

## **PAOLO BORDONE**

### **CURRICULUM**

#### **- Education**

- 1986; Laurea Degree in Physics (full marks with honours) at the Modena University.
- 1992; Ph.D Degree in Physics.

#### **- Positions**

- Faculty Associate, September 1, 1993 - August 31, 1995, at the Department of Electrical Engineering, Arizona State University, Tempe, Arizona (U.S.A.).
- Post-Doctoral position, September 1, 1995 - August 31, 1997, at the Physics Department of the University of Modena, funded by A.R.O and O.N.R through E.R.O. and INFN (Istituto Nazionale per la Fisica della Materia (Italy)).
- Post-Doctoral position, October 1, 1997 - March 31, 2000, at the Physics Department of the University of Modena, funded by INFN .
- September 2000 - September 2020. University Researcher at the Department of Physics (now Department of Physics, Informatics e Mathematics) of the University of Modena and Reggio Emilia.
- Since September 2020 is Associate Professor of Theoretical Physics at the Department of Physics, Informatics e Mathematics of the University of Modena and Reggio Emilia.
- Since March 25, 2022, he has been the President of the Master's Degree in Physics at the University of Modena and Reggio Emilia.
- English language proficiency: level C1.

#### **- Qualifications**

- Since April 10 2017 qualification as Associate professor of Theoretical Physics of Matter.
- Since January 7, 2020 qualification as Associate professor of Theoretical Physics
- Since January 7, 2020 qualification as Full professor of Theoretical Physics.
- Since July 8, 2020 qualification as Full professor of Theoretical Physics of Matter.

#### **- RESEARCH INTEREST**

- Quantum transport in nanostructures

- electron quantum optics
- Coherent quantum dynamics in noisy systems (open systems)
- Quantum correlations in complex systems
- Quantum Walks
- Quantum estimation theory

## **- CONFERENCE ORGANIZATION**

Workshop “Quantum walks for quantum technology”, kick-off meeting of the project PRIN PNRR 2022 “Chiral quantum walks for enhanced energy storage, transport and routing” (QWEST). Modena, June 6-7, 2024.

## **- PARTICIPATION IN SCHOOL AND CONFERENCES**

- 1985 - 4<sup>th</sup> International Conference on Hot Carriers in Semiconductors, 8-12 July 1985, Innsbruck, AUSTRIA.
- 1987 - 5<sup>th</sup> International Conference on Hot Carriers in Semiconductors, 20-24 July 1987, Boston, U.S.A. .
- 1988 - Scuola Nazionale del GNSM-CISM “Fisica delle superfici, interfacce, superreticoli e quantum wells”, 12/9/88-24/9/88 Castro Marina (Le), alla quale ha partecipato come studente.
- 1989 - Scuola Nazionale del GNSM-CISM “Fondamenti di fisica e tecnologia dei semiconduttori”, 4/9/89-15/9/89 Castro Marina (Le), alla quale ha partecipato come studente.
- 1990 - SPIE conference 1282 “Ultrafast Laser Probe Phenomena in Bulk and Microstructure Semiconductors III”, 18-19 March 1990, San Diego, U.S.A. .
- 1990 - Congresso Nazionale del Consorzio INFN, 11-13 Giugno 1990, Cetraro (CS).
- 1990 - Scuola Internazionale NATO ASI “Granular Nanoelectronics”, 23 Luglio - 4 Agosto 1990, il Ciocco, Castelvechio Pascoli (LU).
- 1992 - Congresso Nazionale Settore Semiconduttori, 27-29 Gennaio 1992, Firenze.
- 1992 - Workshop on “Mesoscopic Systems for Future Nanoelectronics Applications”, 13-14 novembre 1992, Modena.
- 1993 - 8<sup>th</sup> International Conference on Hot Carrier in Semiconductors, 16-20 August 1993, Oxford, U.K. .
- 1994 - 3<sup>rd</sup> International Workshop on Computational Electronics (IWCE-3), May 18-20, 1994, Portland, Oregon, U.S.A. .
- 1994 - NATO-ASI International School “Quantum Transport in Ultrasmall Devices”, July 17-30, 1994, il Ciocco, Castelvechio Pascoli (LU), Italy.

- 1995 - 22<sup>nd</sup> Annual Conference on the “Physics and Chemistry of Semiconductor Interfaces”, January 8-12, 1995, Scottsdale, U.S.A. .
- 1995 - 9<sup>th</sup> International Conference on Hot Electron in Semiconductors (HCIS-9), July 31 - August 4, 1995, Chicago, U.S.A.
- 1995 - 4<sup>th</sup> International Seminar on Simulation of Devices and Technologies (ISSDT), November 15-17, 1995, Berg-en-Dal, Kruger National Park, South Africa.
- 1997 - 5<sup>th</sup> International Workshop on Computational Electronics (IWCE-5), May 28-30, 1997, University of Notre Dame, Notre Dame, Indiana, U.S.A. .
- 1998 - Congresso Nazionale di Fisica della Materia INFMeeting, 25-30 giugno 1998, Rimini.
- 1998 - 10<sup>th</sup> International Symposium on Ultrafast Phenomena in Semiconductors (10UFPS), August 29 - September 3, 1998, Semiconductor Physics Institute, Vilnius, Lithuania.
- 1999 - Congresso Nazionale di Fisica della Materia INFMeeting, 14-18 giugno 1999, Catania.
- 1999 - 11<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-11), July 19 - 23, 1999, Kyoto, Japan.
- 2000 - 7<sup>th</sup> International Workshop on Computational Electronics (IWCE-7), May 22-25, 2000, University of Glasgow, Glasgow, United Kingdom.
- 2000 - WE-Heraeus-Seminar on “High Field and Quantum Transport in Semiconductors”, Warnemunde-Rostock, Germania.
- 2000 - National Conference on Physics of Matter INFMeeting, 12-16 giugno 2000, Genova.
- 2001 - Advanced Research Workshop “Quantum Transport in Semiconductors”, 17-22 giugno, Maratea, Potenza.
- 2001 - 3<sup>rd</sup> IMACS Seminar on Monte Carlo Methods (MCM2001), September 10-14, 2001, Salzburg, Austria.
- 2001 - 8<sup>th</sup> International Workshop on Computational Electronics (IWCE-8), October 15-18, 2001, Beckman Institute of the University of Illinois, Urbana, Illinois, USA.
- 2002 - National Conference on Physics of Matter INFMeeting, 24-28 giugno 2002, Bari.
- 2002 - Workshop on Progress in Nonequilibrium Green’s Functions, August 19-22, 2002, Dresden, Germany.
- 2002 - 11<sup>a</sup> Scuola Estiva di Calcolo Parallelo, 9-20 settembre 2002, CINECA, Casalecchio di Reno (BO).
- 2003 - National Conference on Physics of Matter INFMeeting, 23-25 giugno 2002, Genova.

- 2003 - 13<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-13), July 28 - August 1, 2003, Modena, Italy.
- 2003 - LXXXIX Congresso Nazionale della Società Italiana di Fisica, 17-22 settembre 2003, Parma, Italia.
- 2004 - VII Congress SIMAI (Italian Society for Applied and Industrial Mathematics), September 20-24, 2004, Venezia.
- 2004 - 10<sup>th</sup> International Workshop on Computational Electronics (IWCE-10), October 24-27, 2004, Purdue University, West Lafayette, Indiana, USA.
- 2005 - 14<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-14), July 24-29, 2005, Chicago, Illinois, Usa.
- 2005 - New Trends in Quantum Mechanics: Fundamental Aspects and Applications (TQMFA 2005), 11-13 novembre 2005, Palermo.
- 2006 - SEMIC 2006 Recent Advances in Modeling and Simulation of Semiconductors Devices and Circuits, February 16-17, Technische Universitat Wien, Wien, Austria.
- 2006 - 11<sup>th</sup> International Workshop on Computational Electronics (IWCE-11), May 24-27, 2006, Technische Universitat Wien, Wien, Austria.
- 2007 - Problemi Attuali di Fisica Teorica, Tredicesima edizione, 30 marzo - 4 aprile 2007, Vietri sul mare (SA).
- 2007 - 12<sup>th</sup> International Workshop on Computational Electronics (IWCE-12), October 8-10, 2007, University of Massachusetts, Amherst, USA.
- 2009 - 16<sup>th</sup> International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (Edison16), August 24-28, 2009, Montpellier, France.
- 2009 - Italian Quantum Information Science Conference 2009, November 5-8 2009, Scuola Normale Superiore, Pisa, Italy.
- 2010 - International Workshop "Quantum 2010", May 24-28, 2010, iNRiM, Torino, Italy.
- 2010 - First Meeting of the Institute of Nanoscience, October 4-5, 2010, Matraia (Capannori, LU), Italy.
- 2011 - 17<sup>th</sup> International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (Edison17), August 8-12th, 2011, Santa Barbara, California, USA.
- 2012 - 6<sup>th</sup> International Conference on Unsolved Problems on Noise and Fluctuations in Physics, Biology & High Technology (UPoN 2012), February 20-24, 2012, Kolkata, India.
- 2012 - SIMAI 2012 (Italian Society for Applied and Industrial Mathematics), June 25-29, 2012, Politecnico di Torino, Torino, Italy.

- 2012 - IQIS 2012, 5<sup>th</sup> Italian Quantum Information Science Conference, 26-28 settembre 2012, Padova.
- 2013 - ICNF 2013, 22<sup>nd</sup> International Conference on Noise and Fluctuations, June 24-28, Montpellier, France.
- 2013 - FisMat 2013, Italian National Conference on Condensed Matter Physics, 09-13 september 2013, Politecnico di Milano, Milano, Italy.
- 2015 - 7<sup>th</sup> International Conference on Unsolved Problems on Noise and Fluctuations in Physics, Biology & High Tecnology (UPoN 2015), July 13-17, 2015, Barcelona, Spain.
- 2016 - SEODAY2016, Workshop on mathematical models for quantum and classical mechanics, November 17-18, 2016, Dipartimento di matematica U. Dini, Università degli Studi di Firenze, Italy.
- 2017 - 20th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON20), July 16-21, 2017, Buffalo (NY), USA.
- 2017 - IQIS 2017, 10<sup>th</sup> Italian Quantum Information Science Conference, 12-15 September 2017, Firenze, Italy.
- 2017 - Advance in Mathematics for Technology 2017 (AMATH 2017), October 9-11 2017, Catania, Italy.
- 2018 - SIMAI 2018 (Italian Society for Applied and Industrial Mathematics), July 2-6, 2018, Sapienza Università di Roma, Roma, Italy.
- 2018 - IMSc Workshop on Quantum Metrology and Open Quantum Systems, August 27<sup>th</sup>- 31<sup>st</sup> 2018, Kodaikanal Solar Observatory, India.
- 2018 - Kinetical and Transport Equations: Mathematical Advances and Applications (KTE2018), October 10-12, 2018, Centro Sant'Elisabetta, Università di Parma, Parma, Italy.
- 2019 - 21th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON21), July 14-19, 2019, Nara, Japan.
- 2019 - IQIS 2019, 12<sup>th</sup> Italian Quantum Information Science Conference, 9-12 September 2019, Milano, Italy.
- 2021 - 21th ECMI Conference on Industrial and Applied Mathematics (ECMI 2021), April 13-15, 2021, Wuppertal, Germany.
- 2021 - SIMAI 2020+2021 (Italian Society for Applied and Industrial Mathematics), August 30<sup>th</sup> - September 3<sup>rd</sup>, 2021, Università di Parma, Parma, Italy.

- 2023 - 22nd International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON22), 14-18 August 2023, Münster, Germany.

## - PRESENTATION AT CONFERENCES

### - Invited talks

- 1990 - SPIE conference 1282 “Ultrafast Laser Probe Phenomena in Bulk and Microstructure Semiconductors III”, 18-19 March 1990, San Diego, U.S.A. .  
“Effect of phonon confinement in quantum well systems”.
- 2000 - 7<sup>th</sup> International Workshop on Computational Electronics (IWCE-7), May 22-25, 2000, University of Glasgow, Glasgow, United Kingdom.  
“Wigner paths method in quantum transport with dissipation”.
- 2001 - 3<sup>rd</sup> IMACS Seminar on Monte Carlo Methods (MCM2001), September 10-14, 2001, Salzburg, Austria.  
“Monte Carlo simulation of quantum electron transport based on Wigner paths”.
- 2001 - 8<sup>th</sup> International Workshop on Computational Electronics (IWCE-8), October 15-18, 2001, Beckman Institute of the University of Illinois, Urbana, Illinois, USA.  
“Wigner Paths for Quantum Transport”.
- 2003 - LXXXIX Congresso Nazionale della Società Italiana di Fisica, 17-22 settembre 2003, Parma, Italia.  
“Dinamica elettronica in sistemi mesoscopici”.
- 2004 - VII Congress SIMAI (Italian Society for Applied and Industrial Mathematics), September 20-24, 2004, Venezia.  
“Non-parabolic electron transport in semiconductors by the Wigner-function approach”.
- 2009 - 16<sup>th</sup> International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (Edison16), August 24-28, 2009, Montpellier, France.  
“Dynamics of electron entanglement in semiconductor nanostructures”.
- 2012 - (**Keynote**) 6<sup>th</sup> International Conference on Unsolved Problems on Noise and Fluctuations in Physics, Biology & High Technology (UPoN 2012), February 20-24, 2012, Kolkata, India.  
“Effects of Markov and non-Markov classical noise on entanglement dynamics”.
- 2012 - SIMAI 2012 (Italian Society for Applied and Industrial Mathematics), Minisimposium [MSP] *Mathematical problems in semiconductors and related topics*, June 25-29, 2012, Politecnico di Torino, Torino, Italy.  
“Has the Wigner transport equation to be modified for open systems?”.

- 2016 - SEMODAY2016, Workshop on mathematical models for quantum and classical mechanics, November 17-18, 2016, Dipartimento di matematica U. Dini, Università degli Studi di Firenze, Italy  
“Noisy quantum walks of two indistinguishable particles”
- 2017 - Advance in Mathematics for Technology 2017 (AMATH 2017), October 9-11 2017, Catania, Italy.  
“Quantum walks on a bidimensional lattice in the presence of a magnetic field”.
- 2018 - SIMAI 2018 (Italian Society for Applied and Industrial Mathematics), Minisimposium *[MS-23] Mathematical Modeling of Charge Transport in Low Dimensional Structures*, July 2-6, 2018, Università degli Studi di Roma La Sapienza, Roma, Italy.  
“Split-step Fourier method as a solver for electronic transport in single-qubit interferometers”
- 2018 - IMSc (The Institute of Mathematical Sciences) Workshop on Quantum Metrology and Open Quantum Systems, August 27<sup>th</sup>- 31<sup>st</sup> 2018, Kodaikanal Solar Observatory, India.  
“A random walk through quantum walks”
- 2019 - IQIS 2019, 12<sup>th</sup> Italian Quantum Information Science Conference, 9-12 September 2019, Milano, Italy  
“Continuous-time quantum walks of a charged particle on planar lattice graphs in the presence of a magnetic field”
- 2021- 21th ECMI Conference on Industrial and Applied Mathematics (ECMI 2021), Minisimposium *MS08/4a: Mathematical Modeling of Charge Transport in Graphene and Low Dimensional Structures*, April 13-15, 2021, University of Wuppertal, Wuppertal, Germany.  
“Two-electron selective coupling in an edge-state based conditional phase shifter”
- 2021 - SIMAI 2020+2021 (Italian Society for Applied and Industrial Mathematics), Minisimposium *[MS-44] Charge Transport in Low Dimensional Structures*, August 30<sup>th</sup> - September 3<sup>rd</sup>, 2021, Università di Parma, Parma, Italy.  
“Correlated electron interferometers for quantum computing”
- 2023 - WAMQCM3023 Workshop on Applied Mathematics: Quantum and Classical Models, November 29-30 - December, 1 - 2023, Dipartimento di matematica U. Dini, Università degli Studi di Firenze, Italy.  
“Coherent transport in Mach-Zehnder interferometers in Graphene”
- **Oral presentation**
  - 1985 - 4<sup>th</sup> International Conference on “Hot Electron in Semiconductors”, 8-12 July 1985, Innsbruck, AUSTRIA.  
“Monte Carlo analysis of hot-phonon effects on non-polar semiconductors transport properties”.
  - 1992 - Congresso Nazionale Settore Semiconduttori, 27-29 Gennaio 1992, Firenze.  
“Trasporto elettronico in eterogiunzioni singole AlGaAs/GaAs”.

- 1995 - 9<sup>th</sup> International Conference on “Hot Electron in Semiconductors”, July 31 - August 4, 1995, Chicago, U.S.A.  
“Collision duration for polar optical and intervalley phonon scattering”.
- 1998 - 10<sup>th</sup> International Symposium on “Ultrafast Phenomena in Semiconductors (10UFPS)”, August 29 - September 3, 1998, Vilnius, Lithuania.  
“Wigner paths for quantum transport in semiconductors”.
- 1999 - 11<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-11), July 19 - 23, 1999, Kyoto, Japan.  
“Quantum versus classical scattering in semiconductor charge transport: a quantitative comparison”.
- 2005 - 14<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-14), July 24-29, 2005, Chicago, Illinois, Usa.  
“Simulation of entanglement creation for carrier-impurity scattering in a 2D system”
- 2006 - 11<sup>th</sup> International Workshop on Computational Electronics (IWCE-11), May 24-27, 2006, Technische Universitat Wien, Wien, Austria.  
“Simulation of the entanglement creation for identical particles scattering in a 2D system”
- 2007 - 12<sup>th</sup> International Workshop on Computational Electronics (IWCE-12), October 8-10, 2007, University of Massachusetts, Amherst, USA.  
“Effects of scattering resonances on carrier-carrier entanglement in charged quantum dots”
- 2013 - 22<sup>nd</sup> International Conference on Noise and Fluctuations (ICNF 2013), June 24-28, Montpellier, France.  
“Time-evolution of entanglement and quantum discord of bipartite systems subject to  $1/f^\alpha$  noise”
- 2013 - FisMat 2013, Italian National Conference on Condensed Matter Physics, 09-13 september 2013, Politecnico di Milano, Milano, Italy.  
“Quantum correlations in bipartite systems with  $1/f^\alpha$  noise”
- 2017 - 20th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON20), July 16-21, 2017, Buffalo (NY), USA.  
“Dynamics of copropagating edge states in a multichannel Mach-Zender interferometer”
- 2017 - IQIS 2017, 10<sup>th</sup> Italian Quantum Information Science Conference, 12-15 September 2017, Firenze.  
“Quantum walks of two interacting particles in a classical noisy environment”
- 2019 - 21th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON21), July 14-19, 2019, Nara, Japan.  
“Dynamics and spatial entanglement of two interacting electrons in the quantum

Hall Hong-Ou-Mandel interferometer: an exact numerical solution in a full-scale geometry”

**- Posters**

- 1993 - 8<sup>th</sup> International Conference on “Hot Carrier in Semiconductors”, 16-20 August 1993, Oxford, U.K. .  
“Hot-phonon effect on noise and diffusion in GaAs”  
“Phonon effects on electronic transport in single  $Al_xGa_{(1-x)}As/GaAs$  heterojunctions”.
- 1994 - 3<sup>rd</sup> International Workshop on “Computational Electronics”, May 18-20, 1994, Portland, U.S.A. .  
“Evaluation of the electron density of states in a  $Si - SiO_2$  interface using the zero-temperature Green’s function formalism”.
- 1994 - NATO-ASI International School “Quantum Transport in Ultrasmall Devices”, July 17-30, 1994, il Ciocco, Castelvechio Pascoli (LU), Italy.  
“Evaluation of the mobility in a  $Si - SiO_2$  inversion layer at T=0 K using Green’s function formalism”.
- 1995 - 22<sup>nd</sup> Annual Conference on the “Physics and Chemistry of Semiconductor Interfaces”, January 8-12, 1995, Scottsdale, Arizona, U.S.A. .  
“Calculation of the average interface field in inversion layers using zero-temperature Green’s function formalism”.
- 1997 - International Conference on “Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-10)”, July 28 - August 1, 1997, Berlin, Germania.  
“Wigner Function for Open Systems with Electron-Phonon Interaction”.
- 1998 - Congresso Nazionale di Fisica della Materia INFMeeting, 25-30 giugno 1998, Rimini.  
“Quantum electron-phonon interaction for transport in open nanostructures”.
- 1999 - Congresso Nazionale di Fisica della Materia INFMeeting, 14-18 giugno 1999, Catania.  
“Quantum versus semiclassical charge transport in semiconductor nanostructures”.
- 2001 - Advanced Research Workshop “Quantum Transport in Semiconductors”, 17-22 giugno, Maratea, Potenza.  
“Wigner function dynamics in presence of an infinite potential barrier”.
- 2002 - Workshop on Progress in Nonequilibrium Green’s Functions, August 19-22, Dresden, Germany.  
“Wigner-path approach to nonequilibrium quantum transport”.
- 2003 - 13<sup>th</sup> International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-13), July 28 - August 1, 2003, Modena, Italy.  
“Coherent transport in coupled quantum wires assisted by surface acoustic waves”.
- 2004 - 10<sup>th</sup> International Workshop on Computational Electronics (IWCE-10), October 24-27, 2004, Purdue University, West Lafayette, Indiana, USA.

- “Simulation of entanglement dynamics for a scattering between a free and a bound carrier in a quantum wire”
- “Wigner function for identical particles”
- “Single electron transport and entanglement induced by surface acoustic waves versus free ballistic propagation in coupled quantum wires”
- 2009 - Italian Quantum Information Science Conference 2009, November 5-8, 2009, Scuola Normale Superiore, Pisa, Italy.
  - “Quantum teleportation of electrons in quantum wires with surface acoustic waves”
- 2010 - First Meeting of the Institute of Nanoscience, October 4-5, 2010, Matraia (Capannori, LU), Italy.
  - “Theory of electron transport in semiconductors”
- 2011 - 17<sup>th</sup> International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (Edison17), August 8-12th, 2011, Santa Barbara, California, USA.
  - “Quantum teleportation of indistinguishable electrons in quantum Hall regime edge states”
  - “Quantum wires architectures of electron interferometers with distinguishable and indistinguishable particles”
- 2012 - IQIS 2012, 5<sup>th</sup> Italian Quantum Information Science Conference, 26-28 settembre 2012, Padova.
  - “Tripartite entanglement of identical and non-identical particles in Markov and non-Markov classical environments”
- 2017 - 20th International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructures (EDISON20), July 16-21, 2017, Buffalo (NY), USA.
  - “Quantum Walks of two interacting particles on percolation graphs”

## - PUBLICATION LIST

### - Publications in International Journals with referees

1985

- [1] P. Bordone, C. Jacoboni, P. Lugli, L. Reggiani and P. Kocevar, “Monte Carlo analysis of hot-phonon effects on non-polar semiconductors transport properties” *Physica* **134 B**, 169-173 (1985).

1987

- [2] P. Bordone, C. Jacoboni, P. Lugli, L. Reggiani and P. Kocevar, “Effect of a perturbed acoustic-phonon distribution on hot-electron transport: a Monte Carlo analysis” *J. Appl. Phys.* **61**, 1460-1468 (1987).

1988

- [3] M. Rieger, P. Kocevar, P. Bordone, P. Lugli and L. Reggiani, “Transient hot-phonon effects on the velocity overshoot of GaAs: a Monte Carlo analysis” *Solid State Electron.* **31**, 687-690 (1988).

1989

- [4] P. Lugli, P. Bordone, L. Reggiani, M. Rieger, P. Kocevar, S. Goodnick, “Monte Carlo studies of nonequilibrium phonon effects in polar semiconductors and quantum wells. I. Laser photoexcitation” *Phys. Rev. B* **39**, 7852-7865 (1989).
- [5] M. Rieger, P. Kocevar, P. Lugli, P. Bordone, L. Reggiani, S. Goodnick, “Monte Carlo studies of nonequilibrium phonon effects in polar semiconductors and quantum wells. II. Non-Ohmic transport in *n*-type gallium arsenide” *Phys. Rev. B* **39**, 7866-7875 (1989).
- [6] P. Lugli, P. Bordone, S. Gualdi, P. Poli and S.M. Goodnick, “Hot phonons in quantum wells system”, *Solid. State Electr.*, **32**, p. 1881 (1989).

1992

- [7] P. Lugli, P. Bordone, E. Molinari, H. Rücker, A.M. de Paula, A.C. Maciel, J.F. Ryan and M. Shayegan, “Interaction of electrons with interface phonons in GaAs/AlAs and GaAs/AlGaAs heterostructures”, *Semicond. Sci. Technol.* **7**, B116-B119, (1992).

1993

- [8] P. Bordone, L. Varani, L. Reggiani, L. Rota and T. Kuhn, “Influence of Hot Phonons on Electronic Noise in GaAs”, *Appl. Phys. Lett.* **63**, 1107 (1993).

1994

- [9] P. Bordone, L. Reggiani, L. Varani and T. Kuhn, “Hot-phonon effect on noise and diffusion in GaAs”, *Semicond. Sci. Technol.* **9**, 623 (1994).

[10] P. Bordone, P. Lugli and M. Gulia, “Phonon Effects on Electronic Transport in Single  $Al_xGa_{(1-x)}As/GaAs$  Heterojunctons”, *Semicond. Sci. Technol.* **9**, 820 (1994).

[11] P. Bordone, P. Lugli, “Effect of Half-space and Interface Phonons on the Transport Properties of AlGaAs/GaAs Single Heterostructures”, *Phys. Rev. B* **49**, 8178 (1994).

1995

[12] D. Vasileska-Kafedziska, P. Bordone, T. Eldridge, and D. K. Ferry, “Calculation of the Average Interface Field in Inversion Layers Using Zero-Temperature Green’s Function Formalism”, *J. Vac. Sci. Technol. B* **13**(4), 1841 (1995).

1996

[13] P. Bordone, D. Vasileska and D. K. Ferry, “Collision Duration Time for Optical Phonon Emission in Semiconductors”, *Phys. Rev. B* **53**, 3846 (1996).

[14] D. Vasileska, P. Bordone, T. Eldridge, and D. K. Ferry, “Quantum transport calculations for silicon inversion layers in MOS structures”, *Physica B* **227**, 333 (1996).

1997

[15] M. Nedjalkov, I. Dimov, P. Bordone, R. Brunetti and C. Jacoboni, “Using the Wigner Function for Quantum Transport in Device Simulation”, *Mathl. Comp. Modelling* **25**, 33 (1997).

[16] P. Bordone, A. Abramo, R. Brunetti, M. Pascoli and C. Jacoboni, “Wigner Function for Open Systems with Electron-Phonon Interaction” *Phys. Stat. Sol. (b)* **204**, 303 (1997).

1998

[17] M. Pascoli, P. Bordone, R. Brunetti, and C. Jacoboni, “Wigner Paths for electrons interacting with phonons” *Phys. Rev. B* **58**, 3503 (1998).

[18] D. Vasileska, T. Eldridge, P. Bordone, and D.K. Ferry, “Quantum Transport Simulation of the DOS function, Self-Consistent Fields, and Mobility in MOS Inversion Layers”, *VLSI DESIGN* **6**, 21 (1998).

[19] C. Jacoboni, A. Abramo, P. Bordone, R. Brunetti, and M. Pascoli, “Application of the Wigner-Function Formulation to Mesoscopic Systems in Presence of Electron-Phonon Interaction”, *VLSI DESIGN* **8**, 185 (1998).

1999

[20] P. Bordone, M. Pascoli, R. Brunetti, A. Bertoni, C. Jacoboni, and A. Abramo, “Quantum transport of electrons in open nanostructures with the Wigner-function formalism”, *Phys. Rev. B* **59**, 3060 (1999).

- [21] P. Bordone, R. Brunetti, M. Pascoli, A. Bertoni, and C. Jacoboni, “Wigner paths for quantum transport in semiconductors”, *Material Science Forum* **297-298**, 21 (1999).
- [22] A. Bertoni, P. Bordone, R. Brunetti, and C. Jacoboni, “The Wigner function for electron transport in mesoscopic systems”, *J. Phys.: Condensed Matter* **11**, 5999 (1999).
- [23] A. Bertoni, P. Bordone, R. Brunetti, C. Jacoboni, and N. Sano, “Quantum versus classical scattering in semiconductors charge transport: a quantitative comparison”, *Physica B* **272**, 299 (1999).

2000

- [24] A. Bertoni, P. Bordone, R. Brunetti, C. Jacoboni, and S. Reggiani, “Quantum logic gates based on coherent electron transport in quantum wires” *Phys. Rev. Lett.* **84**, 5912 (2000).

2001

- [25] C. Jacoboni, A. Bertoni, P. Bordone, R. Brunetti, “Wigner-function formulation for quantum transport in semiconductors: theory and Monte Carlo approach”, *Math. Comput. Simul.* **55**, 67 (2001).
- [26] R. Brunetti, A. Bertoni, P. Bordone, and C. Jacoboni, “Dynamical equation and Monte Carlo simulation of the two-time Wigner function for electron quantum transport”, *VLSI DESIGN* **13**, 375 (2001).
- [27] A. Bertoni, P. Bordone, R. Brunetti, C. Jacoboni, and S. Reggiani, “Numerical simulation of quantum logic gates based on quantum wires”, *VLSI DESIGN* **13**, 97 (2001).
- [28] P. Bordone, A. Bertoni, R. Brunetti, and C. Jacoboni, “Wigner paths method in quantum transport with dissipation”, *VLSI DESIGN* **13**, 211 (2001).

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- [29] L. Demeio, L. Barletti, A. Bertoni, P. Bordone, and C. Jacoboni, “Wigner-function approach to multiband transport in semiconductors”, *Physica B* **314**, 104 (2002).
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## - Publication in Conference Proceeding

- [1] P. Lugli, P. Bordone, S. Gualdi, L. Rota and S.M. Goodnick, “Femtosecond phenomena in III-V semiconductors” Proceedings of the sixth International NASEC-ODE Conference Ed. by J.J. Miller (Boole Press Ltd., Dublin 1989) p.238.
- [2] P. Bordone, L. Reggiani, L. Varani and V. Mitin, “Generation-recombination noise in p-Si at 77 K”, Proceedings della 10<sup>th</sup> International Conference on *Noise in Physical Systems*, Ed. by A. Ambrozy (Akademiai Kiado, Budapest 1990) p.99.
- [3] P. Lugli, P. Bordone, S. Gualdi and S.M. Goodnick, “Effect of phonon confinement in quantum well systems”, in SPIE Vol. 1282 “Ultrafast Laser Probe Phenomena in Bulk and Microstructure Semiconductors III”, ed. R.R. Alfano, p. 11, SPIE, Bellingham (WA), (1990).
- [4] P. Bordone, L. Varani, L. Reggiani and T. Kuhn, “Hot-Phonon Effect on Charge-Carrier Fluctuations in GaAs”, Proceedings of the 12<sup>th</sup> International Conference on *Noise in Physical Systems and 1/f Fluctuations*, Eds. P.H. Handel and A. L. Chung, AIP Conf. Proc. Vol. **285**, p. 657-660, Melville (NY) 1994.
- [5] D. Vasileska-Kafedziska, P. Bordone, and D. K. Ferry, “Evaluation of the Electron Density of States in a *Si-SiO<sub>2</sub>* Interface Using the Zero-Temperature Green’s Function Formalism”, in Proceedings del Third International Workshop on Computational Electronics (IWCE-3), Portland, 1994, pp. 175-8.
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- [10] A. Bertoni, J. García-García, P. Bordone, R. Brunetti, and C. Jacoboni, “Monte Carlo Simulation of Quantum Transport in Semiconductors Using Wigner Paths”, in *Statistical and Dynamical Aspects of Mesoscopic Systems*, Eds. D.Reguerra, G.Platero, L.L.Bonilla, J.M.Rubí, Springer, Berlin 2000, p. 338.
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- [12] L. Demeio, P. Bordone and C. Jacoboni, “Numerical and Analytical Applications of Multiband Transport in Semiconductors”, in *Rarefied Gas Dynamics: 23rd International Symposium*, Edited by A.D. Ketsdever and E.P. Muntz, AIP Conference Proceedings, Vol. 663, Melville, New York, 2003.
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#### **- Books contributions**

- [1] C. Jacoboni, R. Brunetti and P. Bordone, “Monte Carlo Simulation of Semiconductor Transport” in *Theory of Transport Properties of Semiconductor Nanostructures*, Ed. E. Schöll, Chapman & Hall, London 1998, pp. 59-94.
- [2] C. Jacoboni, R. Brunetti, P. Bordone, and A. Bertoni, “Quantum transport and its simulation with the Wigner-function approach”, in *Topics in High Field Transport in Semiconductors*, Eds. K. Brennan and P. Paul Ruden, World Scientific, Singapore 2001, pp.25-61
- [3] C. Jacoboni, P. Bordone and R. Brunetti, “Wigner-path approach to nonequilibrium quantum transport”, *Progress in Nonequilibrium Green's Functions II*, Ed.s M. Bonitz and D. Semkat, World Scientific, Singapore (2003), pp. 464-471.

#### **- EDITOR ACTIVITY**

- [1] Semicond. Sci. Technol., Vol. 19, N. 4, April 2004. Special issue featuring papers from the International Conference on Nonequilibrium Carrier Dynamics in Semiconductors. Guest Editors: L Reggiani, P Bordone and R Brunetti.

- [2] Entropy; Special Issue “Transport and Diffusion in Quantum Complex Systems”. Guest Editors: Paolo Bordone and Dario Tamascelli.
- [3] Dal Novembre 2020 è membro dell’Editorial Board di Entropy (MDPI).
- [4] Entropy; Special Issue “Quantum Walks for Quantum Technologies”. Guest Editors: Luca Razzoli and Paolo Bordone.

## **- PARTICIPATION IN RESEARCH PROJECTS**

- 1995/1996; “*Quantum Theory of Electron Transport in Mesoscopic Systems*”, funded by the European Research Office (ERO) of the U.S. Army. Contract N.: N68171-95-C-9057.
- 1996/1997; “*Quantum Theory of Electron Transport in Mesoscopic Systems*”, funded by the European Research Office (ERO) of the U.S. Army. Contract N.: N68171-96-C-9089.
- 1998; PRIN 1998, “*Elaborazione dell’informazione mediante schiere di punti quantici.*” scientific coordinator : M. Rudan.
- 1998/2003; “*Monte Carlo Approach to Quantum Transport in Mesoscopic Systems Based on Electron Wigner Paths*”, funded by the Office of Naval Research (ONR) of the U.S. Army. Contract N.: N00014-98-1-0777.
- 2003/2006; “*Monte Carlo Approach to Quantum Transport in Mesoscopic Systems Based on Electron Wigner Paths*”, funded by the Office of Naval Research (ONR) of the U.S. Army. Contract N.: N00014-03-1-0289.
- 2006; PRIN 2006, “*Modelli Matematici per Dispositivi a Semiconduttore, Metodi Matematici in Teorie Cinetiche ed Applicazioni*”. scientific coordinator : G. Toscani; responsabile scientifico: G. Frosali (Università degli Studi di Firenze). Area: 01. Protocollo: 2006012132\_004 .
- 2006; Principal investigator of the supercomputing project CNISM-CINECA 2006 *Numerical Simulation of Entanglement Dynamics for Identical Particles Scattering*.
- 2007; Principal investigator of the supercomputing project CNISM-CINECA 2007 *Numerical Simulation of Entanglement Dynamics for Identical Particles Scattering - Part 2*.
- 2008; Principal investigator of the supercomputing project CNISM-CINECA 2008 *Entanglement, teletrasporto quantistico e decoerenza in sistemi a stato solido*.
- 2014; Principal investigator of the Class C Project ISCRA (CINECA) *Edge-States Time Evolution in Nanometric Devices for Interferometry*, ESTENDI - HP10CFIP4Y .
- 2014; University fund for research 2014 (FAR2014), UNIMORE.  
scientific manager of the project: *Quantum Walk a Molti Corpi e Loro Applicazione alla Teoria Quantistica dell’Informazione*.

- 2017; Principal investigator of the Class C Project ISCRA (CINECA) *Multichannel Interferometer Based on Copropagating Edge-States*, MINTERES - HP10CXDTX6 .
- 2018; Group leader of the project “Dynamics of quantum interference and entanglement in two-interacting-particle interferometers”. HPC-Europa3. Programme: H2020, Call: INFRAIA-2016-1, Grant number: 730879. Euro 4.714,08.
- 2019; Principal investigator of the Class C Project ISCRA (CINECA) *Coulomb-driven Hong-ou-mandel Interferometer with single-electron Hall EXcitations*, CHINHEX - HP10CEMC7B
- 2023; PRIN PNRR 2022, “Chiral quantum walks for enhanced energy storage, transport and routing” (QWEST), Prot. P202222WBL. Coordinator of the Unit of the Università di Modena e Reggio Emilia.

## 1.9 PARTICIPATION IN INTERNATIONAL SCIENTIFIC COMMITTEES<sup>1</sup>

- Since February 2012 is member of the *International Scientific Committee* of the *International Conference on Unsolved Problems on Noise and Fluctuations in Physics, Biology & High Technology (UPoN)*.
- Since January 2024 is member of the International Advisory Committee dell’*International Conference on Electron Dynamics in Semiconductors, Optoelectronics and Nanostructure (EDISON)*.