.

Scientific Positions:

From 2010 to Present: Ricercatore Universitario (Permanent)
Università degli Studi di Roma "Tor Vergata", Via O. Raimondo 18,
00173 Roma (Italia)

From 2007 to 2010: Staff Member (non permanent)
Istituto Nazionale di Fisica Nucleare, Via E. Fermi 40, 00044
Frascati (Italia)

From 2004 to 2010: Scientific Advisor
Museo Storico della Fisica e Centro Studi e Ricerche "E. Fermi",
Compendio Viminale, 00184 Roma (Italia)

Form 2005 to 2007: Fellow

Istituto Nazionale di Fisica Nucleare, Via E. Fermi 40, 00044
Frascati (Italia)

From 2001 to 2001: Fellow
Università degli Studi "La Sapienza" di Roma, Piazzale Aldo Moro 5,
00185 Roma (Italia)

Conference Organising Committees:

06/2010: Local Organising Committee of the international conference
LATTICE2010,
Conference: "the XXVIII International Symposium on Lattice Field
Theory", Villasimius, Italy

Invited Talks:

Over the years I had the opportunity to give talks to several
international conferences and workshops. I list below some of the
invited talks:

07/2013: I have been invited to give a plenary talk to "the XXXI
International Symposium on Lattice Field Theory", Mainz, Germany.
Title: Isospin Breaking Effects in Lattice QCD.

09/2012: 7th International Workshop on the CKM Unitarity Triangle
(CKM 2012), Cincinnati, USA
Title: Lattice QCD calculations of isospin corrections to K_{l2} and
 K_{l3} decays.

07/2011: 2011 Europhysics Conference On High Energy Physics: HEP
2011 (EPS-HEP2011), Grenoble, France
Title: Lattice flavour physics.

05/2011: XVII SuperB Workshop and Kick Off Meeting, La Biodola,
Italy
Title: Lattice QCD in view of the SuperB.

09/2008: 5th International Workshop on the CKM Unitarity Triangle
(CKM 2008), Rome, Italy
Title: Future prospects for LQCD form factors calculations.

06/2008: 34th International Conference on High Energy Physics (ICHEP
2008), Philadelphia, USA
Title: Heavy-light meson's physics in Lattice QCD.

12/2006: 4th International Workshop on the CKM Unitarity Triangle

(CKM 2006), Nagoya, Japan
Title: Lattice calculations for B and K mixing.

Teaching:

From 2011 to 2013: I have been teaching "Lattice Gauge Theories"
Università degli Studi "Tor Vergata" di Roma

From 2011 to 2012: Member of the board of Professors of the Ph.D.
Physics School
Università degli Studi "Tor Vergata" di Roma

From 2004 to 2012: I have given complements to the classes "Theory
of fundamental particles I e II", Prof. R. Petronzio
Università degli Studi "Tor Vergata" di Roma

From 2002 to 2002: I have given complements to the class "Meccanica
Razionale", Prof. G.C.. Rossi
Università degli Studi "Tor Vergata" di Roma

During 2012 I have been co-advisor of the master degree thesis of
Dott. Giulio Gasbarri at Università degli studi di Roma "Tor
Vergata".

Education:

I took the master degree in Physics with the highest grade at
Università degli Studi "La Sapienza" di Roma, on the day 25/05/2005,
advisor Prof. Nicola Cabibbo.

I took the Ph.D. in Physics at Università degli Studi "Tor Vergata"
di Roma, on the day 11/10/2005, advisor Prof. Roberto Petronzio.

Publications:

1) Leading isospin breaking effects on the lattice
By G.M. de Divitiis, R. Frezzotti, V. Lubicz, G. Martinelli, R.
Petronzio, G.C. Rossi, F. Sanfilippo, S. Simula et al..
arXiv:1303.4896 [hep-lat].
Accepted on Phys.Rev.D

2) On the extraction of zero momentum form factors on the lattice

By G.M. de Divitiis, R. Petronzio, N. Tantalo.
arXiv:1208.5914 [hep-lat].
10.1016/j.physletb.2012.10.035.
Phys.Lett. B718 (2012) 589–596.

3) Parameters of Heavy Quark Effective Theory from $N_f=2$ lattice QCD
By ALPHA Collaboration (Benoit Blossier et al.).
arXiv:1203.6516 [hep-lat].
10.1007/JHEP09(2012)132.
JHEP 1209 (2012) 132.

4) Isospin breaking effects due to the up-down mass difference in Lattice QCD
By G.M. de Divitiis, P. Dimopoulos, R. Frezzotti, V. Lubicz, G. Martinelli, R. Petronzio, G.C. Rossi, F. Sanfilippo et al..
arXiv:1110.6294 [hep-lat].
10.1007/JHEP04(2012)124.
JHEP 1204 (2012) 124.

5) Distance preconditioning for lattice Dirac operators
By G.M. de Divitiis, R. Petronzio, N. Tantalo.
arXiv:1006.4028 [hep-lat].
10.1016/j.physletb.2010.07.031.
Phys.Lett. B692 (2010) 157–160.

6) Non-perturbative improvement of quark mass renormalization in two-flavour lattice QCD
By Patrick Fritzsche, Jochen Heitger, Nazario Tantalo.
arXiv:1004.3978 [hep-lat].
10.1007/JHEP08(2010)074.
JHEP 1008 (2010) 074.

7) Flavor Physics in the Quark Sector
By Mario Antonelli, David Mark Asner, Daniel Adams Bauer, Thomas G. Becher, M. Beneke, Adrian John Bevan, Monika Blanke, C. Bloise et al..
arXiv:0907.5386 [hep-ph].
10.1016/j.physrep.2010.05.003.
Phys.Rept. 494 (2010) 197–414.

8) Quenched lattice calculation of the vector channel $B \rightarrow D^* l \nu$ decay rate
By G.M. de Divitiis, R. Petronzio, N. Tantalo.
arXiv:0807.2944 [hep-lat].
10.1016/j.nuclphysb.2008.09.013.
Nucl.Phys. B807 (2009) 373–395.

9) Precision for B-meson matrix elements
By Damiano Guazzini, Rainer Sommer, Nazario Tantalo.
arXiv:0710.2229 [hep-lat].
10.1088/1126-6708/2008/01/076.
JHEP 0801 (2008) 076.

10) Quenched lattice calculation of semileptonic heavy-light meson

form factors

By G.M. de Divitiis, R. Petronzio, N. Tantalo.

arXiv:0707.0587 [hep-lat].

10.1088/1126-6708/2007/10/062.

JHEP 0710 (2007) 062.

11) Quenched lattice calculation of the $B \rightarrow D \ell \nu$ decay rate

By G.M. de Divitiis, E. Molinaro, R. Petronzio, N. Tantalo.

arXiv:0707.0582 [hep-lat].

10.1016/j.physletb.2007.08.085.

Phys.Lett. B655 (2007) 45-49.

12) QCD with light Wilson quarks on fine lattices. II. DD-HMC simulations and data analysis

By L. Del Debbio, Leonardo Giusti, M. Luscher, R. Petronzio, N. Tantalo.

hep-lat/0701009.

10.1088/1126-6708/2007/02/082.

JHEP 0702 (2007) 082.

13) QCD with light Wilson quarks on fine lattices (I): First experiences and physics results

By L. Del Debbio, Leonardo Giusti, M. Luscher, R. Petronzio, N. Tantalo.

hep-lat/0610059.

10.1088/1126-6708/2007/02/056.

JHEP 0702 (2007) 056.

14) Stability of lattice QCD simulations and the thermodynamic limit

By L. Del Debbio, Leonardo Giusti, M. Luscher, R. Petronzio, N. Tantalo.

hep-lat/0512021.

10.1088/1126-6708/2006/02/011.

JHEP 0602 (2006) 011.

15) Stability and Structure of Oligomers of the Alzheimer Peptide A β 16-22: From the Dimer to the 32-Mer

By Ute F. Röhrig, Alessandro Laio, Nazario Tantalo, Michele Parrinello, Roberto Petronzio

Biophys. J. 91 (2006) 3217-3229.

16) On the discretization of physical momenta in lattice QCD

By G.M. de Divitiis, R. Petronzio, N. Tantalo.

hep-lat/0405002.

10.1016/j.physletb.2004.06.035.

Phys.Lett. B595 (2004) 408-413.

17) Heavy light decay constants in the continuum limit of quenched lattice QCD

By G.M. de Divitiis, M. Guagnelli, F. Palombi, R. Petronzio, N. Tantalo.

hep-lat/0307005.
10.1016/j.nuclphysb.2003.09.013.
Nucl.Phys. B672 (2003) 372-386.

18) Heavy quark masses in the continuum limit of quenched lattice QCD

By Giulia Maria de Divitiis, Marco Guagnelli, Roberto Petronzio, Nazario Tantalo, Filippo Palombi.
hep-lat/0305018.
10.1016/j.nuclphysb.2003.10.001.
Nucl.Phys. B675 (2003) 309-332.

19) The Lattice scale at large beta in quenched QCD

By Marco Guagnelli, Roberto Petronzio, Nazario Tantalo.
hep-lat/0209112.
10.1016/S0370-2693(02)02819-8.
Phys.Lett. B548 (2002) 58-62.

20) $f(B)$ and two scales problems in lattice QCD

By Marco Guagnelli, Filippo Palombi, Roberto Petronzio, Nazario Tantalo.
hep-lat/0206023.
10.1016/S0370-2693(02)02700-4.
Phys.Lett. B546 (2002) 237-246.

21) Remarks on the gauge dependence of the RI / MOM renormalization procedure

By Leonardo Giusti, S. Petrarca, B. Taglienti, N. Tantalo.
hep-lat/0205009.
10.1016/S0370-2693(02)02243-8.
Phys.Lett. B541 (2002) 350-355.

Proceedings:

1) Lattice calculation of isospin corrections to K_{l2} and K_{l3} decays

By Nazario Tantalo.
arXiv:1301.2881 [hep-lat].

2) Lattice flavour physics

By Nazario Tantalo.
PoS EPS-HEP2011 (2011) 179.

3) Lattice QCD calculation of isospin breaking effects due to the up-down mass difference

By Francesco Sanfilippo, G.M. de Divitiis, R. Frezzotti, R. Petronzio, G.C. Rossi, N. Tantalo, P. Dimopoulos, V. Lubicz et al..
PoS LATTICE2011 (2011) 290.

4) Lattice QCD calculation of strong isospin breaking effects

By G.M. de Divitiis, P. Dimopoulos, R. Frezzotti, V. Lubicz, G.

Martinelli, R. Petronzio, G.C. Rossi, F. Sanfilippo et al..
arXiv:1202.5222 [hep-lat].

5) APENet+: a 3D toroidal network enabling Petaflops scale Lattice QCD simulations on commodity clusters

By Roberto Ammendola, Andrea Biagioni, Ottorino Frezza, Francesca Lo Cicero, Alessandro Lonardo, Pier Paolucci, Roberto Petronzio, Davide Rossetti et al..

arXiv:1012.0253 [hep-lat].

PoS LATTICE2010 (2010) 022.

6) Computer simulations of the theory of strong interactions

By N. Tantalò.

10.1393/ncc/i2009-10417-5.

Nuovo Cim. C32N2 (2009) 267-271.

7) Computing for Lattice QCD: New developments from the APE experiment

By R. Ammendola, A. Biagioni, S. De Luca, F. Lo Cicero, A. Lonardo, P. Paolucci, M. Perra, Davide Rossetti et al..

10.1393/ncb/i2008-10649-8.

Nuovo Cim. B123 (2008) 964-968.

8) Heavy-light meson's physics in Lattice QCD

By N. Tantalò.

arXiv:0810.3624 [hep-ph].

9) D(s) physics from fine lattices

By Georg von Hippel, Rainer Sommer, Jochen Heitger, Stefan Schaefer, Nazario Tantalò.

arXiv:0810.0214 [hep-lat].

PoS LATTICE2008 (2008) 227.

10) Semileptonic decays of heavy-light pseudoscalar mesons

By Nazario Tantalò.

arXiv:0710.0729 [hep-lat].

PoS LAT2007 (2007) 373.

11) Lattice calculations for B and K mixing

By Nazario Tantalò.

hep-ph/0703241 [HEP-PH].

12) $m(b)$ and $f(B)(s)$ from a combination of HQET and QCD

By Damiano Guazzini, Rainer Sommer, Nazario Tantalò.

hep-lat/0609065.

PoS LAT2006 (2006) 084.

13) Status of the APENet project

By R. Ammendola, R. Petronzio, D. Rossetti, A. Salamon, N. Tantalò, P. Vicini.

hep-lat/0509130.

PoS LAT2005 (2006) 100.

14) Remarks on the discretization of physical momenta in lattice QCD

By Nazario Tantalo.
hep-lat/0409037.
10.1016/j.nuclphysbps.2004.11.204.
Nucl.Phys.Proc.Suppl. 140 (2005) 332–334.

15) Heavy quark masses from finite volume effects
By Nazario Tantalo.
hep-lat/0310008.
10.1016/S0920-5632(03)02582-9.
Nucl.Phys.Proc.Suppl. 129 (2004) 361–363.

16) $f(B)$ from finite size effects in lattice QCD
By M. Guagnelli, F. Palombi, R. Petronzio, N. Tantalo.
hep-lat/0209113.
10.1016/S0920-5632(03)01640-2.
Nucl.Phys.Proc.Suppl. 119 (2003) 616–618.

17) Numerical exploration of the RI / MOM scheme gauge dependence
By Leonardo Giusti, S. Petrarca, B. Taglienti, N. Tantalo.
hep-lat/0209102.
10.1016/S0920-5632(03)01731-6.
Nucl.Phys.Proc.Suppl. 119 (2003) 962–964.

18) Quark and gluon propagators in covariant gauges
By Leonardo Giusti, M.L. Paciello, S. Petrarca, B. Taglienti, N. Tantalo.
hep-lat/0110040.
10.1016/S0920-5632(01)01908-9.
Nucl.Phys.Proc.Suppl. 106 (2002) 995–997.