# CURRICULUM VITAE


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| Name : | **Alberto Zaffaroni** |
| Nationality : | Italian |
| Date of birth : | 10 June 1967 |
| Position : | Full Professor, University of Milano-Bicocca |
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## 1 Academic degrees

- Laurea magna cum laude Università di Milano, 1991.
- Ph. D in Physics, SISSA/ISAS, Trieste, 1994. Supervisors: Prof. Pietro Fre' (SISSA) and Luciano Girardello (Milano).

## 2 Academic career

- Post-doctoral fellow at Ecole Polytechnique, Palaiseau, France (1994-1995).
- Post-doctoral fellow at the Institute for Advanced Study in Princeton (1995-1997).
- Post-doctoral fellow at the Theory Division at CERN, Geneva (1997-1999).
- INFN researcher (1999-2001 - temporary position, Milano).
- Professor at the University of Milano-Bicocca (associate 2001 -, full 2016-)

## 3 Awards and honors

- SIGRAV prize 2000 (Società Italiana di Relatività Generale e Gravitazione).

# 4 Teaching:

*Bachelor and master courses:*

- Mathematical Methods for Physics, bachelor (from 2002/03 to 2007/08 and from 2015/16 to 2016/17).
- Quantum Gravity, master (from 2015/16).
- Mathematical Methods for Physics, master (from 2001/02 to 2009/10).
- Group Theory, master (from 2003/04 to 2007/08).
- Introduction to Quantum Mechanics, bachelor (from 2008/09 to 2009/10).
- Quantum Mechanics, master (from 2010/11 to 2014/15).
- Statistical Mechanics, master (from 2015/16 to 2016/17).
- Theoretical Physics (introduction to Quantum Field Theory and the Standard Model), master (from 2017/18).

*Ph. D. courses:*

- Ph. D. courses for the Ph. D school in Milano-Bicocca, 2001, 2002, 2003, 2004, 2011, 2012, 2015 and 2017.
- *Superstrings*, Scuola Normale Superiore, Pisa, anno 2000.
- *Introduction to AdS/CFT*, Ecole Polytechnique Federal de Lausanne (Troisème cycle de la physique en suisse romande), 2009.
- *Introduction to AdS/CFT*, Scuola Normale Superiore, Pisa, 2011, 2017 and 2018.
- *Monopoles in Three Dimensional Gauge Theories*, Ecole Normale Superieure, Parigi, 2015.

*Courses at national and international schools for Ph. D students and post-docs:*

- School on Supersymmetric Localization, Holography and Related Topics, ICTP, Trieste July 2018.
- CERN Winter School on Strings and Fields 2017, February 2017.
- Parma International School of Theoretical Physics, Parma, 30/8 - 4/10 2010.
- Scuola di Dottorato LACES 2009, Galileo Galilei Institute, Firenze 2009.
- TMR European Network Graduate school on *Strings, Supergravity and Gauge Theories*, Trieste, 31/1-4/2/2005, pubblicate in PoS RTN2005:005,2005.

- Scuola Nazionale di Dottorato dell'INFN, Parma, 30/8 -3/9/2005.
- TMR European Network Graduate school on *Quantum aspects of gauge theories supersymmetry and unification*, Torino, 26/1-2/2/2000.
- Scuola Nazionale di Dottorato dell'INFN, Parma, 6-10/9/1999.

# 5 Student Supervision:

- Ph. D students:

  1) Riccardo Apreda, "Gravity duals of supersymmetric and non-supersymmetric gauge theories", Università di Pisa, 2004.

  2) Enrico Trincherini, "To AdS and back again",Università di Milano, 2004 - now researcher at Scuola Normale Superiore, Pisa.

  3) Agostino Butti, "Recent results in N=1 gauge/gravity correspondence", Università di Milano-Bicocca, 2006.

  4) Davide Forcella, "Moduli Space and Chiral Ring of D3 Branes at Singularities", SISSA, 2008.

  5) Claudius Klare, "Supersymmetry on Curved Space and Holography", Università di Milano-Bicocca, 2014.

  6) Morteza Seyed Hosseini, "Black hole microstates and supersymmetric localization", Università di Milano-Bicocca, 2018.

  6) I have one Ph. D. student now: Lorenzo Coccia.

- I partially supervised the research of other students of the Ph. D. school in Milano (Francesco Bigazzi - now INFN researcher in Pisa -, Aldo Cotrone - associate professor in Firenze - and Roberto Casero.)
- I supervised about 18 laurea thesis (including Francesco Benini - associate professor SISSA - and Andrea Brini - CNRS, Montpellier).

# 6 Administrative and teaching activities

- President of the Teaching Committee for the degrees in Physics, since 2006.
- Member of the "Comitato d'Area Fisica dell'Ateneo di Milano-Bicocca" until September 2009.
- Member of the "Commissione Paritetica della Scuola di Scienze di Milano-Bicocca" until 2014/15.
- Member of the "Commissione Paritetica del Dipartimento di Fisica dell'Università di Milano-Bicocca" since 2015/16.
- Member of the "Commissione per l'Abilitazione Scientifica Nazionale nel settore 02/A2, tornata 2018-2020".

# 7 Research grant management

- Scientific coordination of Milano unit "Supersymmetry Breaking with Fields, Strings and Branes" in MIUR - Prin2007.
- National coordinator of contract GSS of Istituto Nazionale di Fisica Nucleare (INFN), which includes seven units: Bicocca, Milano, Torino, Genova, Padova, Lecce, Frascati (2010 -2016).
- Scientific coordination of Milano unit "Campi di gauge, stringhe e dualità" nel MIUR - Prin2007.
- Scientific coordination of Milano unit "Simmetrie dell'Universo e delle Interazioni Fondamentali " in MIUR - Prin2009.
- Participation to several italian and european grants: "Teorie di gauge e stringhe", MIUR - Prin 2003; - "Campi di gauge, stringhe e dualita", MIUR - Prin 2005 - "La teoria delle stringhe e la fisica delle interazioni fondamentali", MIUR - Firb 2010; - EC-RTN network "Constituents, Fundamental Forces and Symmetries of the Universe" (MRTN-CT-2004-005104); - TMR network "The quantum structure of spacetime and the geometric nature of fundamental interactions" (RTN HPRN-CT-2000-00131).

# 8 Books

- *A Guide to Mathematical Methods for Physicists With Problems and Solutions.* By Michela Petrini, Gianfranco Pradisi, Alberto Zaffaroni; World Scientific (2017).
- *A Guide to Mathematical Methods for Physicists Advanced Topics and applications.* By Michela Petrini, Gianfranco Pradisi, Alberto Zaffaroni; World Scientific (2018).

# 9 Other Activities

- Referee for various international journals including JHEP, Nuclear Physics B, Physics Letters B, Physical Review D, Physical Review Letters.
- Invited scientific visits and seminars at several international Institutions including MIT, UCLA, USC, Caltech, KITP Santa Barbara, New York University, Imperial College London, King's College London, Queen Mary College London, Cambridge, Oxford, Max Planck Munich, Desy, CERN, ICTP, Universitad Autonoma Madrid, Amsterdam University, Utrecht, Ecole Normale Superieure Parigi, Ecole Polytechnique Parigi, Paris VI-Jussieu.

# 10 Seminari recenti:

Invited plenary seminars at international conferences and workshops in the last few years (2006-):

- Progress on AdS Black Holes in String Theory (review talk)", *Strings 2019*, Bruxelles, July 2019.
- "Topologically twisted indices and holography", *Joburg Workshop on String Theory*, South Africa, September 2018.
- "AdS black hole in diverse dimensions", *ERC/Solvay workshop "Holography"*, Bruxelles, May 2018.
- "AdS black hole entropy in diverse dimensions", *Strings, Geometry and Black Holes*, King's College London, April 2018.
- "Localization and entropy counting", *Fields And Duality 2017*, Munich October 2017.
- "Extremization principles for BPS black holes in AdS", *String Theory and Quantum Gravity*, Ascona, Switzerland July 2017.
- "Extremization principles for BPS black holes in AdS", *Supergravity 2017*, Padova May 2017.
- "Supersymmetric localization and AdS4 black holes", *Iberian Strings 2017*, Lisbon January 2017.
- "AdS4 black holes and 3d gauge theories", *Autumn Symposium in String Theory*, KIAS Corea September 2016.
- "3d supersymmetric gauge theories and AdS4 black holes", *Recent Developments in Strings and Gravity*, Corfu September 2016.
- "AdS4 black holes and 3d gauge theories", *Supersymmetric theories, dualities and deformations*, Bern july 2016.
- "Holography, localization and black holes", *Second workshop on String Theory and Gender* inside String-Math Trimester, IHP, Paris, june 2016.
- "AdS4 black holes and 3d gauge theories", *Current Themes in Holography*, Copenhagen, April 2016.
- "Recent Developments in Superconformal Field Theories", *XXVIII Workshop Beyond the Standard Model*, Bad Hoonnef, Bonn, February 2016.
- "AdS4 black holes and 3d gauge theories", *CERN Theory Institute "Recent Developments in M-theory"*, Ginevra February 2016.
- "Entropy of supersymmetric black holes in AdS4", *VII Round Table Italy-Russia*, Dubna, November 2015.

- "Aspects of 3d gauge theories", *Gauge theories, supergravity and superstrings*, Benasque, August 2015.
- "A topologically twisted index for 3d gauge theories", *Strings 2015*, Bangalore, June 2015.
- " Monopole operators and three dimensional SCFTs", *Exact Quantum Fields and the Structure of M-theory*, Heraklion, Crete, 2014
- "Tilings, BPS operators and moduli spaces", *Quiver Gauge Theories, Tilings and Calabi-Yau Geometry*, The Royal Society at Chicheley Hall, Chicheley, UK, 2013.
- "Quantum field theory lessons from string theory", *A Passion for Particles*, Pisa 2013.
- "Supersymmetry on curved space", *Frontiers of Mathematical Physics*, 2012 Dubna, 16-16 December 2012.
- "Backgrounds without Relativistic Invariance and Holography ", *Hatch 2012* Moscow,11-15 June 2012.
- "Holography for 3d theories", *Holograv 2012* Swansea,16-20 April 2012.
- "A Holographic View on Supersymmetry in Curved Space ", *Workshop on Supersymmetry, Quantum Gravity and Gauge Fields*, Scuola Normale Superiore, PISA, 12-14 Settembre 2012.
- "Supersymmetry on curved spaces and holography" , *XLIIme Institute d'eè* (20 - 31 agosto 2012), Ecole Normale, Parigi.
- "Massive type IIA and strong coupling ", *Crete Conference On Gauge Theories And The Structure Of Spacetime*,11-18 September 2010.
- "Aspects of Gauge/Gravity Dualities ", *XIX SIGRAV Conference*, Pisa, September 27-October 1, 2010.
- "Chern-Simons Theories and Their Supergravity Duals", *Miniworkshop String Theory*, Oviedo, 27th May 2009.
- "The master space of N=1 gauge theories", *Continuous Advances in QCD (CAQCD-08)*, Minneapolis, May 15-18, 2008.
- "Chiral Rings and Generating Functions for Superconformal Gauge Theories", *Solvay Workshop "Gauge Theories, Strings and Geometry"*, Brussels, 9-11 May 2007.
- "Aspects of the N=1 AdS/CFT correspondence", *QCD and String Theory*, July 2-8, 2006. Ringberg Castle, Munich .
- "Mesons and Baryons in N=1 AdS/CFT", *Interactions Fondamentales et la Structure de L'espace-temps*, Ecole Normale Superieure, Paris, 14-25 Agosto 2006.

Invited participation to long international scientific programs, 2006-2016 (and corresponding seminars):

- "Twisted compactifications, holography and localisation", Mainz Institute for Theoretical Physics, nel contesto del programma "Holography, Generalized Geometry and Duality", 6-17 May 2019.
- "Entropy counting for AdS4 black holes", Galileo Galilei Institute in Florence, inside the program: "Supergravity: What next?", 05/16 - 28/10/16.
- "Entropy of AdS4 black-holes in M-theory from 3d gauge theories", CERN inside the TH Institute, "Recent Developments in M-theory" 8-18 Febbraio 2016.
- "M theory black holes and 3d gauge theories", Mainz Institute for Theoretical Physics, inside the program "Stringy Geometry", 14-25 Settembre 2015.
- "Twisted index of 3d gauge theories", inside the program: "Gauge/Gravity duality 2015" inside the program "Holographic Methods for Strongly Coupled Systems", 09/03 - 30/04/2015 Galileo Galilei Institute in Firenze.
- "Massive type IIA and strong coupling ", Galileo Galilei Institute in Florence, inside the program: AdS4/CFT3 and the Holographic States of Matter, 30/08 - 05/11/2010.
- "Chern-Simons theories and the AdS4/CFT3 correspondence", Galileo Galilei Institute in Florence, inside the program: New Perspectives in String Theory, 06/04 - 19/06/2009.
- "Counting BPS states in conformal gauge theories", Isaac Newton Institute for Mathematical Sciences, Cambridge, october 2007 inside the program: Strong Fields, Integrability and Strings 23/7 - 21/12/2007.
- "Sasaki-Einstein manifold and AdS/CFT", Galileo Galilei Institute in Florence, inside the program: String and M theory approaches to particle physics and cosmology, 19/03 - 22/06/2007.
- "Branes at singularities", Galileo Galilei Institute in Florence, inside the program: New Directions Beyond the Standard Model in Field and String Theory, 02/05 - 30/06/2006.

# 11 Research activity

My main research activity concerns the study of fundamental interactions and their unification, including gravity. In particular I studied non perturbative properties of Gauge and String Theories. The results of my research consist of more than 80 publications on international journals with referee. They have received about 6400 citations, with 3 papers with more than 250 citations, 14 with more that 100 and 32

with more than 50, with average citations per paper 65, h index=49 - from Inspire: - http://inspirehep.net/ - september 2019 - standard database for high energy physics - explicit links on my page `virgilio.mib.infn.it/~zaffaron`

Some of the most important contributions are the following:

- Duality in field theory: an early evidence in favor of electric/magnetic S-duality in N=4 super Yang-Mills theories in 4D [93, 90].
- D branes and gauge theories: the study of realizations of gauge theories in terms of D-branes and their non perturbative properties [84, 82].
- The AdS/CFT correspondence: the investigation, from the very beginning of the correspondence, of the dictionary between field theory and supergravity [81]
- The study of the renormalization group flow in AdS/CFT which pioneered a line of research, that is still alive; the proof, in particular, of a c-theorem for theories with AdS dual [74, 73, 69]
- The discovery of various supergravity solutions relevant for the correspondence [59, 50]
- The analysis of superconformal theories in 3d and 4d and their duals [49, 48, 40, 37, 36, 31]
- Extra-dimensions: the holographic interpretation of the Randall-Sundrum model [61].
- My recent activity concerns extensions and generalizations of the correspondence, the study of supersymmetry in curved space and localization also applied to black hole physics: in this context, I would like to mention, the study and classification of supersymmetric theories in curved space [26, 25], a new description of the chiral ring of 3d supersymmetric theories [21], the proposal of a new index for supersymmetric theories from two to four dimensions [17] and the very first microscopic computations of the entropy of asymptotically AdS black holes [16].

# 12 List of Publication:

The following list contains publications, preprints and proceedings with original material. A complete list with citations can be found on my page

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# References


[1] S. M. Hosseini and A. Zaffaroni, JHEP **1907** (2019) 174 doi:10.1007/JHEP07(2019)174 [arXiv:1904.04269 [hep-th]].

[2] A. Zaffaroni, arXiv:1902.07176 [hep-th].

[3] S. M. Hosseini and A. Zaffaroni, JHEP **1903** (2019) 108 doi:10.1007/JHEP03(2019)108 [arXiv:1901.05977 [hep-th]].

[4] S. M. Hosseini, K. Hristov, A. Passias and A. Zaffaroni, JHEP **1812** (2018) 001 doi:10.1007/JHEP12(2018)001 [arXiv:1809.10685 [hep-th]].

[5] M. Petrini, G. Pradisi and A. Zaffaroni, doi:10.1142/q0162

[6] S. M. Hosseini, I. Yaakov and A. Zaffaroni, JHEP **1811** (2018) 119 doi:10.1007/JHEP11(2018)119 [arXiv:1808.06626 [hep-th]].

[7] S. M. Hosseini, K. Hristov and A. Zaffaroni, JHEP **1805** (2018) 121 doi:10.1007/JHEP05(2018)121 [arXiv:1803.07568 [hep-th]].

[8] F. Azzurli, N. Bobev, P. M. Crichigno, V. S. Min and A. Zaffaroni, JHEP **1802**, 054 (2018) doi:10.1007/JHEP02(2018)054 [arXiv:1707.04257 [hep-th]].

[9] S. M. Hosseini, K. Hristov and A. Zaffaroni, "An extremization principle for the entropy of rotating BPS black holes in $AdS_5$," JHEP **1707**, 106 (2017) [arXiv:1705.05383 [hep-th]].

[10] S. M. Hosseini, A. Nedelin and A. Zaffaroni, "The Cardy limit of the topologically twisted index and black strings in $AdS_5$," JHEP **1704**, 014 (2017) [arXiv:1611.09374 [hep-th]].

[11] F. Benini, K. Hristov and A. Zaffaroni, "Exact microstate counting for dyonic black holes in AdS4," Phys. Lett. B **771**, 462 (2017) [arXiv:1608.07294 [hep-th]].

[12] S. Cremonesi, N. Mekareeya and A. Zaffaroni, "The moduli spaces of 3d $\mathcal{N} \geq 2$ Chern-Simons gauge theories and their Hilbert series," JHEP **1610** (2016) 046 [arXiv:1607.05728 [hep-th]].

[13] F. Benini and A. Zaffaroni, "Supersymmetric partition functions on Riemann surfaces," arXiv:1605.06120 [hep-th].

[14] S. M. Hosseini and A. Zaffaroni, "Large $N$ matrix models for 3d $\mathcal{N} = 2$ theories: twisted index, free energy and black holes," JHEP **1608** (2016) 064 doi:10.1007/JHEP08(2016)064 [arXiv:1604.03122 [hep-th]].

[15] L. Martucci and A. Zaffaroni, "Holographic Effective Field Theories," JHEP **1606** (2016) 166 doi:10.1007/JHEP06(2016)166 [arXiv:1603.04470 [hep-th]].

[16] F. Benini, K. Hristov and A. Zaffaroni, "Black hole microstates in $AdS_4$ from supersymmetric localization," JHEP **1605** (2016) 054 doi:10.1007/JHEP05(2016)054 [arXiv:1511.04085 [hep-th]].

[17] F. Benini and A. Zaffaroni, JHEP **1507** (2015) 127 doi:10.1007/JHEP07(2015)127 [arXiv:1504.03698 [hep-th]].

[18] S. Cremonesi, A. Hanany, N. Mekareeya and A. Zaffaroni, "$T_\rho^\sigma$ (G) theories and their Hilbert series," JHEP **1501**, 150 (2015) [arXiv:1410.1548 [hep-th]].

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