# DR. JUAN DIEGO JARAMILLO SALAZAR

## Curriculum Vitae

**Work Address**
Institut für Physik
Universität Augsburg
Universitätsstr. 1
D-86159 Augsburg

| | |
|---|---|
| *Email* | juan.jaramillo@physik.uni-augsburg.de, judijasa@gmail.com |
| *Links* | ResearcherID, ResearchGate |
| *Place of Birth* | *Colombia* |
| *Date of Birth* | 28 March 1983 |
| *Nationality* | Colombian |

*"The good life is one inspired by love and guided by knowledge."*
Bertrand Russell

### POSITIONS

*2017-2018* — Universität Augsburg

*Postdoc*
Institut für Physik
Universitätsstr. 1
D-86159 Augsburg
**Advisor**: Prof. Dr. Peter Hänggi

*2016-2017* — National University of Singapore

*Postdoc*
Department of Physics
2 Science Drive 3
S-117551 Singapore
**Advisor**: Dr. Jiangbin Gong

*2015* — University of Massachusetts Boston

*Postdoc*
Department of Physics
100 Morrissey Blvd.
Boston MA 02125–3393 USA
**Advisor**: Dr. Adolfo del Campo

## EDUCATION

*2010-2014* — **Leibniz Universität Hannover**

*PhD*

Institute for Theoretical Physics
Appelstrasse 2, 30167 Hannover, Germany
**Thesis**: *One Dimensional 4-Component Alkali Fermions*
**Description**: Experiments in ultracold atoms suggest that an effective 4-components spinor gas is responsible for the spin dynamics of $^{40}K$. In this thesis we determine the corresponding phase diagram using a combination of numerical and analytical tools. In particular, we make an extensive use of bosonization to characterize the low energy excitations around the phase transitions.
**Advisor**: Dr. Jun.-Prof. Temo Vekua

*2008-2009* — **Abdus Salam Intl. Centre for Theo. Physics**

*Diploma*

Condensed Matter Physics Section
Str. Costiera, 11, Trieste, Italy
**Thesis**: *Topological Order in Matter*
**Description**: Review on the physics of anyons, particles carrying representations of the braiding group; including application to topological qubits and their relation to quantum groups.
**Advisor**: Dr. Prof. Giuseppe Mussardo

*2001-2007* — **Universidad del Valle - Colombia**

*Bachelor of Science*

Department of Physics
Calle 13 # 100-00, Cali, Valle del Cauca, Colombia
**Thesis**: *Local and Global Quantum Computation: Evaluation of Interaction Cost in Nano-structures*
**Description**: In this thesis we compare the polynomial efficiency between different architectures for quantum computation based on cellular automata, as a measure of time in the performance of a universal set of quantum logic gates.
**Advisor**: Dr. John H. Reina

## PUBLICATIONS

*Oct 2017* — **Quantum Work Fluctuations in connection with Jarzynski Equality**

*Physical Review E*

Phys. Rev. E **96**, 042119. The Jarzynski equality (JE) is a well stablished non-equilibrium method to estimate free energy differences. We report on the existence of divergences in the variance of the Jarzynski equality as induced by non-adiabaticity in the classical and quantum domain.
Authors: Juan D. Jaramillo, Jiawen Deng and Jiangbin Gong

*Jul 2017* — **Deformed Jarzynski Equality**

*Entropy*

Entropy, **19**(8), 419. We present a deformed Jarzynski equality for both classical and quantum non-equilibrium statistics, in efforts to reuse experimental data that already suffers from severe statistical error. The technique proves useful for classical systems and provides insight into the distinctive statistical error from quantum effects.
Authors: Jiawen Deng, Juan D. Jaramillo, Peter Hänggi and Jiangbin Gong

*Jul 2016* — **Quantum supremacy of Many-Particle Thermal Machines**

*New Journal of Physics*

New J. Phys. **18**, 075019. We show how the interplay of nonadiabatic and many-particle quantum effects leads to quantum thermal machines that outperform an ensemble of single-particle heat engines with same resources.
Authors: Juan D. Jaramillo, Mathieu Beau and Adolfo del Campo

*Mar 2016*

### Scaling-Up Quantum Heat Engines Efficiently via Shortcuts to Adiabaticity

*Entropy*

Entropy, **18**(5), 168. We scale up a quantum heat engine utilizing a many-particle working medium and shortcuts to adiabaticity to boost power with minimal quantum friction. The particles interact via inverse-square pairwise potential and are confined by a time-dependent harmonic trap. We report performance for the Otto cycle.
Authors: Mathieu Beau, Juan D. Jaramillo and Adolfo del Campo

*Oct 2013*

### Band-to-Mott Insulator Transformations in 4-component Alkali-metal Fermions at Half-filling

*Physical Review A*

Phys. Rev. A **88**, 043616. We study the influence of an external magnetic field in a fermi gas with spin-changing collisions.
Authors: Juan D. Jaramillo, Sebastian Greschner and Temo Vekua

*Oct 2013*

### Spin-orbit Coupled Fermions in Ladderlike Optical Lattices at Half-filling

*Physical Review B*

Phys. Rev. B **88**, 165101. We study the ground-state phase diagram of two-component fermions loaded in a ladderlike lattice at half filling in the presence of spin-orbit coupling.
Authors: Gao-Yong Sun, Juan D. Jaramillo, Luis Santos and Temo Vekua

*Dec 2008*

### Temporal Resources for Global Quantum Computing Architectures

*Brazilian Journal of Physics*

Braz. J. Phys. **38**, Numb. 4. Using the methods for optimal simulation of quantum logic gates, we perform a quantitative estimation of the time resources involved in the execution of universal gate sets for the case of three representative models of quantum computation based on global control.
Authors: Juan D. Jaramillo and John H. Reina

## PRESENTATION AT INTERNATIONAL WORKSHOPS AND CONFERENCES

2016 · Talk at C3QS Conference: Coherent Control of Complex Quantum Systems, Okinawa Institute of Technology, Okinawa, Japan. Title: "Quantum supremacy of many-particle thermal machines"

2015 · Invited colloquium talk at University of Massachusetts Boston. Department of Physics. Title: "Strongly Correlated Spinor Gas"

2014 · Invited colloquium talk at Universidad Nacional de Colombia, Sede Manizales. Department of Physical Engineering. Location: Manizales, Caldas, Colombia. Talk: "Fermiones Acalinos en 1D: El diagrama de fases de $^{40}K$"

2013 · RTG Workshop 2013. Research Training Group 1729: Fundamentals and applications of ultra-cold matter, Leibniz Universität Hannover. Location: Goslar, Lower Saxony, Germany.
Talk: "Spin-3/2 Fermions with Cold Gases"

2012 · 6th Windsor Summer School: Low-Dimensional Materials, Strong Correlations and Quantum Technologies.
Poster Contribution: "Quartetting to Pairing Transition in Spin-3/2 Fermions Under the Quadratic Zeeman Coupling"

2011 · École de Physique des Houches: Strongly Correlated Electronic Systems, Beyond Fermi Liquid Theory. Location: Chamonix, France.
Poster Contribution: "Induced Transitions in Spin-3/2 Condensates"

2010 · Quo Vadis Bose-Einstein Condensation? International Workshop and Summer School. Max-Planck-Institut fur Physik komplexer Systeme.

2007 · Geometric and Topological Methods for Quantum Field Theory, Summer School, Villa de Leyva, Colombia.

2005 · 2nd National Meeting of Quantum Computing and Quantum Information, Popayán, Colombia.

## COMPUTER SKILLS

*Basic* — HTML, C++

*Intermediate* — FORTRAN, BASH (Unix Shell)

*Advanced* — Python, Wolfram Mathematica, LaTeX

## PROFESSIONAL EXPERIENCE

*Referee* — *Scientific Reports*, Nature Publishing Group
*New Journal of Physics*, IOP Publishing

*Education* — Teaching assistant at Leibniz Universität Hannover
Teaching assistant at Augsburg Universität

## PROFESSIONAL INTERESTS

*General* — Quantum Technology, Quantum Dynamics, Condensed Matter Physics

*Specific* — Quantum Heat Engines, Fluctuation Theorems, Quantum Many-Body Physics

## OTHER INFORMATION

*Languages*

SPANISH · Mothertongue

ENGLISH · Fluent

GERMAN · Basic

## ACADEMIC REFEREES

*Postdoc Advisor*

Prof. Dr. Peter Hänggi
Professor of Physics
Institut für Physik
Universität Augsburg
Universitätsstr. 1
D-86159 Augsburg
Phone: +49 821 598 3249
Email: hanggi(at)physik.uni-Augsburg.de

*Postdoc Advisor*

Dr. Jiangbin Gong
Professor of Physics
Faculty of Science
National University of Singapore
Department of Physics S12
2 Science Drive 3
S-117551 Singapore
Phone: +65 6516 1154
Email: phygj(at)nus.edu.sg

*Postdoc Advisor*

Dr. Adolfo del Campo
Associate Professor of Physics
College of Science and Mathematics
University of Massachusetts Boston
100 Morrissey Blvd. Boston, MA 02125-3393
Office Location: S-3-105
Phone: 617 287 6050
Email: adolfo.delcampo(at)umb.edu

*PhD Advisor*

Dr. Jun.-Prof. Temo Vekua
Junior Professor
Condensed Matter
Leibniz Universität Hannover
Institut für Theoretische Physik
Appelstrasse 2, 30167 Hannover, Germany
Office Location: Raum 210
Phone: +49 (511) 762 17343
Email: Temo.Vekua(at)itp.uni-hannover.de

*Diploma Advisor*

Dr. Prof. Giuseppe Mussardo
Full Professor
Statistical Physics
Scuola Internazionale Superiore di Studi Avanzati (SISSA)
via Bonomea, 265 - 34136 Trieste, Italy
Phone: +39 040 3787 411
Email: mussardo(at)sissa.it

*BSc Advisor*

Dr. John H. Reina
Associate Professor
Quantum Technology Information and Complexity
Universidad del Valle, Colombia
Departamento de Física
Edif. 320 - Sede Melendez
Calle 13 No 100-00 Cali, Colombia
Phone: +57 (2) 3394610
Email: john.reina(at)correounivalle.edu.co

January 3, 2018