# CURRICULUM VITAE DEL PROF. CARLO JACOBONI

Nato a Bologna il 23 Gennaio 1941.
Laureato in Fisica all'Università di Bologna nel 1964.
Ha ricevuto il Dottorato di Ricerca (Ph.D) in Fisica alla Purdue University (Lafayette, Indiana, U.S.A.) nel 1969.
Professore Associato dal 1969 to 1979 presso la Facoltà di Scienze M.F.N. dell'Università di Modena.
Professore Ordinario di Struttura della material 1980 presso la Facoltà di Scienze M.F.N. dell'Università di Modena.
Fondatore del Settore Semiconduttori del C.N.R. che ha diretto dal 1975 al 1978.
Direttore del Centro di Calcolo dell'Università di Modena dal 1978 al 1981
Direttore del Dipartimento di Fisica dell'Università di Modena dal 1981 al 1985

Membro del Comitato Tecnico del C.I.N.E.C.A. (Centro Interuniversitario per il Calcolo Automatico dell'Italia Nord Orientale) dal 1981 al 1985.
Direttore della Scuola di Informatica dell'Università di Modena dal 1981 al 1987 e dal 1990 al 1991.
Presidente del Corso di Laurea in Fisica dell'Università di Modena dal 1989 al 1992.
Direttore del Dipartimento di Fisica dell'Università di Modena dal 1995 al 1996.
Preside della Facoltà di Scienze Matematiche, Fisiche e Naturali dell'Università di Modena dal 1996 al 2002.

Ha pubblicato tre libri e circa 180 articoli scientifici in riviste internazionali nel campo del trasporto di carica in semiconduttori. Inoltre è stato co-editore di cinque volumi in argomenti correlati.

Direttore del NATO Advanced Study Institute on *Physics of Nonlinear Transport in Semiconductors*, tenuto ad Urbino, Italia, nell'estate 1979. ==========
Director of the NATO Advanced Study Institute on *Physics of Submicron Semiconductors Devices*, held in S. Miniato (PI) Italy, in the summer 1983.
Director of the NATO Advanced Study Institute on *Physics of Granular Nanoelectronics*, held in Casrelvecchio Pascoli (LU) Italy, in the summer 1990.
Director of the NATO Advanced Study Institute on *Quantum Transport in Ultrasmall Devices*, held in Castelvecchio Pascoli (LU) Italy, in the summer 1994.

Principal investigator of several Research Contracts with the Italian Ministery of Research, National Research Council, European Research Office (London), I.B.M. (USA), N.T.T. (Japan).
Chairman of the 13$^{th}$ International Conference on Nonequilibrium Carrier Dynamics in Semiconductors (HCIS-13)

Member of the Italian Physical Society since 1966 and of the American Physical Society since 1969
Fellow of the American Physical Society since 1999.

## Scientific Activity

The main scientific activity of Carlo Jacoboni has been related to electron transport in high electric field, to the theory of quantum transport and to the simulation of electron transport in mesoscopic structures.

**High field transport**. Electron transport in semiconductors under high electric fields has been extensively studied by means of Monte Carlo simulation, also in connection with experimental activity. Furthermore large effort has been devoted to the development of the method itself: in particular the method has been extended to include electron-electron interaction, electron degeneracy, the analysis of noise through the velocity autocorrelation function, and the combination of Monte Carlo and molecular dynamics tecniques. A review paper in Reviews of Modern Physics and a book published by Springer on these topics have become standard references for Monte Carlo simulation of electron transport in semiconductors and semiconductor devices.

**Theory of quantum Transport**. In the last years the scientific activity of Jacoboni and his group has been concentrated on the efford to extend to the theory of quantum transport the reliabilty and effectivness of the Monte Carlo approach. The introduction of the Wigner paths, within the formalism of the Wigner approach, has been proven to reach the above goal, allowing a rigorous quantum treatment of both coherent electron propagation and scattering processes both elastic (impurities) and inelastic (phonons).

**Transport in mesoscopic structures**

Low-dimension and low-dimensionality structures present very peculiar properties that are particularly appealing from the point of view of basic physics and are the fundamental stones of a large number of practical applications, mainly in modern nanoelectronics. The quantum transport theory developped by our group is particularly suitable for the analysis of such mesoscopic structures, where coherent electron propagation is the basic phenomenon and dephasing phonon interaction can be considered a reasonable small perturbation. Applications based on numerical simulations have been already realized, also in collaboration with experimental activities. Recently a new proposal of logic gates for quantum computation has been put forward based on mesoscopic coupled quantum wires.

**National and International Research Projects**

Jacoboni has been research group leader in several research projects, including:

- *Weighted Monte Carlo Algorithms for electron transport* (NTT, Japan, 1991)
- *Quantum theory of electron transport in Mesoscopic Systems* (ERO Project, 1995/97)
- *Monte Carlo Approach to Quantum Transport in Mesoscopic Systems based on Electron Wigner Trajectories* (ONR Project 1998/2000/2003/2006)
- *Quantum* transport for sub-micron devices (CNR-MADESS 1986/91)
- *Theory and Simulation of electronic transport properties in advanced devices: High-energy electron effects* (CNR-MADESS-II 1998-)
- *Physics of Nanostructures* (MURST-Cofin. 1997-98)
- *Elaboration of information through arrays of quantum dots* (MURST-Cofin. 1998-99)

**National and International Collaborations**

Prof. G. Baccarani, Prof. M. Rudan, Electrical Engineering Department, University of Bologna.
Prof. L. Demeio, Department of Mathematics, Università Politecnica delle Marche, Ancona.
Prof. F. Rossi, Department of Physics, Politecnico di Torino

Prof. N. Sano, University of Tsukuba, Japan.
Prof. D.K. Ferry, Arizona State University, USA
Dr. M. Fischetti, IBM Yorktown Heights, NY, USA.
Prof. I. Dimov, Dr. M. Nedjalkov, Bulgarian Academy of Sciences, Sofia, Bulgaria.
Dr. P.J. Price, IBM Yorktown Heights, NY, USA.

**10 pubblicazioni degli ultimi 5 anni (2004-2008)**

1. C.Jacoboni and P.Bordone
   *30 years of HCIS*
   Semicond. Sci. Technol. **19**, S1-S4, (2004)
2. R.Brunetti, S.Monastra, and C.Jacoboni
   *Quantum dynamics of polaron formation with the Wigner-function approach*
   Semicond. Sci. Technol. **19**, S250-S253, (2004)
3. Carlo Jacoboni and Paolo Bordone
   *The Wigner-function approach to non-equilibrium electron transport*
   Rep. Prog. Phys. **67**, 1033-1071, (2004)
4. E.Cancellieri, P.Bordone, A.Bertoni, G.Ferrari, and C.Jacoboni
   *Wigner Function for Identical Particles*
   J. Comput. Electronics, **3**, 411-415 (2004)
5. G.Ferrari, P.Bordone, and C.Jacoboni
   *Electron dynamics inside short-coherence systems*
   Phys. Letters A **356**, 371-375 (2006)
6. M.Nedjalkov, D.Vasileska, D.K.Ferry, C.Jacoboni, C.Ringhofer, I.Dimov, and V.Palankovski
   *Wigner transport models of the electron-phonon kinetics in quantum wires*
   Phys. Rev.B **74**, 035311 1-18, (2006)
7. E.Cancellieri, P.Bordone, and C.Jacoboni
   *Effect of symmetry in the many-particle Wigner function*
   Phys. Rev.B **76**, 214301 1-11, (2007)
8. E.Piccinini, M.Ceccarelli, F.Affinito, R.Brunetti, and C.Jacoboni
   *Biased Molecular Simulations for Free-Energy Mapping: A comparison on the KcsA Channel as a Test Case*
   J. Chem. Theory Comput. **4**, 173-183 (2008)
9. F.Buscami, E.Cancellieri, P.Bordone, A.Bertoni, and C.Jacoboni

*Electron decoherence in a semiconductor due to electron-phonon scattering*
Phys. stat. sol. (C), **5**, 52-55 (2008)

10. D.Ercolani, G.Biasol, E.Cancellieri, M.Rosini, C.Jacoboni, F.Carillo, S. Heun, L.Sorba, F. Nolting
*Transport anisotropy in $In_{0.75}Ga_{0.25}As$ two-dimensional electron gases induced by indium concentration modulation*
Phys. Rev. B, **77**, 235307 1-9 (2008)