Dr. Fabio **Franchini**

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Current Tenured Employment

Ruđer Bošković Institute	Research Associate (Ass. Prof.)
Division of Theoretical Physics	*April, 2016 – Present*
Zagreb, Croatia	

Past Research Employments

INFN - Florence	Postdoctoral Research Fellow
Florence Theory Group	*February, 2015 – February, 2016*
Florence, Italy	
Massachusetts Institute of Technology	Marie Curie Postdoctoral Fellow
Center for Theoretical Physics	*September, 2011 – September, 2014*
Cambridge, MA, U.S.A.	
SISSA	
Statistical Physics Group	
Trieste, Italy	
SISSA	Postdoctoral Research Associate
Statistical Physics Group	*October, 2009 – September, 2011*
Trieste, Italy	
The Adbus Salam ICTP	Postdoctoral Research Associate
Condensed Matter Theory Group	*October, 2006 – October, 2009*
Trieste, Italy	

Scientific Education

Stony Brook University	Ph.D. in Physics
Department of Physics & Astronomy	*Fall, 2002 – Fall, 2006*
New York, U.S.A.	Advisor: *Prof. Alexander Abanov*
	"On Hydrodynamic Correlations in Low-Dimensional Interacting Systems"
	M.A. in Physics
	Fall, 2000 – Fall, 2002
University of Bologna	Laurea in Physics
Physics Department	*Fall, 1995 – Spring, 2000*
Bologna, Italy	Advisor: *Prof. Roberto Balbinot*
	"Negative Energy States", 110/110 cum Laude

Fellowships

Marie Curie People - International Outgoing Fellowship	*2011*
European **FP7** funding to pursue, in collaboration with M.I.T. & SISSA, the project Spontaneous Symmetry Breaking in Random Matrices: a model for the Anderson Transition from String Theory.	
Peter B. Kahn Fellowship,	*2003*
Student Travel Fellowship, Department of Physics and Astronomy at Stony Brook.	

Grants

HrZZ - Croatian Science Foundation Grant IP-2016-06-3347	*2016*
Host: Ruđer Bošković Institute	
Project Title: NOVEL CHARACTERIZATIONS OF CLASSICAL AND QUANTUM MANY-BODY SYSTEMS	*2017-2021*
HrZZ - Croatian Science Foundation Grant DOK-2018-01-7464	*2018*
Hosts: SISSA & Ruđer Bošković Institute	
Ph.D. fellowship for: NOVEL CHARACTERIZATIONS OF CLASSICAL AND QUANTUM MANY-BODY SYSTEMS	*2018-2021*
HrZZ - Croatian Science Foundation Grant ERC-03-2018	*2018*
Hosts: University of Ljubljana & Ruđer Bošković Institute	
Project: 3 MONTHS VISIT TO THE GROUP OF TOMAŽ PROSEN	*2017-2021*
Marie Curie Action: Innovative Training Network (ITN)	*2020*
Hosts: University of Ljubljana & Ruđer Bošković Institute	
Ph.D. fellowship for: MOQS: MOLECULAR QUANTUM SIMULATIONS	*2020-2023*

Awards

Italian qualification ("*Abilitazione***") as Associate Professor.**	*2013*
Laurea Magna Cum Laude: Graduation with honors and highest GPA of the class (Classes GPA 4.0/4.0; Graduation: 110/110 cum Laude); University of Bologna	*2000*

Research Interests

Disordered Systems:
- Anderson Metal/Insulator Transition;
- Matrix Models;
- Hofstadter & Aubry-Harper Models

Spin chains:
- Entanglement;
- Local & Non-local Correlation functions;
- Integrability

Cold Atom Systems:
- Non-equilibrium dynamics;
- Universality;
- Quantum Quenches

Strongly Correlated Systems:
- Conformal Field Theory & Bosonization;
- Bethe Ansatz Methods;
- Quantum Computation

Non-linear systems:
- Spin-Charge interaction;
- Semi-classical Hydrodynamics;
- Shock Waves & Solitons

Quantum Field Theory:
- Quantum Phase Transitions;
- Topology;
- QFT in Curved Space-Time & Hawking radiation

Main Scientific Results

Establish that frustrated boundary conditions can destroy and replace the local order parameter

Identification of mechanism for spontaneous breaking of $U(N)$ symmetry in matrix models and proposition of first exactly solvable toy-model for Anderson Metal/Insulator Transition *(in progress)*

Universality in short-time dynamics of localized excitation after an interaction quench

Edge state recombination gives lack of *Local Convertibility*: necessary in Universal Quantum Simulators

Described an essential singularity of the entanglement entropies approaching non-conformal critical points

Complete analytical characterization of entanglement entropies and spectrum for several integrable models

Non-linear hydrodynamic coupling between spin and charge degrees of freedom in one-dimensional systems

Description of correlations in a matrix models as emerging Hawking radiation (Luttinger liquid in Ridler space)

Teaching Experiences

JOB TITLE:	Lecturer
CLASS NAME:	*Introduction to Bethe Ansatz*
SCHOOL:	**Ph.D. Program in Statistical Physics** at **SISSA** (Trieste)
TEACHING LOAD:	20–hour class per year × 8 Years (2007–2012 and 2013–2020)
JOB TITLE:	Lecturer
CLASS NAME:	*Mathematical Techniques*
SCHOOL:	**Condensed Matter Diploma Program** at **ICTP** (Trieste)
TEACHING LOAD:	18–hour class per year × 4 Years (2007–2011 and 2013–2014)
JOB TITLE:	Coordinator & Lecturer
CLASS NAME:	*Diploma Seminars*
SCHOOL:	**Condensed Matter Diploma Program** at **ICTP** (Trieste)
TEACHING LOAD:	84-hours over 3 Years (Spring 2008, 2008–2010)
JOB TITLE:	Teaching Assistant
CLASS NAME:	*Recitations of introductory level Calculus & Laboratories of introductory level Physics*
SCHOOL:	**Stony Brook University** (2000–2003)

Students Mentored & Co-Mentored

STUDENT	Degree	Institution	Advisor	Graduated
Vanja Marič	Ph.D. student	SISSA	dr. F. Franchini	*not yet*
Vanja Marič	Master student	University of Zagreb	dr. F. Franchinii	*Summer 2017*
David Palazzo	Master student	University of Bologna	Prof. F. Ravanini	*Fall 2014*
Stefano Evangelisti	Ph.D. student	University of Bologna	Prof. F. Ravanini	*Spring 2013*
Manas Kulkarni	Ph.D. student	Stony Brook University	Prof. A. G. Abanov	*Summer 2011*

Post-Docs Supervised

NAME	Institution	Funding Source	Year
Domagoj Kuič	Ruđer Bošković Institute	HrZZ	*2018–2021*
Jovan Odavič	Ruđer Bošković Institute	Institute	*2020–2024*
Gianpaolo Torre	Ruđer Bošković Institute	QuantiXLie	*2020–2022*

Other Relevant Experiences

COORDINATOR	Joint **ICTP/SISSA Statistical Physics group** weekly seminar activities
	3 academic years (2008–2011)
REFEREE	IOP's **Journal of Physics A:***Mathematical and Theoretical*
	IOP's **Journal of Statistical Mechanics:***Theory and Experiment*
	IOP's **Nonlinearity**
	APS' **Physical Review B**
	APS' **Physical Review E**
	APS' **Physical Review Letters**
	APS' **Physical Review X**
	Springer's **The European Physical Journal Plus**
	Nature Publishing Group's **Scientific Reports**

Conferences Organized

TITLE:	**Modern Aspects of Quantum Physics**
TIME & PLACE:	October 1st – 5th, 2018; Ruđer Bošković Institute, Zagreb, Croatia
ORGANIZERS:	*Fabio Franchini & Ugo Marzolino*
CONFERENCE WEBSITE:	maqp.irb.hr

Selected Conference Presentations

VENUE:	**Integrable systems in Mathemartics, Condensed Matter and Statistical Physics**
TIME & PLACE:	July 16th – August 10th, 2018; ICTS-TIFR, Bangalore, India
VENUE:	**Workshop on Statistical Field Theory and Applications**
TIME & PLACE:	September 7th – December 16th, 2016; SCGP, Stony Brook, NY, USA
VENUE:	**Entanglement and Dynamical Systems**
TIME & PLACE:	September 29th –30th, 2017; SISSA, Trieste, Italy
VENUE:	**New approaches to non-equilibrium and random systems: KPZ integrability, universality, applications and experiments**
TIME & PLACE:	Janaury 11th – March 11th, 2016; KITP, Santa Barbara, CA, USA
VENUE:	**Foundations and Applications of Random Matrix Theory in Mathematics and Physics**
TIME & PLACE:	August 24th – December 18th, 2015; SCGP, Stony Brook, NY, USA
VENUE:	**Beyond integrability: The mathematics and physics of integrability and its breaking in low-dimensional strongly correlated quantum phenomena**
TIME & PLACE:	July 13th – 17th, 2015; CRM, Montreal, Canada
VENUE:	**9th Bologna Workshop on: CFT AND INTEGRABLE MODELS**
TIME & PLACE:	September 15th – 18th, 2014; Bologna, Italy
VENUE:	**XIX National Conference on Statistical Physics and Complex Systems**
TIME & PLACE:	June 25th–27th, 2014; Parma, Italy
VENUE:	**Workshop on Entanglement Entropy in Many Body Quantum Systems**
TIME & PLACE:	June 2nd – 4th, 2014; London, U.K.
VENUE:	**New Frontiers in Theoretical Physics – XXXIV Convegno Nazionale di Fisica Teorica**
TIME & PLACE:	May 28th – 31st, 2014; Cortona, Italy
VENUE:	**Workshop on "Quantum Integrability, Conformal Field Theory and Topological Quantum Computation"**
TIME & PLACE:	March 23rd – April 6th, 2014, Natal, Brasil
VENUE:	**G.G.I. Workshop on: New quantum states of matter in and out of equilibrium**
TIME & PLACE:	April 10th – June 1st, 2012; Arcetri, Italy
VENUE:	**8th Bologna Workshop on: CFT AND INTEGRABLE MODELS**
TIME & PLACE:	September 12th – 15th, 2011; Bologna, Italy
VENUE:	**Workshop: Quantum Matter in Low Dimensions: Opportunities and Challenges**
TIME & PLACE:	August 30th – September 24th, 2010; NORDITA; Stockholm, Sweden
VENUE:	**Workshop on Finite-Size Technology in Low-Dimensional Quantum Systems**
TIME & PLACE:	June 27th – July 17th, 2010; Benasque, Spain
VENUE:	**V BRUNEL Workshop on Random Matrix Theory**
TIME & PLACE:	December 18th – 19th, 2009; Brunel University, West London, U.K.
VENUE:	**Research Workshop on Random Matrices and Integrability**
TIME & PLACE:	March 25th – 30th, 2009; Yad Hashmona, Israel
VENUE:	**Workshop on Quantum Phenomena and Information: From Atomic to Mesoscopic Systems**
TIME & PLACE:	May 5th –16th, 2008; The Abdus Salam ICTP, Trieste, Italy
VENUE:	**International Workshop and Seminar on Quantum Phase Transitions**
TIME & PLACE:	June 23rd – 25th, 2003; **Max-Planck Institut für Physik Komplexer Systeme** – Dresden, Germany

Selected institute visits with presentation

INSTITUTE:	**King's College**; London, U.K.
DATES:	June 2019
INSTITUTE:	**LPTMS Orsay**; Paris, France
DATES:	January 2019
INSTITUTE:	**Oxford University**; Oxford, U.K.
DATES:	March 2012
INSTITUTE:	**University of Minnesota**; Minneapolis, U.S.A.
DATES:	March 2006, October 2009
INSTITUTE:	**Firenze University**; Florence, Italy
DATES:	February 2007, March 2010
INSTITUTE:	**EPFL**; Lausanne, Switzerland
DATES:	May 2007
INSTITUTE:	**Stony Brook University**; Stony Brook, New York, U.S.A.
DATES:	December 2007, March 2009, October 2009
INSTITUTE:	**University of Bologna**; Bologna, Italy
DATES:	June 2008
INSTITUTE:	**Dublin Institute For Advanced Studies**; Dublin, Ireland
DATES:	February 2009
INSTITUTE:	**Columbia University**; New York City, New York, U.S.A.
DATES:	September 2009
INSTITUTE:	**University of Illinois at Urbana-Champaign**; Urbana, Illinois, U.S.A
DATES:	September 2009
INSTITUTE:	**Boston University**; Boston, Massachusetts, U.S.A
DATES:	October 2009
INSTITUTE:	**Universität Innsbruck, Peter Zoller's Group**; Innsbruck, Austria
DATES:	May 2011
INSTITUTE:	**University of Geneva, Thierry Giamarchi's group**; Geneva, Switzerland
DATES:	June 2011

Languages

Italian:	Mother Tongue
English:	Excellent knowledge of written and spoken English
German:	High-school level knowledge of German
Computer Languages:	C/C++, Fortran, Mathematica, Turbo Pascal

Books

AUTHORS	**F. Franchini**
TITLE	*An Introduction to Integrable Techniques for One-Dimensional Quantum Systems*
REFERENCE	Springer, Lecture Notes in Physics **940** (2017) – *arXiv:1609.02100*

Ph.D. Thesis

AUTHORS	**F. Franchini**; Ph.D. Defense Thesis (Stony Brook University)
TITLE	*On Hydrodynamic Correlations in Low-Dimensional Interacting Systems*
PREPRINT	arXiv:0801.2734

Publications

AUTHORS	F. Benatti, R. Floreanini, **F. Franchini**, & U. Marzolino
TITLE	*Entanglement in indistinguishable particle systems*
J. REFERENCE	Physics Report, **Accepted** (2020)
AUTHORS	J. Odavć & **F. Franchini**
TITLE	*Optimal metropolis approach for full random matrices*
PREPRINT	*In Preparation* (2020)
AUTHORS	**F. Franchini**
TITLE	*Lack of ergodicity as a SSB phenomenon*
PREPRINT	*In Preparation* (2020)
AUTHORS	V. Marić, **F. Franchini**, D. Kuić, & S. M. Giampaolo
TITLE	*The Frustration of being Odd: Cluster Ising Chains*
PREPRINT	*In Preparation* (2020)
AUTHORS	G. Torre, V. Marić, **F. Franchini**, & S. M. Giampaolo
TITLE	*The Frustration of being Odd: The effect of defects*
PREPRINT	*In Preparation* (2020)
AUTHORS	V. Marić, **F. Franchini**, & S. M. Giampaolo
TITLE	*The Frustration of being Odd: Nematic Order*
PREPRINT	*In Preparation* (2020)
AUTHORS	S. Paganelli, L. Lepori, **F. Franchini**, & A. Trombettoni
TITLE	*Mutual information for long-range fermionic systems*
PREPRINT	*In Preparation* (2020)
AUTHORS	V. Marić, S. M. Giampaolo, D. Kuić, & **F. Franchini**
TITLE	*The Frustration of being Odd: Resilience of the Topological Phases*
PREPRINT	*arXiv:2006.09397*
AUTHORS	V. Marić & **F. Franchini**
TITLE	*Asymptotic behavior of Toeplitz determinants with delta function singularities*
PREPRINT	*arXiv:2006.01922*
AUTHORS	V. Marić, S. M. Giampaolo, & **F. Franchini**
TITLE	*The Frustration in being Odd: Can Boundary Conditions induce a Quantum Phase Transition?*
PREPRINT	*arXiv:2002.07197*
AUTHORS	V. Marić, S. M. Giampaolo, D. Kuić, & **F. Franchini**
TITLE	*The Frustration of being Odd: How Boundary Conditions can destroy Local Order*
J. REFERENCE	New Journal of Physics https://doi.org/10.1088/1367-2630/aba064 (2020) – *arXiv:1908.10876*
AUTHORS	S. M. Giampaolo, F. Braga Ramos, & **F. Franchini**
TITLE	*The Frustration in being Odd: Universal Area Law violation in local systems*
J. REFERENCE	Journal of Physics Communications **3**, 081001 (2019) – *arXiv:1807.07055*

AUTHORS	F. Benatti, R. Floreanini, **F. Franchini**, & U. Marzolino
TITLE	*Remarks on entanglement and identical particles*
J. REFERENCE	Open Systems & Information Dynamics **24**, 1740004 (2017) – *arXiv:1709.05520*
AUTHORS	**F. Franchini**, M. Kulkarni, & A. Trombettoni
TITLE	*Hydrodynamics of local excitations after an interaction quench in 1D atomic gases*
J. REFERENCE	New Journal of Physics **18**, 115003 (2016) – *arXiv:1603.03051*
AUTHORS	**F. Franchini**, A. Gromov, M. Kulkarni, & A. Trombettoni
TITLE	*Universal dynamics of a soliton after a quantum quench*
J. REFERENCE	Journal of Physics **A**: Mathematical and Theoretical **48**, 28FT01 (2015) – *arXiv:1408.3618*
AUTHORS	**F. Franchini**, J. Cui, L. Amico, H. Fang, M. Gu, V. Korepin, L.C. Kwek, & V. Vedral
TITLE	*Local Convertibility and edge states in quantum many body systems*
J. REFERENCE	Physical Review **X 4**, 041028 (2014) – *arXiv:1306.6685*
AUTHORS	E. Ercolessi, S. Evangelisti, **F. Franchini**, & F. Ravanini
TITLE	*Modular invariance in the gapped XYZ spin chain*
J. REFERENCE	Physical Review **B 88**, 104418 (2013) – *arXiv:1301.6758*
AUTHORS	A. De Luca & **F. Franchini**
TITLE	*Approaching the RSOS critical points through entanglement: One model for many universalities*
J. REFERENCE	Physical Review **B 87**, 045118 (2013) – *arXiv:1205.6426*
AUTHORS	E. Ercolessi, S. Evangelisti, **F. Franchini**, & F. Ravanini
TITLE	*Correlation Length and Unusual Corrections to the Entanglement Entropy*
J. REFERENCE	Physical Review **B 85**, 115428 (2012) – *arXiv:1201.6367*
AUTHORS	E. Ercolessi, S. Evangelisti, **F. Franchini**, & F. Ravanini
TITLE	*Essential singularity in the Renyi entanglement entropy of the 1D XYZ spin-$\frac{1}{2}$ chain*
J. REFERENCE	Physical Review **B 83**, 12402 (2011) – *arXiv:1008.3892*
AUTHORS	**F. Franchini**, A.R. Its, V.E. Korepin, & L.A. Takhtajan
TITLE	*Spectrum of the density matrix of a large block of spins of the XY model in one dimension*
J. REFERENCE	Quantum Information Processing **10**, 325 (2011) – *arXiv:1002.2931*
AUTHORS	**F. Franchini** & M. Kulkarni
TITLE	*Emptiness and Depletion Formation Probability in spin models with inverse square interaction*
J. REFERENCE	Nuclear Physics **B 825**, 320 (2010) – *arXiv:0908.2652*
AUTHORS	**F Franchini** & V.E. Kravtsov
TITLE	*Horizon in Random Matrix Theory, Hawking Radiation and Flow of Cold Atoms*
J. REFERENCE	Physical Review Letters **103**, 166401 (2009) – *arXiv:0905.3533* PRL Editors' Suggestion
AUTHORS	M. Kulkarni, **F. Franchini**, & A. G. Abanov
TITLE	*Nonlinear dynamics of spin and charge in spin-Calogero model*
J. REFERENCE	Physical Review **B 80**, 165105 (2009) – *arXiv:0904.3762*
AUTHORS	**F. Franchini**, A. R. Its, & V. E. Korepin
TITLE	*Renyi Entropy of the XY Spin Chain*
J. REFERENCE	Journal of Physics **A**: Mathematical and Theoretical **41**, 25302 (2008) – *arXiv:0707.2534*
AUTHORS	**F. Franchini** & A. S. Goldhaber
TITLE	*Aharonov-Bohm effect with many vortices*
J. REFERENCE	Physica Scripta **78**, 065002 (2008) – *arXiv:0805.1910*
AUTHORS	**F. Franchini**, A. R. Its, B.-Q. Jin, & V. E. Korepin
TITLE	*Ellipses of Constant Entropy in the XY Spin Chain*
J. REFERENCE	Journal of Physics **A**: Mathematical and Theoretical **40**, 8467 (2007) – *arXiv:quant-ph/0609098*
AUTHORS	**F. Franchini**, A. R. Its, B.-Q. Jin, & V. E. Korepin
TITLE	*Analysis of entropy of XY Spin Chain*
J. REFERENCE	Proceedings of the Third Feynman Workshop, 2006 – *arXiv:quant-ph/0606240*

AUTHORS **F. Franchini** & A. G. Abanov

TITLE *Asymptotics of Toeplitz Determinants and the Emptiness Formation Probability for the XY Spin Chain*

J. REFERENCE Journal of Physics. **A**: Mathematical and General **38**, 5069 (2005) – *arXiv:cond-mat/0502015*

AUTHORS A. G. Abanov & **F. Franchini**

TITLE *Emptiness Formation Probability for the Anisotropic XY Spin Chain in a Magnetic Field*

J. REFERENCE Physics Letters **A 316**, 342 (2003) – *arXiv:cond-mat/0307001*