EMILIO E. MENDEZ

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Professional Interests

- Electronic properties of nanomaterials; physics and materials science of quantum devices
- Higher education
- Management of science and technology

Education

- Ph. D., Physics, Massachusetts Institute of Technology, 1979
- B. S., Physics, Universidad Complutense, Madrid, Spain, 1971

Professional Experience

Brookhaven National Laboratory

2020 - Senior Adviser, Energy and Photon Sciences Directorate
2016 - 2020 Director, Energy Science and Technology Department
2006 - 2016 Director, Center for Functional Nanomaterials

State University of New York at Stony Brook

2004 - 2006 Director of the Undergraduate Program, Physics and Astronomy
1995 - 2002 Director of the Interface Phenomena Institute
1995 - Professor of Physics

IBM T. J. Watson Research Center

1993 - 1994 Senior Manager, Quantum Structures
1990 - 1992 Manager, Quantum Heterostructures
1988 - 1989 Staff Member, Office of Strategy and Planning
1981 - 1988 Research Staff Member
1979 - 1981 Postdoctoral Fellow

Visiting Positions

2004 Visiting Scientist, Paul Drude Institute, Berlin, Germany
2003 Distinguished Scholar, NTT Basic Research Laboratories, Atsugi, Japan
1999 BBV Distinguished Professor, Universidad Autonoma, Madrid, Spain
1998 Iberdrola Distinguished Professor, Universidad Autonoma, Madrid, Spain

Main Technical Contributions (Appendix 1)

- Experimental demonstration of the existence of the Wannier-Stark ladder and determination of quantum coherence in semiconductor superlattices (1988-1991)
- Proposal and demonstration of the Stark effect in semiconductor quantum wells (1982-1991)
- Proposal and demonstration of field tunable lasers and other novel structures (1992-1993)
- First observation of resonant tunneling of holes, magnetotunneling via Landau levels, and other phenomena related to resonant tunneling (1985-2003)
- First observation of Quantum Hall Effect in a 2D electron-hole system, first confirmation of Fractional Quantum Hall Effect ($\nu = 1/3$) and first observation of FQHE for Landau-level filling factors $\nu = 1/5$, 7/3 and 8/3 (1983-1985)

Publications and Patents (Appendices 2-6)

- Author of over one hundred and sixty refereed publications, of two chapters in monographs on semiconductor heterostructures and of an article in Encyclopedia of Physics
- Editor of two books on physics and applications of quantum wells and superlattices
- Author of six patents on semiconductor devices based on quantum wells and superlattices
- More than 11000 citations. Impact index h = 52. (Google Scholar)
- More than one hundred invited lectures
- Past contributor to El Pais, the leading Spanish newspaper, on science and policy

Selected Professional Activities (Appendices 7-10)

- Member, Continuing Review Panel, European Graphene Flagship, 2013 to present
- Chairman, Int. Sci. Advis. Commit. Materials and Nanoscience Institute Aragon, 2017 - 2022
- Member Committee, Board of Trustees, Bankinter Innovation Foundation, 2012 to present
- Member, Visiting Committee, Materials Sci. and Engineer. Dpt., MIT, 2010-2017
- Member, Scientific Advisory Committee, NANOGUNE, San Sebastian, 2007 to present
- Member, Board of Trustees, IMDEA Nano, Madrid, 2008 to 2014
- Member, Scientific Commission in charge of drafting Spain's Law of Science, 2008-2009
- Member, Program Committee, 14th Int. Conf. Mod. Semicond. Struct., Kobe, Japan, 2009
- Member, Committee of Visitors, Division Materials Research, US Nat. Sci. Found., 2008
- Chairman, Int. Advisory Committee, Materials Science Centers, CSIC, Spain, 1993 to 1999
- Member, Editorial Board of Semiconductor Science and Technology, 1993-1995
- Editor, Solid State Communications, 1992 – 2002

Major Recognitions (Appendix 11)

- Foreign Member, Royal Spanish Academy of Sciences (2023)
- Fujitsu Quantum Device Award (2000), for pioneering studies of the electro-optical properties of semiconductor quantum-well and superlattice devices
- Prince of Asturias Prize (1998), for seminal research on semiconductor heterostructures
- Fellow of the American Physical Society (1990), for his discovery of the Stark effects in quantum wells and superlattices
- IBM Outstanding Technical Achievement Award (1987), for work on tunneling and quantum Hall effect properties of two-dimensional holes

Citations

	ISI Web of Science	Google Scholar
Total number of citations	> 8000	> 11700
Average citations per paper	49	73
h index	43	53

In the 30 most-cited articles:
Average number of authors: < 4
Mendez as first author: 12 times
Mendez as second author: 12 times

30 Most Cited Publications

1. *Stark Localization in GaAs-GaAlAs Superlattices under an Electric Field*, **E. E. Mendez**, F. Agulló-Rueda, and J. M. Hong, Phys. Rev. Lett. **60,** 2426 (1988). Cited 1134 times (Google)
2. *Exciton Binding Energy in Quantum Wells*, G. Bastard, **E. E. Mendez**, L. L. Chang and L. Esaki, Phys. Rev. B **26**, 1974 (1982). Cited 1093 times.
3. *Variational Calculations on a Quantum Well in an Electric Field*, G. Bastard, **E. E. Mendez**, L. L. Chang, and L. Esaki, Phys. Rev. B **28,** 3241 (1983). Cited 1054 times.
4. *Effect of an Electric Field on the Luminescence of GaAs Quantum Wells*, **E. E. Mendez**, G. Bastard, L. L. Chang, L. Esaki, H. Morkoç and R. Fischer, Phys. Rev. B **26,** 7101 (1982). Cited 390 times.
5. *Phase Transition of an Exciton System in GaAs Coupled Quantum Wells*, T. Fukuzawa, **E. E. Mendez**, and J. M. Hong, Phys. Rev. Lett. **64,** 3066 (1990). Cited 334 times.
6. *Crystal Orientation Dependence of Silicon Doping in Molecular Beam Epitaxial AlGaAs/GaAs Heterostructures*, W. I. Wang, **E. E. Mendez**, T. S. Kuan, and L. Esaki, Appl. Phys. Lett. **47,** 826 (1985). Cited 301 times.
7. *Resonant Tunneling of Holes in AlAs-GaAs-AlAs Heterostructures*, **E. E. Mendez**, W. I. Wang, B. Ricco, and L. Esaki, Appl. Phys. Lett. **47,** 415 (1985). Cited 249 times.
8. *Wannier-Stark Ladders and Bloch Oscillations in Superlattices*, **E. E. Mendez** and G. Bastard, Physics Today, June 1993, p. 34. Cited 246 times.
9. *Resonant Magnetotunneling in GaAlAs-GaAs-GaAlAs Heterostructures*, **E. E. Mendez**, L. Esaki, and W. I. Wang, Phys. Rev. B 33, 2893 (1986). Cited 236 times.
10. *Observation of "Tamm States" in Superlattices*, H. Ohno, **E. E. Mendez**, J. A. Brum, J. M. Hong, F. Agulló-Rueda, L. L. Chang, and L. Esaki, Phys. Rev. Lett. **64,** 2555 (1990). Cited 209 times.
11. *High Mobility Hole Gas and Valence Band Offset in Modulation-Doped p: AlGaAs/GaAs Heterojunctions*, W. I. Wang, **E. E. Mendez**, and F. Stern, Appl. Phys. Lett. 45, 639 (1984). Cited 206 times.
12. *Temperature Dependence of the Electron Mobility in GaAs-GaAlAs Heterostructures*, **E. E. Mendez**, P. J. Price, and M. Heiblum, Appl. Phys. Lett. **45,** 294 (1984). Cited 187 times.
13. *Quantum Coherence in Semiconductor Superlattices*, F. Agulló-Rueda, **E. E. Mendez**, and J. M. Hong, Phys. Rev.B **40,** 1357 (1989). Cited 171 times.

14. *Fermi-Dirac Distribution of Excitons in Coupled Quantum Wells*, J. A. Kash, M. Zachau, **E. E. Mendez**, J.M. Hong, and T. Fukuzawa, Phys. Rev. Lett. **66,** 2247 (1991). Cited 165 times.
15. Quantum Hall Effect in a Two-Dimensional Electron-Hole Gas, **E. E. Mendez**, L. Esaki, and L. L. Chang, Phys. Rev. Lett. 55, 2216 (1985). Cited 162 times.
16. Polytype Superlattices and Multi-Heterojunctions, L. Esaki, L. L. Chang, and **E. E. Mendez**, Jap. J. Appl. Phys. Lett. 20, L529 (1981). Cited 154 times.
17. *Tunneling through Indirect-Gap Semiconductor Barriers*, **E. E. Mendez**, E. Calleja, and W. I. Wang, Phys. Rev. B **34,** 6026 (1986). Cited 149 times.
18. *Resonant Tunneling via X-point States in AlAs-GaAs-AlAs Heterostructures*, **E. E. Mendez**, W. I. Wang, E. Calleja, and C. E. T. Gonçalves da Silva, Appl. Phys. Lett. **50,** 1263 (1987). Cited 141 times.
19. *Electric-field effects on exciton lifetimes in symmetric coupled GaAs/$Al_{0.3}Ga_{0.7}As$ double quantum wells*, A. Alexandrou, J. A. Kash, **E. E. Mendez,** M. Zachau, and J. M. Hong, Phys. Rev. B, **42,** 9225 (1990). Cited 136 times.
20. *Electric-Field Induced Decrease of Photoluminescence Lifetime in GaAs Quantum Wells*, J. A. Kash, **E. E. Mendez**, and H. Morkoç, Appl. Phys. Lett. **46,** 173 (1985). Cited 120 times.
21. *Raman Scattering in GaSb-AlSb Strained Layer Superlattices*, B. Jusserand, P. Voisin, M. Voos, L. L. Chang, **E. E. Mendez**, and L. Esaki, Appl. Phys. Lett. **46,** 678 (1985). 117 times.
22. *Mobility-dependent Low-frequency Noise in Graphene Field-effect Transistors*, Y. Zhang, **E. E. Mendez**, and X. Du, ACS Nano 5, 8124 (2011). Cited 129 times.
23. *Growth by Molecular Beam Epitaxy and Characterization of High Purity GaAs and AlGaAs*, M. Heiblum, **E. E. Mendez**, and L. Osterling, J. Appl. Phys. **54,** 6982 (1983). 113 times.
24. *Electroreflectance of Indium Gallium Arsenide Phosphide Lattice Matched to Indium Phosphide*, E. H. Perea, **E. E. Mendez**, and C. G. Fonstad, Appl. Phys. Lett **36,** 978 (1980). Cited 110 times.
25. *High Magnetic Field Transport in a Dilute Two-Dimensional Electron Gas*, **E. E. Mendez**, M. Heiblum, L. L. Chang, and L. Esaki, Phys. Rev. B 28, 4886 (1983). Cited 106 times.
26. *Observation by Resonant Tunneling of High-Energy States in GaAs-GaAlAs Quantum Wells*, **E. E. Mendez**, E. Calleja, C. E. T. Gonçalves da Silva, L. L. Chang, and W. I. Wang, Phys. Rev. B 33, 7368 (1986). Cited 105 times.
27. *Shot Noise Enhancement in Resonant Tunneling Structures in a Magnetic Field*, V. V. Kuznetsov, **E. E. Mendez**, J. D. Bruno, and J. T. Pham, Phys. Rev. B **58**, R10159 (1998). Cited 99 times.
28. *Observation of the Fractional Quantum Hall Effect in Si/SiGe Heterostructures*, S. F. Nelson, K. Ismail, J. J. Nocera, F. F. Fang, **E. E. Mendez**, J. O. Chu, and B. S. Meyerson, Appl. Phys. Lett. **61,** 64 (1992). Cited 99 times.
29. *Excitonic Coupling in GaAs/GaAlAs Quantum Wells in an Electric Field*, L. Viña, R. T. Collins, **E. E. Mendez**, and W. I. Wang, Phys. Rev. Lett. **58,** 832 (1987). Cited 81 times.
30. *Inelastic Tunneling in AlAs-GaAs-AlAs Heterostructures*, **E. E. Mendez**, E. Calleja, and W. I. Wang, Appl. Phys. Lett. **53,** 977 (1988). Cited 81 times.

APPENDIX 1

Main Technical Achievements

Emilio Mendez has contributed to our fundamental understanding of the electronic properties of semiconductor nanostructures and has opened new research directions whose impact has reached as far as atomic physics and the telecommunications industry. Mendez has published about 160 refereed papers, which have been cited more than 11,000 times (Google Scholar). According to that data base, the impact h-index of Mendez publications is 52.

Mendez's seminal work on the effects of an electric field on a confined semiconductor has provided the scientific basis for light modulators that are essential components of electro-absorption modulated lasers widely used in telecommunications and datacom products. After a long-standing theoretical controversy about the Wannier-Stark ladder in solids, using optical spectroscopy, Mendez demonstrated its existence in semiconductor superlattices as well as electric-field induced Wannier-Stark localization. These results, which evidence in a very direct and elegant way the wave-nature of electrons in solids, stimulated atomic physicists, who extended similar concepts to optical superlattices. Mendez employed coupled quantum wells under an electric field to explore Bose-Einstein condensation of excitons, a scheme that is still widely used by others in their quest for demonstrating that phenomenon. More recently, he has developed novel lasers based on coupled quantum wells, proposed a type II quantum-cascade laser, and applied his expertise on electric-field effects to semiconductor microcavities.

In the area of electronic transport, Mendez was the first to observe the quantum Hall effect in a system of coexisting electrons and holes and the fractional quantum Hall effect of electrons at 1/5 filling factor, and the first to confirm Hall quantization at 1/3 and 2/3 filling. He has carried out many "firsts" in resonant-tunneling phenomena in semiconductor nanostructures as well. Recently, in an elegant experiment, he has shown that in a resonant-tunneling diode it is the microscopic accumulation of charge, and not just the presence of negative differential conductance, that determines the enhancement of shot noise observed in that kind of devices, contrary to some theoretical predictions.

The following paragraphs describe in detail Mendez's most notable contributions.

A) OPTICAL PROPERTIES OF QUANTUM WELLS AND SUPERLATTICES

Stark Effect in Quantum Wells

Mendez proposed in 1982 the application of an electric field to a quantum well to shift its energy levels and change its electronic wavefunctions, in analogy to the Stark effect in atomic systems. He demonstrated the effect (often called the quantum-confined Stark effect) using photoluminescence experiments that showed a field-induced red-shift of the emission spectra from the quantum wells. Using perturbation and variational approximations, with G. Bastard he calculated the effect of the electric field on quantum-well energy levels and wavefunctions. He recognized the possibilities of these effects for optoelectronic applications, namely, light emitters and detectors, as indicated in his IBM invention disclosure: "The above-mentioned effect shows the possibility of making wavelength-tunable optoelectronic devices such as light emitting diodes, lasers and optical detectors". And in his 1982 paper: "These concepts...could be used in a

variety of optoelectronic applications, e.g., for control and modulation of both the photon energy and the intensity of the output of radiation-emitting devices based on quantum wells and superlattices".

The Stark effect that Mendez proposed and demonstrated is the fundamental mechanism behind quantum-well modulators in commercial electro-absorption modulated lasers widely used in telecommunications and datacom products. Combined, Mendez's two key publications have been cited about 1400 times.

Key publications

Effect of an Electric Field on the Luminescence of GaAs Quantum Wells, **E. E. Mendez**, G. Bastard, L. L. Chang, L. Esaki, H. Morkoc and R. Fischer, Phys. Rev. B **26**, 7101 (1982)

Variational Calculations on a Quantum Well in an Electric Field, G. Bastard, **E. E. Mendez**, L. L. Chang, and L. Esaki, Phys. Rev. B 28, 3241 (1983)

Stark Ladder, Stark Localization and Quantum Coherence in Superlattices

In 1988 Mendez demonstrated experimentally the existence of the Wannier-Stark ladder in semiconductor superlattices, thus ending a controversy that had surrounded the "Stark ladder" concept in solids practically since its proposal by H. James and G. Wannier almost forty years earlier, and at once stimulating a renewed effort for the search of Bloch oscillations.

In an ideal crystal under an electric field, scattering-free electrons in the conduction band would undergo rapid oscillations and radiate at a frequency proportional to the field (Bloch oscillations). This semiclassical picture is replaced in quantum mechanics by a set of discrete states (Wannier-Stark ladder) unfolding from the conduction band, equidistant in energy and with a separation proportional to the field and the lattice parameter. Transitions between those states would give rise to radiation at the same frequency as the semiclassical Bloch oscillations.

Esaki and Tsu pointed out in 1969 that crystalline superlattices, because of their larger "superatomic" period, would be excellent candidates to look for Bloch oscillations. Semiconductor superlattices were subsequently realized and intensely studied in the laboratory, but there was not even direct evidence of the superlattice effect, in the sense of a coherent electronic wavefunction that is extended throughout many periods. Without such quantum coherence, Wannier-Stark ladder or Bloch oscillations would be meaningless.

Mendez designed an optical experiment that could simultaneously probe the coherence of electronic wavefunctions of superlattices and show the existence of the Wannier-Stark ladder. Using photoluminescence and photocurrent spectroscopy in GaAs-GaAlAs superlattices under an electric field, Mendez and his group at IBM observed in 1988 a set of optical transitions whose energy dependence on the field corresponded exactly to that of the quantum levels of the Wannier-Stark ladders formed in the conduction and valence bands of the superlattice. Moreover, the disappearance from the spectra of transitions with high quantum index with increasing field was evidence of the field-induced localization of superlattice wavefunctions and, by extension, of their quantum coherence at any field. At the time, coherence at the lowest field of up to thirteen periods was demonstrated, later extended by others to over twenty periods. These concepts were soon exploited by Ohno, Mendez and their collaborators to demonstrate the existence of long-sought Tamm states.

These accomplishments opened new opportunities for electro-optic applications and renewed the search for Bloch oscillations in superlattices, whose observation was reported a few years later. Mendez's pioneering experiments also guided atomic physicists in their own successful search for Wannier-Stark ladders and Bloch oscillations in optical superlattices.
The key 1988 publication alone has been cited more than 1000 times.

Key publications

Stark Localization in GaAs-GaAlAs Superlattices under an Electric Field, **E. E. Mendez**, F. Agullo-Rueda, and J. M. Hong, Phys. Rev. Lett. **60**, 2426 (1988)

Quantum Coherence in Semiconductor Superlattices, F. Agullo-Rueda, **E. E. Mendez**, and J. M. Hong, Phys. Rev. B **40**, 1357 (1989)

Observation of "Tamm States" in Superlattices, H. Ohno, **E. E. Mendez**, J. A. Brum, J. M. Hong, F. Agulló-Rueda, L. L. Chang, and L. Esaki, Phys. Rev. Lett. **64**, 2555 (1990)

Binding Energy of Excitons in Quantum Wells

In 1982, Bastard and Mendez, using a variational approach, made the first realistic calculation of the binding energy of excitons in semiconductor quantum wells and its dependence on well width, predicting and quantifying an enhancement of the exciton's binding energy (and, correspondingly, oscillator strength) with decreasing width. Such an enhancement makes it possible to observe excitonic effects even at room temperature, which manifest themselves as a sharpened absorption edge that is exploited in electro-absorption modulators. (See above) The original paper soon became the starting point for subsequent, more refined calculations by many others and has been cited more than 1000 times.

Key publication

Exciton Binding Energy in Quantum Wells, G. Bastard, **E. E. Mendez**, L. L. Chang, and L. Esaki, Phys. Rev. B **26**, 1974 (1982)

Coupled Quantum Wells for Exciton Condensation

A long lifetime is essential to achieve Bose-Einstein condensation of excitons, a goal pursued unsuccessfully for many years in a variety of solids. Soon after his observation of the Stark effect in semiconductor quantum wells, Mendez's group realized that a system of two coupled quantum wells (CQWs) would be more suitable for electron-hole separation than an isolated well, and therefore a better candidate system for exciton condensation. The group first showed experimentally an electric-field-induced enhancement of the exciton's lifetime by several orders of magnitude in strongly coupled wells, and then used this scheme to search for excitonic condensation. Mendez's group observed a dramatic reduction of the CQW's photoluminescence (PL) linewidth below a critical temperature, which was tentatively attributed to a possible phase transition of the exciton gas into an ordered state. Subsequent time-resolved experiments by his group revealed that the narrowing of the PL spectrum was in reality due to metastable trapping of excitons caused by disorder-induced potential fluctuations.

This work stimulated the current interest in exciton condensation in semiconductor nanostructures. The scheme first employed by Mendez's group is the preferred one used nowadays in the search for exciton condensation. Although there is no direct evidence of

condensation yet, crucial steps have been made toward it. Combined, the two key publications have been cited about 450 times.

Key publications

Phase Transition of an Exciton System in GaAs Coupled Quantum Wells, T. Fukuzawa, **E. E. Mendez**, and J.M. Hong, Phys. Rev. Lett. **64**, 3066 (1990)

Fermi Dirac Distribution of Excitons in Coupled Quantum Wells, J. A. Kash, M. Zachau, **E. E. Mendez**, J. M. Hong, and T. Fukuzawa, Phys. Rev. Lett. **66**, 2247 (1991)

B) TRANSPORT PROPERTIES OF SEMICONDUCTOR HETEROSTRUCTURES

Quantum Hall Effect

Mendez has contributed significantly to the elucidation of the quantum Hall effects, both integer and fractional. He was the first to confirm Tsui, Stormer, and Gossard's observation of the fractional Hall effect for filling factor $\nu = 1/3$, for which they were awarded the Nobel Prize in Physics in 1998. For the first time, he observed fractional quantization at $\nu = 1/5$ and suggested the transition from an interacting liquid to a Wigner solid in the filling-factor region between 1/5 and 1/7. In the extreme of high electron density, he showed fractional quantization beyond the last Landau level, namely at fractional filling $\nu = 7/3$ and 8/3. He did the first systematic study of fractional quantization of two-dimensional hole gases, and the first experiments of coexisting electrons and holes in the quantum Hall regime, demonstrating the compensating contributions to the quantum Hall effect of two-dimensional (2D) electrons and holes. This work was in some way ahead of its time and it went almost unnoticed for a while. After other researchers began considering the interaction between 2D electrons and holes, the work started receiving attention and it has now been cited about 150 times.

Key Publications

High Magnetic Field Transport in a Dilute Two-Dimensional Electron Gas, **E. E. Mendez**, M. Heiblum, L. L. Chang, and L. Esaki, Phys. Rev .B **28,** 4886 (1983)

Fractionally Quantized Hall Effect in Two-Dimensional Systems of Extreme Electron Concentration, **E. E. Mendez**, L. L. Chang, M. Heiblum, L. Esaki, M. Naughton, K. Martin, and J. Brooks, Phys. Rev. B **30,** 7310 (1984)

Quantum Hall Effect in a Two-Dimensional Electron-Hole Gas, **E. E. Mendez**, L. Esaki, and L. L. Chang, Phys. Rev. Lett. **55,** 2216 (1985)

Resonant Tunneling

Mendez has also opened new ground in the field of resonant tunneling in semiconductor nanostructures. Among his many contributions, the following "experimental firsts" should be highlighted: resonant tunneling of holes; resonant magneto-tunneling; and resonant tunneling through indirect-gap barriers. A review article on Resonant Tunneling by Mendez has been used in several graduate-school courses. Mendez's recognition in this field is exemplified by his contribution to the Encyclopedia of Applied Physics with a chapter on Resonant Tunneling. Combined, the four key publications have been cited over 750 times.

Key publications

Resonant Tunneling of Holes in AlAs-GaAs-AlAs Heterostructures, **E. E. Mendez**, W. I. Wang, B. Ricco, and L. Esaki, Appl. Phys. Lett. **47,** 415 (1985)

Resonant Magnetotunneling in GaAlAs-GaAs-GaAlAs Heterostructures, **E. E. Mendez**, L. Esaki, and W. I. Wang, Phys. Rev. B **33,** 2893 (1986)

Tunneling through Indirect-Gap Semiconductor Barriers, **E. E. Mendez**, E. Calleja, and W. I. Wang, Phys. Rev. B **34,** 6026 (1986)

Resonant Tunneling via X points States in AlsAs-GaAs-AlAs Heterostrucures, **E. E. Mendez**, W. I. Wang, E. Calleja, and C. E. T. Goncalves da Silva, Appl. Phys. Lett. **50,** 1263 (1987)

Shot Noise in Nanostructures

Mendez has elucidated the shot noise properties of electrons (or holes) in the hopping-conduction regime. Although this transport mechanism had been studied extensively, its noise properties were not known until the work by Mendez's group. Specifically, the group demonstrated that shot noise is reduced relative to that of a Poissonian process, and that the reduction depends on the length of the sample, with a characteristic length that measures the inhomogeneity of hopping transport. His group has also proved wrong a prediction that the shot noise of all devices that exhibit negative differential conductance (NDC) should be drastically enhanced in the NDC region. By comparing the very different noise properties of two types of heterostructures (a double-barrier separating two bulk-like electrodes and a single barrier blocking two identical superlattices) that have similar current-voltage characteristics, Mendez demonstrated that it is the microscopic accumulation of charge that determines the enhancement of shot noise, and not just the presence of negative differential conductance. This result could be instrumental to elucidate the potential profile that determines electronic transport in future molecular devices. Mendez's 4 key publications on noise have been cited over 300 times.

Key publications

Shot Noise Enhancement in Resonant Tunneling Structures in a Magnetic Field, V. V. Kuznetsov, **E. E. Mendez***,* J. D. Bruno, and J. T. Pham, Phys. Rev. B 58, R10159 (1998).

Partially Suppressed Shot Noise in Hopping Conduction, V. V. Kuznetsov, **E. E. Mendez**, X. Zuo, G. L. Snider, and E. T. Croke, Phys. Rev. Lett. **85**, 397 (2000)

Shot Noise in Negative-Differential-Conductance Devices, W. Song, **E. E. Mendez**, V. V. Kuznetsov, and B. Nielsen, Appl. Phys. Lett. **82**, 1568 (2003)

Mobility-dependent Low-frequency Noise in Graphene Field-effect Transistors, Y. Zhang, **E. E. Mendez**, and X. Du, ACS Nano 5, 8124 (2011).

APPENDIX 2

Publications

1. Temperature Dependence of the Band Parameters in Bi and Bi-Sb Alloys, M. P. Vecchi, E. Mendez, and M. S. Dresselhaus, Proc. 13th Int. Conf. Semicond. Rome, 1976, p. 459.
2. High Field Magnetooptical Studies in Bi and Bi-Sb Alloys, M. P. Vecchi, E. Mendez, and M. S. Dresselhaus, Physica **89** B, 150 (1977).
3. Magnetooptical Study of Bi and Bi-Sb alloys under Hydrostatic Pressure, E. Mendez, A. Misu and M. S. Dresselhaus, Proc. 14th Int. Conf. Semicond., Edinburgh, 1978, p. 1089.
4. High Field Magnetoreflectivity of Semimetals Under Pressure, E. Mendez, M. S. Dresselhaus, and A. Misu, J. Magnetism and Magnetic Materials **11,** 146 (1979).
5. Near Infrared Reflectivity of Graphite Under Pressure, A. Misu, E. Mendez, and M. S. Dresselhaus, J. Phys. Soc. Jap. **47,** 199 (1979).
6. Electrolyte Electroreflectance Investigation of Ion-Damaged Laser-Annealed Silicon, F. H. Pollak, R. Tsu, and E. E. Mendez, Proc.Mat. Res. Soc. Symp. on "Laser and Electron Beam Processing of Materials," Cambridge, Mass. (1979).
7. Electron Effective Mass in $In_uGa_{1-u}P_vAs_{1-v}$/InP for $0 \leq v \leq 1$, E. H. Perea, E. Mendez, and C. Fonstad, J. Electron. Mat. **9,** 459 (1980).
8. Magnetoreflection Study of Graphite Under Pressure, E. Mendez, M. S. Dresselhaus, and A. Misu, Phys. Rev. B **21,** 827 (1980).
9. Magnetoreflection Studies of Graphite Intercalacion Compounds, E. Mendez, T.C. Chieu, N. Kambe, and M. S. Dresselhaus, Solid State Commun. **33,** 837 (1980).
10. Electroreflectance of Indium Gallium Arsenide Phosphide Lattice Matched to Indium Phosphide, E. H. Perea, E. E. Mendez, and C. G. Fonstad, Appl. Phys. Lett **36,** 978 (1980).
11. Electroreflectance Study of Semiconductor Superlattices, E. E. Mendez, C.-A. Chang, L. L. Chang, L. Esaki, and F. H. Pollak, J. Phys. Soc. Jap. Suppl. A **49,** 1009 (1980).
12. Semimetallic InAs-GaSb Superlattices to the Heterojunction Limit, L. L. Chang, N. J. Kawai, E. E. Mendez, C.-A. Chang, and L. Esaki, Appl. Phys. Lett. **38,** 30 (1981).
13. Observation of Superlattice Effects on the Electronic Bands of Multilayer Heterostructures, E. E. Mendez, L. L. Chang, G. Landgren, R. Ludeke, L. Esaki, and F. H. Pollak, Phys. Rev. Lett. **46,** 1230 (1981).
14. Pressure-Dependent Magnetoreflection Studies of Bi and $Bi_{1-x}Sb_x$ Alloys, E. E. Mendez, A. Misu and M. S. Dresselhaus, Phys. Rev. B **24,** 639 (1981)
15. Polytype Superlattices and Multi-Heterojunctions, L. Esaki, L. L. Chang, and E. E. Mendez, Jap. J. Appl. Phys. Lett. **20,** L529 (1981).
16. Molecular Beam Epitaxy of Ge-GaAs Superlattices, C.-A. Chang, W. K. Chu, E. E. Mendez, L. L. Chang, and L. Esaki, J.Vac. Sci. Technol. **19,** 567 (1981).
17. Photoexcited and Photostimulated Luminescence and Conduction in Zinc Silicate Single Crystals with Deep Centers and Traps, F. Chang, P. Thioulouse, E. E. Mendez, E. A. Giess, D. B. Dove, and T. Takamori, J. Lumin. **24-25,** 313 (1981).
18. Influence of Electron Traps on the Phosphorescence of Zinc Silicate Mn Phosphors, D. B. Dove, T. Takamori, I. F. Chang, P. Thioulouse, E. E. Mendez, and E. A. Giess, J. Lumin. **24-25,** 317 (1981).
19. Two-Dimensional Quantum States in Multi-Heterostructures of Triple Constituents, E. E. Mendez, L. L. Chang, and L. Esaki, Surf. Sci. **113,** 474 (1982).

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147. Electric Field Enhancement of the Rabi Splitting in a Superlattice-Microcavity System, J. H. Dickerson, E. E. Mendez, A. A. Allerman, S. Manotas, F. Agulló-Rueda, and C. Pecharromán, Physica E **13**, 398 (2002).
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149. Electric Field Tuning of the Rabi Splitting in a Superlattice-Embedded Microcavity, J. H. Dickerson, J. K. Son, E. E. Mendez, and A. A. Allerman, Appl. Phys. Lett. **81**, 803 (2002).
150. Tunneling Characteristics of an Electron-Hole Trilayer in a Parallel Magnetic Field, Y. Lin, E.E. Mendez, and A.G. Abanov, Phys. Rev. B. **66**, 195311 (2002).
151. Control by an Electric Field of Electron-Hole Separation in Type-II Heterostructures, Yu. B. Vasilyev, V. A. Solov'ev, B. Ya. Mel'tser, A. N. Semenov, M. V. Baidakova, S. V. Ivanov, P. S. Kop'ev, E. E. Mendez, and Y. Lin, Solid State Commun. **124**, 323-326 (2002).
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153. Magnetotunneling between Two-dimensional Electron Gases in InAs-AlSb-GaSb Heterostructures, Y. Lin, E. M. Gonzalez, E. E. Mendez, R. Magno, B. R. Bennett, and A. S. Bracker, Phys. Rev. B **68**, 035311 (2003)
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157. Zincblende GaAs Films Grown on Wurzite GaN/Sapphire Templates, V.V. Chaldyshev, B. Nielsen, E. E. Mendez, Yu. G. Musikhin, and N. A. Bert, Appl. Phys. Lett. **86**, 131916 (2005)
158. Drastic Reduction of Shot Noise in Semiconductor Superlattices, W. Song, A. K. M. Newaz, J. K. Son, and E. E. Mendez, Phys. Rev. Lett. **96**, 126803 (2006)
159. Growth and Electronic Properties of GaN/ZnO Solid Solution Nanowires, W.-Q. Han, Y. Zhang, C.-Y. Nam, C. T. Black, and E. E. Mendez, Appl. Phys. Lett. **97**, 083108 (2010)
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Physics and Applications of Quantum Wells and Superlattices, E. E. Mendez and K. v. Klitzing, Editors, Plenum, 1988

Resonant Tunneling in Semiconductors: Physics and Applications, L. L. Chang, E. E. Mendez and C. Tejedor, Editors, Plenum, 1991

Compositionally Modulated Superlattices, L. L. Chang and E. E. Mendez, Chapter 4, in *Synthetic Modulated Structures*, L. Chang and B. C. Griesen, Editors, Academic Press, 1985

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Resonant Tunneling, E. E. Mendez and L. Esaki, Encyclopedia of Applied Physics, vol. 16, p. 437-454, VCH Publishers, 1996.

APPENDIX 3

Patents

(authors listed in alphabetical order)

1. *Field-effect Transistor with Heterojunction Induced Channel*, C. A. Chang, L. L. Chang, L. Esaki, and E. E. Mendez, US Patent No. 4,358,165
2. *Field-Effect Transistor*, C. A. Chang, L. L. Chang, L. Esaki, and E. E. Mendez, US Patent No. 4,743,951
3. *Optoelectronic Devices Based on Intraband Transitions in Combinations of Type I and Type II Tunnel Junctions*, L. Esaki, E. E. Mendez, and H. Ohno, US Patent No. 5,079,601
4. *Polarization-Tunable Optoelectronic Devices,* D. Ahn and E. E. Mendez, US Patent No. 5,079,774
5. *Biaxial-Stress Barrier Shifts in Pseudomorphic Devices*, E. E. Mendez, T. P. Smith, III, , and J. M. Woodall, US Patent No. 5,132,746
6. *Coupled-Double-Quantum-Well Tunable Laser*, T. Fukuzawa, L. Y. Liu, and E. E. Mendez, US Patent No. 5,287,377

Invention Publications

1. *Variable-Threshold Gunn Oscillators by Quantum States,* E. E. Mendez, IBM Tech. Disclos. Bull.**24,** 3701 (1981)
2. *InAs-AlSb-GaSb Tunnel Diode*, C. A. Chang, L. Esaki, and E. E. Mendez, IBM Tech. Disclos. Bull. **25**, 1185 (1982)
3. *Growth of GaAs and GaAlAs in Molecular Beam Epitaxy*, M. Heiblum, E. E. Mendez, and L. Osterling, IBM Tech. Disclos. Bull. **27,** 2215 (1984)
4. *Semiconductor Two-Dimensional Hole Gas Heterostructures*, W. I. Wang, E. E. Mendez, T. S. Kuan, and L. Esaki, IBM Tech. Disclos. Bull. **29,** 2229 (1986)
5. *Deposition of Silicon Nitride*, W. I. Wang, E. E. Mendez, and S. Tiwari, IBM Tech. Disclos. Bull. **27,** 791 (1986)
6. *InAs-GaSb Quantum Well Resonant Tunnel Diode*, L. Esaki, E. E. Mendez, and H. Munekata, IBM Tech. Disclos. Bull. 31, 442 (1989)
7. *A Quantum Switch*, E. E. Mendez, L. L. Chang, and M. Heiblum, IBM Tech. Disclos. Bull. **31,** 445 (1989)
8. *Type II Superlattice Infrared Photodetector*, L. L. Chang, L. Esaki, E. E. Mendez, and G. A. Sai-Halasz, IBM Tech. Disclos. Bull. **32,** 270 (1989)
9. *Electronic Devices based in Tunneling between Two-Dimensional Systems*, E. E. Mendez and L. L. Chang, IBM Tech. Disclos. Bull. **32**, 452 (1989)
10. *Optoelectronic Devices based on Superlattices under Electric Fields*, E. E. Mendez and F. Agullo-Rueda, IBM Tech. Disclos. Bull. **34**, 301 (1990)

APPENDIX 4

Essays

(In Spanish)

1. *Lecciones de un centenario*, El País, 21 de Mayo, 1997
2. *Renovar el CSIC*, El País, 16 de Julio, 1997
3. *El transistor*, cincuenta años después, El País, 10 de Diciembre, 1997
4. *La recuperación de 'cerebros'*, El País, 15 de Julio, 1998
5. *Del descubrimiento a la comercialización, ¿un camino predecible?*, ABC, 3 de Setiembre, 1998
6. *El extraño mundo de la mecánica cuántica*, El País, 21 de Octubre, 1998
7. *Reflexiones de urgencia sobre la ciencia*, El País, 3 de Febrero, 1999
8. *La física otea sus retos para los próximos 20 años*, El País, 31 de Marzo, 1999
9. *La unidad de los científicos*, El País, 9 de Febrero, 2000
10. *Innovación: mitos y realidad*, El País, 12 de Abril, 2000
11. *La edad de la información, al fin reconocida*, El País, 18 de Octubre, 2000
12. *Una generación olvidada,* El País, 18 de Abril, 2001
13. *Asombrosos experimentos en entredicho*, El País, 29 de Mayo, 2002
14. *Las sombras de un escándalo científico,* El Pais, 2 de Octubre, 2002
15. *Defensa de lo pequeño,* El País, 20 de Noviembre, 2002
16. *Prólogo* al libro *Reflexiones sobre la Ciencia en España*, Editado por J. A. Gutiérrez
17. Fuentes y J. L. Puerta López-Cózar, Ars Medica, 2003
18. *El paraiso imaginario*, El País, 18 de Febrero, 2004
19. *El nacimiento de la electrónica cuántica*, El País, 30 de Junio, 2004
20. *De los tubos de vacío a los nanotubos*, El País, 17 de Noviembre, 2004
21. *¿Agenda nueva, o propósito de año nuevo?* El País, 16 de Febrero, 2005
22. *El país alegre y confiado*, El País, 26 de Octubre, 2005
23. *¿Un Instituto Europeo de Tecnología?*, El País, 1 de Noviembre, 2006
24. *La veloz carrera de los electrones,* El País, 31 de Octubre, 2007
25. *Desafío energético o decadencia*, Expansión, 26 de Marzo, 2008
26. *La luz y la imagen conducen al premio*, El País, 14 de Octubre, 2009
27. *Escuchando a Obama*, El País, 21 de Octubre, 2009

APPENDIX 5

Invited Talks

1. *GaAs Heterostructures and Superlattices: A Classical Example of Textbook Quantum Mechanics*, May 18, 1983, Raytheon Research Division, Lexington, Mass.
2. *Optical Properties of Multilayer Structures*, July, 27, 1983, Symposium on Optical and Optoelectronic Properties of Semiconductor Multilayer Structures, Malvern, United Kingdom
3. *The Quantum Hall Effect*, September 26, 1985, Autonoma University, Madrid, Spain
4. *Quantum Hall and Magnetoconductance Effects in III-V Heterolayers*, Buckley Price Symposium on the Fractional Quantum Hall Effect, March 28, 1984, American Physical Society Meeting, Detroit, Mich.
5. *Is There Life After Silicon*?, April 10, 1985, IBM Spain Convention, Paris, France
6. *Magnetotransport Measurements in III-V Heterolayers*, July 11, 1984, IBM Europe Institute, Davos, Switzerland
7. *Two-Dimensional Electrons and Holes in High Magnetic Fields*, November 19, 1984, National Research Council, Ottawa, Canada
8. *Two-Dimensional Electrons and Holes: How Different Are They?*, November 27, 1984, Yale University
9. *Two-Dimensional Electrons and Holes in High Magnetic Fields*, December 10, 1984, National Magnet Laboratory, MIT, Cambridge, Mass.
10. *Electrons and Holes in Two-Dimensions: How Different Are They?*, April 29, 1985, Princeton University, Princeton, N.J.
11. *The Quantum Hall Effects in 2D Systems: Electrons and Holes*, June 25, 1985, Annual Meeting of the Canadian Association of Physicists, Fredericton, New Brunswick, Canada
12. *Two-Dimensional Holes at High Magnetic Fields*, September 12, 1985, International Conference on Electronic Properties of Two-Dimensional Systems, Kyoto, Japan
13. *Tunneling Spectroscopy in Quantum Wells*, August 4, 1986, IBM Europe Institute, Oberlech, Austria
14. *Resonant Tunneling in Semiconductor Heterostructures*, March 17, 1987 American Physical Society Meeting, New York
15. *Physics of Resonant Tunneling in Semiconductors*, April 25-27, 1987, Advanced Science Institute on Physics and Applications of Quantum Wells adn Superlattices, Erice, Italy
16. *Resonant Tunneling in GaAs-GaAlAs Heterostructures*, July 9, 1987, Third Int. Conf. on Modulated Semiconductor Structures, Montpellier, France
17. *Physics of Semiconductor Superlattices*, July 13, 1987, Summer School on Fundamental Aspects in Physics of Semiconductors, Universidad Menéndez Pelayo, Santander, Spain
18. *Applications of Superlattices*, July 24, 1987, Centro de Investigación de la Armada, Madrid, Spain
19. *Physics and Applications of Resonant Tunneling in Semiconductors*, Advanced Science Institute on Heterostructures, Quantum Wells and Superlattices, August 17-28, 1987, Banff, Alberta, Canada
20. *Physics of Resonant Tunneling in Semiconductor Heterostructures*, November 17, 1987, National Research Council, Ottawa, Canada
21. *Stark Effects in Superlattices under Electric Fields*, Applied Physics Seminar, Columbia University, New York, April 20, 1988
22. *Quantum Wells and Superlattices in an Electric Field*, Philips Research Lab., Briarcliff Manor, June 16, 1988

23. *Physics of Resonant Tunneling*, International Meeting on Low-dimensional Physics, Trieste,September, 1988
24. *Stark Localization and Optical Properties of Superlattices under Electric Fields*" Topical Meeting Quantum Wells for Optics and Optoelectronics, Optical Society of America, Salt Lake City, Utah, March 6, 1989
25. *Device Physics of Resonant Tunneling*, American Physical Society Meeting, St. Louis, March 21, 1989
26. *Quantum Coherence in Superlattices under Electric Fields*, Quantum Electronics Laser Science Conference, Baltimore, April 28, 1989
27. *Mesoscopic Physics and ULSI Devices*, Internat. Meeting on ULSI, Rome, June 23, 1989
28. *Quantum Devices: Dream or Reality?,* Summer School on Applications of Semiconductors, Santander, June 26, 1989
29. *Resonant Tunneling: Physics and Applications*, Summer School on Applications of Semiconductors, Santander, June 30, 1989
30. *Quantum Wells and Superlattices under Electric Fields: from Stark Shifts to the Stark Ladder*, IBM Zurich Research Lab., September 9, 1989
31. *Quantum Wells and Superlattices under Electric Fields: A Coherent Picture*, Harry Diamond Laboratories, Adelphi, Maryland, October, 26, 1989
32. *Resonant Tunneling in Quantum Wells and Superlattices: a Quest for Coherence*, Solid State Physics Seminar, Brown University, Providence, Rhode Island, November, 9, 1989
33. *Quantum Devices: Dream or Reality?,* Physics Colloquium, Brooklyn College, Brooklyn, New York, December, 4, 1989
34. *Coherence and Localization in Superlattices*, Sixth International Winterschool on New Developments in Solid State Physics, Mauterndorf, Austria, February, 19, 1990
35. *Coherence and Localization in Superlattices*, Electronic Materials Colloquium, Princeton University, April 23, 1990
36. *Magneto-Tunneling in Type II Heterostructures*, NATO Workshop on Resonant Tunneling: Physics and Applications, El Escorial, Spain, May 14, 1990
37. *Stark Ladders in Semiconductor Superlattices*, 20th Int. Conf. Phys. of Semicond., Thessaloniki, Greece, August 10, 1990
38. *Condensation of Excitons in Coupled Quantum Wells*, NATO Forum'90, Biarritz, France, September 18, 1990
39. *Semiconductor Quantum Wells under Electric Fields: From the Stark Effect to the Bloch Oscillator*, Physics Colloquium, Ohio University, Athens, Ohio, October, 19,1990
40. *Stark Localization in Semiconductor Superlattices*, 5th Brazilian School on Semiconductor Physics, Aguas de Lindoia, Sao Paulo, February 7, 1991
41. *Quantum Wells and Superlattices under Electric Fields: Physics and Applications*, Colloquium, Ontario Laser and Lightwave Research Center, University of Toronto, Toronto, Canada April 2, 1991
42. *Spectroscopy of Magnetic Levels in Semiconductors Using the Resonant Tunneling Effect*, Colloquium, Universidad Autónoma de Madrid, Spain, May 16, 1991
43. *Interband Magneto-Tunneling in Polytype Type II Heterostructures*, 5th International Conference on Modulated Semiconductor Structures, Nara, Japan, July 8, 1991
44. *Physics and Applications of Interband Resonant Tunneling*, Satellite Meeting on Physics of Novel Low-Dimensional Semiconductor Quantum Structures, Kyoto, Japan, July 12, 1991
45. *Semiconductor Quantum Wells and Superlattices under Electric and Magnetic Fields*, Physics Department Colloquium, Worcester Polytechnic Institute, November 11, 1991

46. *Resonant Tunneling in Polytype Heterostructures*, APS March Meeting, Indianapolis, March 20, 1992
47. *Semiconductor Quantum Wells and Superlattices: Simple Quantum Mechanics for Fun and Profit*, Physics Colloquium, Columbia University, April 10, 1992
48. *Excitonic Polarization Effects in Coupled Quantum Wells under an Electric Field*, III International Workshop on Non Linear Optics and Excitation Kinetics in Semiconductors, Bad Honnef, Germany, May 20, 1992
49. *Tunneling in Crossed-Gap Systems*, International Conference on Narrow Gap Semiconductors, Southampton, England, July 19-23, 1992
50. *Novel Electro-Optical Device Structures Based on Quantum Wells*, NATO Advanced Study Institute, Yountville, California, July 27-31, 1992
51. *Resonant Tunneling Spectroscopy in Semiconductor Heterostructures*, Physics Colloquium, Indiana University, Bloomington, Indiana, January 20, 1993
52. *Resonant Tunneling Spectroscopy in Semiconductor Heterostructures*, Solid State Electronics Colloquium, Duke University, Durham, North Carolina, January 25, 1993
53. *Wannier-Stark Ladder and Bloch Oscillations in Semiconductor Superlattices*, Stevens Institute of Technology, New Jersey, February 3, 1993
54. *The Stark Ladder and the Bloch Oscillator in Semiconductor Superlattices*, Symposium on Quantum Wells, Superlattices, and Heterostructures, Franklin Institute, Philadelphia, May 5, 1993
55. *The Stark Ladder and the Bloch Oscillator in Semiconductor Superlattices*, Solid-State Physics Colloquium, State University of New York, Stony Brook, May 14, 1993
56. *Resonant Magnetotunneling: The Two-Dimensional World Seen from Above*, Physics Colloquium, Materials Science Institutes of Spanish Research Council, Barcelona (June 17) and Madrid (June 18), Spain
57. *Introduction to Wannier-Stark Ladders*, Army Research Office Workshop on Bloch Oscillations, Raleigh, NC, September 13, 1993
58. *Semiconductor Quantum Wells and Superlattices under Electric Fields: From the Stark Effect to the Bloch Oscillator*, Physics Colloquium, State University of New York, Stony Brook, September 14, 1993
59. *The Bloch Oscillator: Possibility or Chimera?* Biannual Meeting of the Spanish Physical Society, Jaca, Spain, September 27, 1993
60. *Stark Ladder and Bloch Oscillator in Semiconductor Superlattices*, 30th Anniversary Symposium of Solid State Communications, Oxford, UK, September 29, 1993
61. *Quantum Wells and Superlattices under Electric Fields: From the Stark Effect to the Bloch Oscillator*, University of Minnesota, Electrical Engineering Colloquium, March 3, 1994
62. *Experiments on the Band-structure of Quantum Wells*" Symposium honoring Manuel Cardona on his 60th Birthday, Barcelona, Mayo 26, 1994
63. *Quantum Engineering of Semiconductors*, Universidad Complutense Summer School on Superlattices, El Escorial, Julio 12, 1994
64. *Electrical Conduction through Quantum Wells and Barriers,* Universidad Complutense Summer School on Superlattices, El Escorial, Julio 13, 1994
65. *Magnetotunneling Spectroscopy: A New Probe of Two-Dimensional Gases in Semiconductor Heterostructures*, 22nd Int. Conf. Physics of Semiconductors, Vancouver, Canada, August 15-19, 1994
66. *Two-Dimensional Gases in Type II Heterostructures Probed by Magneto-Tunneling Spectroscopy*, Advanced Workshop on Free Electrons in Nanostructures, Ginosar, Israel, October 2-5, 1994

67. *Magnetotunneling Spectroscopy: A Contactless Probe of Two-Dimensional Gases*, Army Research Laboratory, Fort Monmouth, New Jersey. December 12, 1994
68. *From Discovery to Commercialization, A Predictable Path?*, (in Spanish) Scientific Inauguration of Materials Research Institute of Madrid, May 20, 1996
69. *From Bloch Oscillations to Tamm States: Semiconductor Superlattices as Probes of Fundamental Physics*, International Workshop on Atoms and Electrons in Periodic andQuasi-periodic Potentials, Les Houches, Jan. 27-31, 1997
70. *Applications of Semiconductor Quantum Wells and Superlattices in Optoelectronics*, International Summer School on New Materials for Micro- and Opto-electronics. El Escorial, Spain, August 25-29, 1997
71. *Semiconductor Quantum Wells for Optoelectronic Applications*, Scientific Inaugurating Symposium of Instituto de Ciencias de Materiales de Sevilla, January 14, 1998
72. *InAs-GaSb Heterostructures: A Hidden Gold Mine for Semiconductor Physics and Applications*, Universidad Autonoma de Madrid, June 25, 1998
73. *Optoelectronic Applications of Quantum Wells and Applications*, Instituto de Ciencias de Materiales de Madrid (July 15), Zaragoza (July 16), and Barcelona (July 17), 1998
74. *The Role of Physics in Microelectronics Innovation: Past, Present, and Future*, International Symposium on Physics and Innovation, Fundación Areces, Madrid, April 21, 1999
75. *The Role of Physics in Microelectronics Innovation: Past, Present, and Future*, Departamento de Fisica de Materiales, Facultad de Quimica, Universidad del País Vasco, San Sebastián, Mayo 27, 1999
76. *Semiconductor Microcavities: From Applications to Physics,* Instituto Nicolas Cabrera, Universidad Autonoma de Madrid, Junio 29, 2000
77. *Materials Physics: Between Science and Technology*, Int. Conf. of New Milenium, Madrid, November 16, 2000
78. *Optical and Electronic Properties of Nano-scale Semiconductor Heterostructures*, Workshop on Nanoscience and Technology, Brookhaven National Lab., Dec. 20, 2000
79. The Uniqueness of the InAs-GaSb Heterojunction, and its Practical Consequences*, University of Tokyo, Jan. 16, 2001*
80. *Electric-Field Control of the Optical Properties of Semiconductor Heterostructures: Physics and Applications* Fujitsu Award Lecture, Fujitsu Quantum Devices Ltd., Jan. 17, 2001
81. *The Uniqueness of the InAs-GaSb Heterojunction, and its Practical Consequences*, NTT Basic ResearchLabs, Atsugi, Jan. 18, 2001
82. *The Uniqueness of the InAs-GaSb Heterojunction, and its Practical Consequences*, Lincoln Labs, MIT, Jan. 25, 2001
83. *The Uniqueness of the InAs-GaSb Heterojunction, and its Practical Consequences*, Purdue University, March 23, 2001
84. *Recent Results in Narrow-Gap Resonant Tunneling Diodes*, Internat. Conf. on Narrow Gap Semiconductors, Kanazawa, Japan, May 26-31, 2001
85. *Type II Materials and Characterization*, Quantum Cascade Laser Workshop, Arlington, VA, October 9, 2001
86. *Nanoscience Based on Semiconductor Heterostructures* Nanoscale Science Workshop, Brookhaven National Laboratory, March 8, 2002
87. *Band Engineering with Semiconductor Heterostructures for Physics and Applications*, Materials Science Colloquium, Brookhaven National Laboratory, April 4, 2002
88. *Shot Noise in Negative Differential Conductance Devices,* NATO Workshop on Quantum Noise in Mesoscopic Systems, Delft, June 4, 2002

89. *The Semiconductor Heterostructure, Cornerstone of Solid State Physics and Applications*, Instituto de Ciencia de Materiales de Madrid, June 6, 2002
90. *Electro-optic Effects in Semiconductor Superlattices*, Physics Colloquium, Queens College, March 19, 2003
91. *Quantum Heterostructures: A Survey*, Physics Colloquium, NTT Basic Research Laboratories, Morinosato, Japan, July 30, 2003
92. *Physics and Applications of Quantum Heterostructures*, Materials Sciences Seminar, Tokyo Institute of Technology, Tokyo, Japan, August 6, 2003
93. *Resonant Tunneling: an Old Friend that Keeps Surprising Us*, Solid State Electronics Seminar, Northwestern University, Evanston, Ill, December 5, 2003
94. *Electronic Transport in Quantum Cascade Structures*, Int. Workshop on Quantum Cascade Lasers, Seville, 4-8, 2004
95. *Of Wells and Barriers: the Fascinating World of Semiconductor Superlattices*, Electric Engineering Seminar, Northwestern University, Evanston, Ill, March 5, 2004
96. *Electronic Noise in Quantum Heterostructures*, Internat. Meeting on the Advancing Frontiers on Optical and Quantum Effects in Condensed Matter, Trieste, May 12-15, 2004
97. *Electronic Noise in Quantum Heterostructures*, Colloquium, Paul Drude Institut für Festkörperelektronik, Berlin, August 6, 2004
98. *Nanoscience Opportunities in Information Technology*, Workshop on Nanoscience and Nanotechnology, Madrid, Nov. 18, 2004
99. *The Electronics of the Future*, University of Oviedo, Gijón, May 13, 2005
100. *One Hundred Years of Physics of Fluctuations in Nanoscience*, Int. Symposium on Nanoscience, Universidad Complutense, Madrid, December 14, 2005
101. *One Hundred Years of Physics of Fluctuations in Nanoscience*, Physics Colloquium, Vanderbilt University, March 30, 2006
102. *When Noise is the Signal in Nanoscience*, Materials Science Seminar, Brookhaven National Laboratory, May 31, 2006
103. *Nanotechnology: The Industrial Revolution of the XXI Century*, Bankinter Foundation, Madrid, May 11 and Barcelona, June 15, 2006.
104. *Nanotechnology: Opportunities for the Madrid Region*, Annual Meeting of Spain's Scientific Parks, Madrid, October 25, 2006
105. *Nanotechnology: Implications for the Spanish Industry*, Annual Meeting of Instituto de Empresa Alumni, Madrid, November 24, 2006
106. *Advances in Nanoscience,* New Academic Year Keynote Lecture, University of Zaragoza, Spain, Oct. 17, 2007
107. *Electronic Noise in Nanostructures,* E. Mendez (Plenary) 5th Int. Conf. on Trends in Nanotechnology, Oviedo, Spain, Sept. 1-5, 2008
108. *The Promise of Nanoscience: Great Expectations from the Ultra-small World*, Farmingdale State University, April 21, 2009
109. *Nanotechnology and the Energy Challenge*, Atom by Atom Conference, San Sebastián, Spain, Sept. 29, 2009
110. *Richard Feynman and the Birth o Nanotechnology,* Feynman Symposium, Dec. 2, 2009, Universidad Autónoma, Madrid, Spain
111. *Nanotechnology and the Energy Challenge*, The Worlds of Physics, Stony Brook U., March 19, 2010
112. *Nanotechnology: State of the Art, Challenges, and Innovation*, Plenary Lecture, Nanofutures Event, June 15, 2010, Gijón, Spain
113. *Nanotechnology and the Energy Challenge*, Comisión Nacional de Energía, Nov. 27, 2010, Madrid, Spain

114. *Nanotechnology and the Energy Challenge*, IMAGINENANO International Conferencia on Nanotechnology, April 11, 2011, Bilbao, Spain
115. *Nanotechology and the Energy Challenge*, California Nanosystems Institute Colloquium, UCLA, November 15, 2011, Los Angeles, California
116. *Nanotechology and the Energy Challenge*, Physics Colloquium, Stony Brook University, January 24, 2012, Stony Brook, New York
117. *Can Technology Stop Climate Change?* Yes Future Alhondiga Lecture Series, March 1, 2012, Bilbao, Spain
118. *Nanotechology and the Energy Challenge*, Engineering Colloquium, U. Bridgeport, March 29, 2012, Bridgeport, Connecticut
119. *Nanotechology and the Energy Challenge*, Colloquium, Orange County Community College, September 18, 2012, Middletown, New York
120. *Energy Research at the Center for Functional Nanomaterials*, Advanced Energy Conference, April 30, 2013, New York City
121. *DOE's Nanoscale Science Research Centers: an Overview*, NSF Workshop on The Future of NNIN, August 18, 2014, Arlington, VA
122. *Center for Functional Nanomaterials: Nanoscience at Brookhaven National Laboratory*, Yale – BNL Workshop, October 29, 2014, New Haven, CT
123. *Is Energy Efficiency the Short-term Answer to Climate Change?* Physics Open Night Lecture at Stony Brook University, November 21, 2014, Stony Brook, NY
124. *The Center for Functional Nanomaterials at BNL: Unique Capabilities for Nanomaterials by Design and In Operando*, American Chemical Society Meeting, March 24, 2015, Denver, CO
125. *The Center for Functional Nanomaterials at BNL: A Novel Approach to Collaborative Nanoscience*, US-Spain Bilateral Nanomaterials Workshop, Harvard University, May 1, 2015, Cambridge, MA
126. *Nanotechnology and the Energy Challenge*, ECUSA Colloquium, May 21, 2015, New York
127. *The New World of the Ultrasmall: Nanotechnology and its Applications*, Fundación ITMA, October 1, 2015, Avilés, Spain
128. *Confinement and Tunneling, Pillars of Nanoscience*, The 100th Eli Burstein Lecture in Materials Science, February 14, 2017, U. Pennsylvania, Philadelphia
129. *Pursuing a Scientific Career at a National Laboratory*, MIT, August 15, 2022
130. *Pursuing a Scientific Career at a National Laboratory*, Harvard, August 16, 2022
131. *Pursuing a Scientific Career at a National Laboratory*, Columbia U, October 6, 2022
132. *Pursuing a Scientific Career at a National Laboratory*, U. Pennsylvania, October 11, 2022
133. *Nanociencia y Mundo Cuántico*, Real Academia Española de Ciencias, March 13, 2024.

APPENDIX 6

Contributed and Invited Conference Presentations, 1998 –

1. *Enhancement of Shot Noise in Resonant-Tunneling Structures in a Magnetic Field*, V. V. Kuznetsov, E. E. Mendez, J. D. Bruno, and J. T. Pham, APS March Meeting, Los Angeles, March 16-20, 1998
2. *Optical Gain of Type I and Type II Quantum Cascade Lasers*, J. L. Jimenez and E. E. Mendez, APS March Meeting, Los Angeles, March 16-20, 1998
3. *Temperature Dependence of Luminescence from Semiconductor Microcavities*, J. K. Son, I. W. Tao, C. Pecharroman, E. E. Mendez, and R. Ruf, APS March Meeting, Los Angeles, March 16-20, 1998
4. *Dynamics of Polaritons and Stimulated Emission in GaAs Microcavities*, M. D. Martin, G. Aichmayr, L. Viña, J. K. Son, and E. E. Mendez, 24 Internat. Conf. on the Physics of Semiconductors, Jerusalem, Aug. 2-7, 1998
5. *Multiple-Step Magnetotunneling and Noise Enhancement in type II Heterostructures*, E. E. Mendez, V. V. Kuznetsov, D. Chokin, and J. D. Bruno, 13th Int. Conf. on High Magnetic Fields in Semiconductor Physics, Nijmegen, Aug. 10-14, 1998
6. *Electric- Field Tuning of Spin-Dependent Exciton Interaction in Coupled Quantum Wells*, G. Aichmayr, M. Jetter, L. Viña, J. Fernandez-Rossier, C. Tejedor, J. Dickerson, F. Camino, and E. E. Mendez, APS March Meeting, Atlanta, March 21-25, 1999
7. *Spin Dynamics in Semiconductor Microcavities*, M. D. Martin, L. Viña, J. K. Son, R. Ruf, and E. E. Mendez, APS March Meeting, Atlanta, March 21-25, 1999
8. *Double Resonant Tunneling in Type II Heterostructures*, E. E. Mendez, V. V. Kuznetsov, D. Chokin, and J. D. Bruno, APS March Meeting, Atlanta, March 21-25, 1999
9. *Anomalous Resonant-tunneling Effect in Type II Heterostructures*, E. E. Mendez, V. V. Kuznetsov, D. Chokin, and J. D. Bruno, 13th Int. Conf. on Electron. Properties of Two-dimensional Systems, Ottawa, Aug. 1-5, 1999
10. *Polaritonic Coupling and Spin Dynamics in GaAs Microcavities*, M. D. Martin, L. Viña, J. K. Son, R. Ruf, and E. E. Mendez, 13th Int. Conf. on Electron. Properties of Two-dimensional Systems, Ottawa, Aug. 1-5, 1999
11. *Magnetotunneling Between Two InAs Quantum Wells*, A. Sacedon, E. M. Gonzalez, Y. Lin, and E. E. Mendez, American Physical Society Annual Meeting, Minneapolis, March 20-24, 2000
12. *Observation of Suppressed Shot Noise in Hopping Conduction*, V. V. Kuznetsov and E. E. Mendez, American Physical Society Annual Meeting, Minneapolis, March 20-24, 2000
13. *A New Optical Probe of Semiconductor Microcavities*, S. Manotas, F. Agullo-Rueda, J. Dickerson, and E. E. Mendez, American Physical Society Annual Meeting, Minneapolis, March 20-24, 2000
14. *Polariton of Magnetopolaritons in a Semiconductor Microcavity*, M. D. Martin, S. Burgas, M. Alonso, L. Viña, F. J. Teran, M. Potemski, and E. E. Mendez, 25th Int. Conf. on the Physics of Semiconductors, Osaka, September 17-22, 2000
15. *Spin Dependent Exciton-exciton Interaction in Hot and Cold 2D Exciton Gases Controlled by an Electric Field*, G. Aichmayr, L. Viña, S. P. Kennedy, R. T. Phillips, and E. E. Mendez, 25th Int. Conf. on the Physics of Semiconductors, Osaka, September 17-22, 2000

16. *Tunneling Between Two Dimensional Electron and Hole Gases*, Y. P. Lin, E. M. Gonzalez, and E. E. Mendez, American Physical Society Annual Meeting, Seattle, March 12-16, 2001
17. *Enhanced Rabi Splitting in a Superlattice-embedded Microcavity*, J. Dickerson, E. E. Mendez, S. Manotas, F. Agullo-Rueda, and A. A. Allerman, American Physical Society Annual Meeting, Seattle, March 12-16, 2001
18. *Recent Results in Narrow-Gap Resonant Tunneling Diodes*, International Conf. on Narrow Gap Semiconductors, (Invited) E. E. Mendez,Y. Lin, and E. Gonzalez, Kanazawa, Japan, May 26-31, 2001
19. *Enhanced Rabi Splitting in a Microcavity-Superlattice Sytem*, J. Dickerson, E. E. Mendez, S. Manotas, F. Agullo-Rueda, and A. A. Allerman, Int. Conf. Modulated Semicond. Structures, Linz, Austria, July 23-27, 2001
20. *Type II Materials and Characterization*, (Invited) E. E. Mendez, Quantum Cascade Laser Workshop, Arlington, VA, October 9-10, 2001
21. *Nanoscience Based on Semiconductor Heterostructures,* (Invited) E. E. Mendez,Nanoscale Science Workshop, Brookhaven National Laboratory, March 8-9, 2002
22. *Shot Noise in Semiconductor Heterostructure Systems Exhibiting Negative Differential Resistance*, W. Song, V. V. Kuznetsov, and E. E. Mendez, American Physical Society Annual Meeting, Indianapolis, March 18-22, 2002
23. *Tunneling Between 2D Electrons and Holes in an In-plane Magnetic Field*, Y.Lin, E. E. Mendez, R. Magno, and B. R. Bennett, American Physical Society Annual Meeting, Indianapolis, March 18-22, 2002
24. *Shot Noise in Negative Differential Conductance Devices*, (Invited) E. E. Mendez, NATO Workshop on Quantum Noise in Mesoscopic Systems, Delft, June 2-4, 2002
25. *Electric-field Tuning of the Rabi Splitting in a Superlattice-Microcavity System*, (Oral) J. H. Dickerson, J. K. Son, A. K. M. Newaz, E. E. Mendez, and A. A. Allerman, Int. Conf. Phys. of Semicond. Edinburgh, July 2002
26. *Magnetotunneling at Even-denominator Fractional Occupation in InAs-GaSb Tri-layer Systems***,** (Oral) E. E. Mendez, Y. Lin, R. Magno and B. R. Bennett, Int. Conf. Semiconduct. at High Magnetic Fields, Oxford, U. K., Aug. 5-9, 2002
27. *Shot Noise in Negative-Differential-Conductance Devices*, W. Song, A. K. Newaz, E. E. Mendez, B. Nielsen, 11th Int. Conf. Modulated Semiconductor Structures, Nara, Japan, July 14-18, 2003
28. *Electronic Transport in Quantum Cascade Structures*, (Invited) E. E. Mendez, International Workshop on Quantum Cascade Lasers, Seville, January 4-8, 2004
29. *Electronic Noise in Quantum Heterostructures,* (Invited) E. E. Mendez, Advancing Frontiers on Optical and Quantum Effects in Condensed Matter, Trieste, May 12-15, 2004
30. *Unusual Tunneling Characteristics of Double-quantum-well Heterostructures*, Y. Lin, J. Nitta, A. K. M. Newaz, W. Song, and E. E. Mendez, 27th Int. Conf. Physics of Semiconductors, Flagstaff, AZ, July 26-30, 2004

31. *Anomalous Tunneling Characteristics of Triple-barrier InAlAs/InGaAs Heterostructures*, Y. Lin, J. Nitta, A. K. Newaz, W. Song, and E. E. Mendez, APS March Meeting, Los Angeles, March 21-25, 2005
32. *Noise Characteristic of Triple-Barrier Resonant Tunneling Diodes*, A. K. W. Newaz, W. Song, E. E. Mendez, Y. Lin, and J. Nitta, APS March Meeting, Los Angeles, March 21-25, 2005
33. *Drastic Reduction of Shot Noise in Semiconductor Superlattices*, W. Song, A. K. M. Newaz, J. Son, and E. E. Mendez, APS March Meeting, Los Angeles, March 21-25, 2005
34. *Shot-noise Characteristics of Double-well Resonant Tunneling Diodes*, A. K. M. Newaz, W. Song, E. E. Mendez, B. Nielsen, Y. Lin, J. Nitta, H. Kostial, and H. T. Grahn, (Poster) 12th Int. Conf. Modulated Semiconductor Structures, Albuquerque, NM, July 11-15, 2005
35. *Drastic Reduction of Shot Noise in Superlattice-based p-i-n Photodiodes*, W. Song, A. K. M. Newaz, J. Son, and E. E. Mendez (Oral), 12th Int. Conf. Modulated Semiconductor Structures, Albuquerque, NM, July 11-15, 2005
36. *Shot Noise Experiments in Multi-barrier Semiconductor Heterostructures*, E. E. Mendez, W. Song, A. K. M. Newaz, Y. Lin, and J. Nitta, (Oral) 18th Int. Conf. on Noise and Fluctuations, Salamanca, Spain, 19-23, 2005
37. *Shot Noise in Coherently Coupled GaAs-AlGaAs Double-Well Resonant Tunneling Diodes*, A. K. M. Newaz, W. Song, B. Nielsen, E. E. Mendez, R. Hey, H. Kostial, and H. T. Grahn, APS March Meeting, Baltimore, March 13 – 17, 2006
38. *Magnetotunneling Spectroscopy of InGaAs Double-well Structures*, Y. Lin, A. K. M. Newaz, E. E. Mendez, and J. Nitta, APS March Meeting, Baltimore, March 13 – 17, 2006
39. *Can Shot-noise Measurements Distinguish Between Coherent and Sequential Tunneling?*, E. E. Mendez, A.K.M. Newaz, W. Song, B. Nielsen, R. Hey, H. Kostial, and H. T. Grahn, 28th Int. Conf. Physics of Semiconductors, Vienna, Austria, July 24-28, 2006
40. *Hydrostatic Pressure Study of GaN FETs*, Y. Zhang, B. Nielsen, E. E. Mendez, and J. Jimenez, APS March Meeting, Denver, March 5 – 9, 2007
41. *Electronic Noise in Nanostructures,* E. Mendez (Plenary) 5th Int. Conf. on Trends in Nanotechnology, Oviedo, Spain, Sept. 1-5, 2008

APPENDIX 7

Selected Education and Training Activities

Major Courses Taught

1. Graduate Seminar on Atomic and Solid State Physics, Spring 1996 and Fall 1999
2. *Introductory Physics for Biologists*, Fall 1996
3. *Graduate Optics Rotation*, Fall 1996 to Spring 2000
4. Honors *Introductory Physics* for Science and Engineering, Spring 1997 to Spring 1999
5. *Solid State Physics*, Fall 1999 to Spring 2002
6. *Modern Physics*, Fall 2002 to Spring 2004
7. *Connections in Science*, Fall 2004 and Fall 2006
8. Physics Today/Opportunities in Physics, Spring 2005
9. *Connections in Science: Energy and Climate*, Fall 2010, Fall 2012, Fall 2014, Fall 2017
10. *Mechanics for Scientists and Engineers*, Fall 2020, 2021, 2022 and 2023
11. *Electromagnetism for Scientists and Engineers*, Spring 2021, 2022, 2023 and 2024
12. *Honors Mechanics for Science and Engineering,* Fall 2024 and 2025
13. *Honors Electromagnetism for Scientists and Engineers,* Spring 2025

Ph. D. Theses Directed

1. *Resonant Tunneling in GaSb-AlSb Double-barrier Structures,* J. Jiménez, Columbia U., 1996
2. *Optical Properties of Semiconductor Microcavities*, J. K. Son, Stony Brook, 1999
3. *Magnetotunneling in Electron-hole Systems*, Y. Lin, Stony Brook, 2002
4. *Rabi Splitting Enhancement in Semiconductor Microcavities*, J. Dickerson, Stony Brook, 2002
5. *Investigation of Electronic Noise in Mesoscopic Devices*, F. Camino, Stony Brook, 2003
6. *Shot Noise in Negative-Differential Conductance Devices*, W. Song, Stony Brook, 2004
7. *Quantum Transport in Multiple-barrier Resonant-Tunneling Devices*, A. K. M. Newaz, Stony Brook, 2006
8. *Electronic Properties of Semiconductor Nanostructures*, Y. Zhang, Stony Brook, 2011
9. *Optoelectronic Properties of Carbon Nanotubes*, M. Kinoshita, 2011

Postdoctoral Fellows Trained

1. Luis Viña, 1985-86, now Professor at Universidad Autonoma de Madrid, Spain
2. Enrique Calleja, 1986-87, now Professor at Univesidad Politecnica de Madrid, Spain
3. Fernando Agulló, 1988-89, now Researcher, Materials Science Institute, CSIC,Madrid, Spain
4. Antigoni Alexandrou, 1990-91, now Researcher, CNRS, Paris, France
5. Hideo Ohno, 1990-91, now President, Tohoku University, Japan
6. Ling Y. Liu, 1991-92
7. Trund Westgaard, 1992-93
8. Matsuto Ogawa, 1993-94, now Professor, Kobe University, Japan
9. Carlos Pecharromán, 1996-97, now Researcher, Materials Science Institute, CSIC, Madrid
10. Ana Sacedón, 1997-98, now Researcher, Spanish Atomic Energy Commission
11. Vladimir Kuznetsov, 1998-2000, now Engineer, Arbitron, Columbia, MD
12. Elvira González, 2001-02, now Associate Professor, Universidad Complutense, Madrid

APPENDIX 8

Grant History

Title	Agency	Period	Amount
Center for Functional Nanomaterials (block grant)	DOE	2008 to 2016	$160M
Electronic Noise In Nanostructures	NSF	6/1/07 to 12/31/12	$345K
Electronic Noise In Mesoscopic Structures	NSF	7/1/03 to 6/30/07	$327K
Electronic Transport In Carbon Nanotubes	USB/BNL	7/1/05 to 9/30/06	$20K
Multi-layer Electron-Hole Type II Hetero-structures	CRDF	10/1/00 to 3/31/02	8.3K
Materials Preparation Facility for Semiconductor *Microstructures*	ARO	3/31/00 to 03/30/02	162K
Intersubband Light Emission In Type II Heterostructures	ARO	7/1/99 to 6/30/03	240K
Hybrid Semiconductor- Superconductor *Heterostructures*	NSF	7/15/98 to 6/30/03	270K
Sub-electron Charge Transfer and Shote Noise in Nanostructures (with K. Likharev)	DOE	10/1/98 to 9/30/01	525K
Synchroton-based Magnetotransport and Infrared Resonance Facility (with L. Mihaly)	NSF	8/15/98 to 7/31/00	111K

Semiconductor Quantum Microcavities	US-Spain Exchange Commission	6/1/98 to 5/31/00	17K
Control of Light-Matter Interaction in Semiconductor Microcavities	ARO (ASSERT)	6/1/96 to 5/31/01	90K
Sub-electron Transfer of Electric Charge in Semiconductor Nanostructures (with K. Likharev)	DOE	10/1/95 to 9/30/98	580K
Novel Electric-Field Effects in Quantum Wells, Superlattices, and Microcavities	ARO	8/7/95 to 11/7/99	240K

APPENDIX 9

Selected Professional Activities

1. Co-Director (with K. von Klitzing) of NATO Advanced Study Institute on *Physics and Applications of Quantum Wells and Superlattices*, Erice, Italy, April 21 to May 1, 1987
2. Member, Program Committee, 4th Int. Conf. on Modulated Semiconductor Structures, Ann Arbor, MI, July 17 – 21, 1989
3. Co-Director (with L. L. Chang and C. Tejedor) of NATO Advanced Research Workshop on *Resonant Tunneling in Semiconductors: Physics and Applications*, El Escorial, Spain, May 14 – 18, 1990
4. Editor, Solid State Communications, 1992 to 2002
5. Member, Board of Directors, Semiconductor Science and Technology, 1993 to 1995
6. Chairman, Program Committee, 10th Int. Conf. on Electronic Properties of Two-dimensional Systems, Newport, RI, May 21 – June 4, 1993
7. Chairman, International Visiting Committee, Materials Science Centers of the Spanish Research Council, 1993 to 1999
8. Chairman, Review Committee of Princeton Materials Research Centers, Fall 1996
9. Member, US – Spain Council, 2000 to present
10. Member, Program Committee, 11th Int. Conf. Narrow Gap Semiconductors, Buffalo, NY, June, 2003
11. Member, Search Committee, Nanoscience Center Director, Brookhaven National Laboratory, 2003
12. Member, ARO Workshop on Infrared Physics and Applications, U. Michigan, September 28-29, 2003
13. Member, NSF CAREER Evaluation Panel, Arlington, VA, October 15, 2003
14. Member, Search Committee, Associate Director, Basic Energy Sciences, Brookhaven National Laboratory, Spring 2004
15. Member, Advisory Committee, 13th Int. Conf. Superlattices, Nanostructures, and Nanodevices, Cancun, July, 2004
16. Member, Columbia's NSF's MRSEC Visiting Committee, December 2005
17. Member, Advisory Committee, 14th Int. Conf. Superlattices, Nanostructures, and Nanodevices, Istanbul, July 30 – Aug. 4, 2006
18. Member, Visiting Committee, Instituto de Sistemas Optoelectrónicos and Microtecnología, Politechnic University of Madrid, July, 2006
19. Member, Evaluation Committee, CONSOLIDER Program, 2006-2007
20. Member, Scientific Advisory Committee, NANOGUNE, San Sebastian, 2007 to present
21. Member, Committee of Visitors, Division of Materials Research, National Science Foundation, February 6-8, 2008.
22. Member, Scientific Advisory Committee, International Iberian Nanotechnology Laboratory, Braga, Portugal, 2008 to 2013
23. Member, Scientific Advisory Committee and Board of Trustees, IMDEA Nano, Madrid, 2008 to 2014
24. Member, Scientific Commission in charge of drafting Spain's Law of Science, 2008-09

25. Member, Program Committee, 14th Int. Conf. Modulated Semiconductor Structures, Kobe, Japan, July 19-24, 2009.
26. President, Evaluation Committee, CSIC Strategic Plan for Materials Research, January 2009
27. President, Selection Committee, Catedra BBVA, Escuela Técnica Superior Ingenieros Telecomunicación, October, 2010
28. Member, Evaluation Committee, Severo Ochoa Centers of Excellence Program, Spain's Ministry of Science, Technology, and Innovation, 2011
29. Member, Board of Trustees, Bankinter Innovation Foundation, 2010 to present (Member of Executive Committee since 2012)
30. Member, Continuing Review Panel, European Graphene Flagship Program, 2013 to 2024
31. Member, Visiting Committee, Materials Science and Engineering Dpt., MIT, 2010-2017
32. Member, Selection Committee, Blavatnik National Awards, 2014 to 2024
33. President, Science Advisory Committee, Materials and Nanoscience Institute of Aragón, 2017 – 2022
34. Co-chair, Selection Committee, Raymond Davis Jr. Fellowship, BNL, 2024- present

APPENDIX 10

Selected University Service

Departmental

1. Member, Physics Colloquium Committee, September 1996 to May 1997
2. Member, Introductory Physics Curriculum Committee, September 1996 to May 1997
3. Member, Undergraduate Physics Curriculum Committee, September 1997 to May 2001
4. Member, Long-range Planning Committee, Fall 1998
5. Chairman, Physics Minor Committee, Spring 1999
6. Chairman, Prof. Orozco's Promotion Committee, Fall 1999
7. Member, Peter Kahn's Fellowship Committee, Spring 2001
8. Chair, Research Facilities Committee, September 2001 – May 2002
9. Member, Undergraduate Committee, September 2002 – May 2003
10. Chair, committee to review curriculum of lower-division physics courses, Fall 2002
11. Coordinator, The Worlds of Physics Lecture Series, Sept. 2002-May 2003
12. Chair, Adjunct Professor Appointments Committee, Nov.-Dec. 2003
13. Undergraduate Program Director, August 2004 to November 2006
14. Chair, Committee for the Future of the Nuclear Structure Laboratory, March 2006 to November 2006
15. Member, Committee for Steve Dierker's Appointment, 2006
16. Member, Committee on Joint-Appointment in Accelerator Physics, 2010
17. Member, Awards Committee, 2021 – present
18. Member, Giacinto Piacquadio's Full Professor Promotion Committee, 2023
19. Chair, Jan Bernauer's Associate Professor Promotion Committee, 2023
20. Member, Undergraduate Curriculum Committee, 2024 to present

University – wide

1. Member, Turner Fellowship Committee, September 1997 to May 2000
2. Member, Fulbright Fellowship Selection Committee, September 1997 to May 2003
3. Member, Advisory Committee of the Summer Session Program, September 1998 to May 2001
4. Member, International Programs Advisory Committee, September 1999 to May 2001
5. Member, Diversity and Internationalization Task Force for Five-year Plan, September 1999 to May 2000
6. Chair, Search Committee for Associate Dean for Underrepresented Minorities, Sept. 2001
7. Member, Search Committee for Dean of School of Arts and Sciences, 2001
8. Member, Stony Brook-Brookhaven Nat. Lab. Grant Evaluation Committee, Spring 2001
9. Invited Participant, Student/Staff/Faculty Annual Retreat, Nov. 2 - 3, 2001.
10. Member, Faculty of Color Committee, Jan 2003
11. Member, Gelfond Scholarship Committee, March 2004 to 2007
12. Member, Evaluation Committee, Faculty Cluster Program, June 2012
13. Member, Evaluation Committee, SBU-BNL Seed Grant Program, 2024 and 2025

APPENDIX 11

Awards and Recognitions

External Recognitions

- Foreign Member, Royal Spanish Academy of Sciences (2023)
- Fujitsu Quantum Device Award (2000), for pioneering studies of the electro-optical properties of semiconductor quantum-well and superlattice devices
- 100th Eli Burstein Lecture in Materials Science, University of Pennsylvania (2017)
- Prince of Asturias Prize (1998), for seminal research on the properties of semiconductor heterostructures
- Comendador, Spain's Order of Civil Merit (1998)
- Fellow of the American Physical Society (1990), for pioneering contributions to the electronic properties of semiconductor heterostructures, notably the discovery of the Stark effects in quantum wells and superlattices
- IBM Outstanding Technical Achievement Award (1987), for work on tunneling and quantum Hall effect properties of two-dimensional holes

University Recognitions

- Faculty Award (2002 and 2004), given by graduating class to faculty with most positive impact
- Hispanic Heritage Award (1998), in recognition of outstanding leadership and dedication
- Honorary Member, Alpha Epsilon Delta Premedical Society (1998)
- Thank-a-Teacher Letter of Commendation (2023 and 2025)