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Education

Ph.D., Physics, Massachusetts Institute of Technology, 1977
S.B., Physics, Massachusetts Institute of Technology, 1972

Professional History

2024-present: Edwin Howard Armstrong Professor Emeritus of Applied Physics, Columbia University
2016-2023: Edwin Howard Armstrong Professor of Applied Physics, Columbia University
2017-2021: Member, Columbia University Senate
2018-2021: Chair, Department of Applied Physics and Applied Mathematics, Columbia University
1995-2016: Professor of Applied Physics, Columbia University
2015-2019: Director, Columbia University, NSF IGERT: The Columbia Optics and Quantum Electronics IGERT: Engineering Photons for a Sustainable Future
2006-2012: Chair, Department of Applied Physics and Applied Mathematics, Columbia University
1998-2010: Director, NSF Materials Research Science and Engineering Center at Columbia University
2001-2006: Vice Chair, Department of Applied Physics and Applied Mathematics, Columbia University
1998-2023: Co-chair, Committee on Materials Science and Engineering/Solid-State Science and Engineering, Columbia University
1986-1995: Associate Professor of Applied Physics, Columbia University
1993-1998: Chair, Committee on Solid-State Science and Engineering, Columbia University
1987-2023: Member of the Columbia Nano Initiative (CNI) [formerly called Columbia Integrated Science and Engineering Center (CISE) and Columbia Radiation Laboratory (CRL)]
1981-1986: Section Leader, Special Studies Group, Physics Department, LLNL
1977-1986: Professional Staff Member, University of California, Lawrence Livermore National Laboratory
1977: Postdoctoral Scientist, M.I.T., Physics Department
1972-1977: Fannie and John Hertz Predoctoral Research Fellow, M.I.T., Physics Dep't.

Professional Activities

2022-2025: Editorial Board, Materials Research Express

2019- : Board of Directors, Armstrong Memorial Research Foundation

2014-2019: Member, Columbia University MRSEC: PAS3

2012-2018: Associate Editor, Advanced Science, Engineering and Medicine, *American Scientific Publishers*

2012: Workshop at Brookhaven National Laboratory on "In Operando Studies of Materials for Energy Storage", March 12-13, 2012

2009: Co-organizer, Columbia University Symposium on Pure and Applied Science Honoring 40 Years of Contributions by Richard M. Osgood, Jr., Jan. 5, 2009, Columbia University

2009-2014: Member, DoE Energy Frontiers Research Center at Columbia

2008: International Program Committee Member for International Conference on Nanotechnology and Applications (NANA 2008), Sept. 29 - Oct. 01, 2008, Crete, Greece

2007-2012: Associate Editor, Advanced Science Letters, *American Scientific Publishers*.

2004-2005: Chair of the MRSEC Directors Group (April to April); Chair-Elect previous year

2004: Organized Fall 2004 MRS Meeting Session: "On its Tenth Anniversary: The Broader Impact of the NSF MRSEC Program: Moving Materials into the Future", Nov. 30, 2004

2003: Organizing committee for NSF Workshop on Intermediate-Sized Instrumentation Facilities

2002: Invited to and attended the Planning Workshop for the BNL Center for Functional Nanomaterials, Brookhaven National Laboratory, March 7-9, 2002

2002: Attended the NSF-EC Workshop on Nanomaterials and Nanotechnology, Dec. 5-7, 2002, Boston, MA

2001-2012: Member, NSF Nanoscale Science and Engineering Center at Columbia

2000: Co-chair, *Materials "By Design"* working group at the Columbia Nanotechnology Symposium

1997: Co-chair for the Chemistry and Physics of Small-Scale Structures topical conference sponsored by the Optical Society of America; cosponsored by AVS and MRS

1997: Program committee for Laser Chemistry, Materials Processing, and Industrial Applications for CLEO/Pacific Rim 1997 Conference

1997: Advisory committee for Gordon Conference on Chemistry of Electronic Materials

1995: Invited to and attended NRC Workshop on Modeling, Simulation, and Database Needs in Plasma Processing, April 1-2, 1995; Member of Subcommittee on Heterogeneous Processes

1995: Program committee for Laser Chemistry, Materials Processing, and Industrial Applications for CLEO/Pacific Rim 1995 Conference

1994: Program committee for Electronic Materials and Processes Division, and the Manufacturing Science and Technology Topical Conference for 1994 American Vacuum Society Meeting

1991: Organizer for Laser Probes and Processes on Surfaces sessions for 1991 Interdisciplinary Laser Science Conference
1991: Co-organizer for SPIE Process Module Metrology, Control and Clustering Meeting
1990: Organizing subcommittee for Lasers in Electronic and Optical Device Processing for CLEO 1991 meeting
1988: Organizing subcommittee for Lasers in Electronics Processing for CLEO 1989 meeting
1986: Co-organizer and Chairman, Symposium on Photon, Beam and Plasma Stimulated Chemical Processes on Surfaces, Materials Research Society National Meeting
1985-1989: Member of Advisory and Program Committee, International Laser Science Conference
1983-1988: Thesis Advisor, Ph.D. Candidates, Department of Applied Science, University of California at Davis, Livermore Campus
1983: Symposium Organizer and Chairman, International Conference on Lasers, Laser Isotope Separation Symposium

Special Grants, Awards and Appointments
2016: Appointed Edwin Howard Armstrong Professor of Applied Physics
2012: Gift from Honda Research Institute USA, Inc.
2010: The Seidman Family Series Lecturer. Department of Materials Engineering, Technion - Israel Institute of Technology, June 13-17, 2010
2001: Lady Davis Fellowship Visiting Professor, Hebrew University, Jerusalem, awarded for 2000-2001.
1999: Gift from Kulite Semiconductor Products, Inc.
1999: Visiting Scholar: Department of Materials Engineering, Technion - Israel Institute of Technology, Jan. 3-17, 1999
1998: Fellow, Optical Society of America
1997: Fellow, American Physical Society
1993: Awarded AT&T Foundation Special Purpose Grant
1992: Who's Who in Science and Engineering and Who's Who in the East
1977: National Research Council Postdoctoral Fellow (declined)
1972-1977: Fannie and John Hertz Predoctoral Fellow
1972: Phi Beta Kappa
1972: National Science Foundation Fellowship (declined)

Professional Memberships
American Physical Society (fellow),* Materials Research Society,*
Institute of Electrical and Electronics Engineers/Lasers and Electro-Optics Society,
Optical Society of America (now Optica) (fellow),* American Vacuum Society*
*active until 2024

Research Areas - Nanocrystals and complex films, Optical diagnostics of thin film processing including plasma etching, Optical physics of materials and the solid state-including single layers, Laser spectroscopy and its applications, Laser processing, Physics at high pressure

Publications - 170

Books – 6 (including one 2nd edition; 4: sole author; 2: editor)

Patents – 3 (plus 2 applications filed)

Publications

1. N. Skribanowitz, I. P. Herman, R. M. Osgood, Jr., M. S. Feld and A. Javan, "Anisotropic Ultrahigh Gain Emission Observed in Rotational Transitions in Optically Pumped HF Gas," Appl. Phys. Lett. **20**, 428 (1972). doi.org/10.1063/1.1654003

2. N. Skribanowitz, I. P. Herman, and M. S. Feld, "Laser Oscillation and Anisotropic Gain in the $1 \rightarrow 0$ Vibrational Band of Optically Pumped HF Gas," Appl. Phys. Lett. **21**, 466 (1972). doi.org/10.1063/1.1654221

3. N. Skribanowitz, I. P. Herman, J. C. MacGillivray and M. S. Feld, "Observation of Dicke Superradiance in Optically Pumped HF Gas," Phys. Rev. Lett. **30**, 309 (1973). doi.org/10.1103/PhysRevLett.30.309

4. I. P. Herman, J. C. MacGillivray, N. Skribanowitz and M. S. Feld, "Self-Induced Emission in Optically Pumped HF Gas: The Rise and Fall of the Superradiant State," Proc. of the Vail Conf. on Laser Spectroscopy, (Plenum, 1974).

5. I. P. Herman, R. P. Mariella, Jr. and A. Javan, "The Laser-Initiated Reaction: $NO_2^* + CO \rightarrow NO + CO_2$," J. Chem. Phys. **65**, 3792 (1976). doi.org/10.1063/1.433570

6. I. P. Herman, R. P. Mariella, Jr. and A. Javan, "Analysis of the Laser-Stimulated Reaction: $NO_2^* + CO \rightarrow NO + CO_2$," J. Chem. Phys. **68**, 1070 (1978). doi.org/10.1063/1.435798

7. I. P. Herman, A. Javan and R. W. Field, "Observation of Infrared-Optical Double Resonance in NO_2," J. Chem. Phys. **68**, 2398 (1978). doi.org/10.1063/1.436010

8. S. F. Fulghum, I. P. Herman, M. S. Feld and A. Javan, "XeF Ground-State Dynamics in a Laser Discharge," Appl. Phys. Lett. **33**, 926 (1978). doi 10.1063/1.91087

9. J. B. Marling and I. P. Herman, "Deuterium Separation with 1400-fold Single-Step Isotopic Enrichment and High Yield by CO_2-Laser Multiple-Photon Dissociation of 2,2-dichloro-1,1,1-trifluoroethane," Appl. Phys. Lett. **34**, 439 (1979). doi.org/10.1063/1.90819

10. I. P. Herman and J. B. Marling, "IR Photolysis of CDF_3: A Study in Kinetics of Multiple-Photon Dissociation with Applications to Deuterium Separation," Chem. Phys. Lett. **64**, 75 (1979). doi.org/10.1016/0009-2614(79)87279-6

11. I. P. Herman and J. B. Marling, "Vibrationally Stimulated Addition Reactions between Hydrogen Halides and Unsaturated Hydrocarbons: A Negative Result," J. Chem. Phys. **71**, 643 (1979). doi 10.1063/1.438415

12. I. P. Herman, "Calculation of Fluence-Dependent Dissociation Probabilities in Infrared Multiple-Photon Photolysis," Opt. Lett. **4**, 403 (1979). doi.org/10.1364/OL.4.000403

13. I. P. Herman and J. B. Marling, "Ultrahigh Single-Step Deuterium Enrichment in CO_2 Laser Photolysis of Trifluoromethane as Measured by Carbon-Isotope Labelling," J. Chem. Phys. **72**, 516 (1980). doi.org/10.1063/1.438936

14. J. B. Marling, I. P. Herman, and S. J. Thomas, "Deuterium Separation at High Pressure by Nanosecond CO_2 Laser Multiple-Photon Dissociation," J. Chem. Phys. **72**, 5603 (1980). doi.org/10.1063/1.438978

15. I. P. Herman, "Molecular Hydrogen Exchange: A Study of HD(v=5) + HD(v=0) $\rightarrow H_2 + D_2$," J. Chem. Phys. **72**, 5777 (1980). doi.org/10.1063/1.439001

16. I. P. Herman, "Evaluation of Quantum and Photoproduct Yields in Multiple-Photon Dissociation for Isotope Separation," J. Appl. Phys. **51**, 4483 (1980). doi.org/10.1063/1.328270

17. I. P. Herman and J. B. Marling, "Infrared Spectrum of CTF_3 and Implications toward Tritium Isotope Separation by Infrared Laser Multiple-Photon Dissociation of Halogenated Methanes," J. Phys. Chem. **85**, 493 (1981). doi/pdf/10.1021/j150605a008

18. F. Magnotta, I. P. Herman, and F. T. Aldridge, "Highly-Selective Tritium-from-Deuterium Isotope Separation by Pulsed NH_3 Laser Multiple-Photon Dissociation of Chloroform," Chem. Phys. Lett. **92**, 600 (1982). doi.org/10.1016/0009-2614(82)83657-9

19. I. P. Herman, "Two-Frequency CO_2 Laser Multiple-Photon Dissociation and Dynamics of Excited State Absorption in CDF_3," Chem. Phys. **75**, 121 (1983). doi 10.1016/0301-0104(83)85014-9

20. I. P. Herman, R. A. Hyde, B. M. McWilliams, A. H. Weisberg, and L. L. Wood, "Wafer-Scale Lithography: I. Pyrolytic Deposition of Metal Microstructures," Proc. of the Materials Research Society, 1982 Annual Meeting, Volume 17 (North Holland, 1983), p. 9. doi.org/10.1557/PROC-17-9

21. G. Lee, R. Ikeda, I. Herman, R. M. Dwyer, M. Bass, H. Hussein, J. Kozina, and D. T. Mason, "The Qualitative Effects of Laser Irradiation on Human Arteriosclerotic Disease," Am. Heart. J. **105**(6), 885-889 (1983). doi.org/10.1016/0002-8703(83)90384-8

22. I. P. Herman, F. Magnotta, R. J. Buss, and Y. T. Lee, "Infrared Laser Multiple-Photon Dissociation of $CDCl_3$ in a Molecular Beam," J. Chem. Phys. **79**, 1789 (1983). doi.org/10.1063/1.446024

23. B. M. McWilliams, I. P. Herman, F. Mitlitsky, R. A. Hyde, and L. L. Wood, "Wafer-Scale Pantography: Fabrication of n-Metal-Oxide-Semiconductor Transistors and Small-Scale Integrated Circuits by Direct-Write Laser-Induced Pyrolytic Reactions," Appl. Phys. Lett. **43**, 946 (1983). doi.org/10.1063/1.94191

24. J. L. Maienschein, F. Magnotta, I. P. Herman, F. T. Aldridge, and P. Hsiao, "Tritium Removal from Contaminated Water via Infrared Laser Multiple-Photon Dissociation," Nuclear Fusion/Technology **4**, 121 (1983). doi.org/10.13182/FST83-A22855

25. I. P. Herman, F. Magnotta, and F. T. Aldridge, "The Status of the Photochemistry and Photophysics of Tritium-from-Deuterium Isotope Separation by Infrared Laser Multiple-Photon Dissociation of Chloroform," Israel J. Chem. **24**, 192 (1984). doi.org/10.1002/ijch.198400033

26. I. P. Herman, B. M. McWilliams, F. Mitlitsky, H. W. Chin, R. A. Hyde and L. L. Wood, "Wafer-Scale Laser Pantography IV: Physics of Direct Laser-Writing Micron-Dimension Transistors," Proc. of the Materials Research Society 1983 Annual Meeting, Volume 29 (North Holland, 1984), Mat. Res. Soc. Sym. Proc. **29**, 29 (1984). doi.org/10.1557/PROC-29-29

27. F. Magnotta, F. T. Aldridge, I. P. Herman and J. L. Maienschein, "Laser Separation of Hydrogen Isotopes: Tritium from Deuterium Recovery," Proc. of the Int'l. Conf. on Lasers '83 (STS Press, 1984).

28. B. M. McWilliams, H. W. Chin, I. P. Herman, R. A. Hyde, F. Mitlitsky, J. C. Whitehead, and L. L. Wood, "Wafer-Scale Laser Pantography: VI. Direct-Write Interconnection of VLSI Gate Arrays," Proc. of the SPIE/LA '84 Symposium, **459**, 49 (1984). https://doi.org/10.1117/12.939434

29. F. Magnotta and I. P. Herman, "Infrared Laser Multiple-Photon Dissociation of $CTCl_3$: Wavelength Dependence, Collisional Effects, and Tritium/Deuterium Isotope Selectivity," J. Chem. Phys. **81**, 2363 (1984). doi.org/10.1063/1.447936

30. I. P. Herman, "Laser Fabrication of Integrated Circuits," in Laser Processing and Diagnostics (Chemical Physics 39) (Springer, 1984), p. 396.

31. F. Magnotta and I. P. Herman, "Observations on the Spectral Dependence and T/D Isotope Selectivity in the CO_2 Laser Multiple-Photon Dissociation of Trifluoromethane," Appl. Phys. B **36**, 207 (1985).

32. F. Magnotta and I. P. Herman, "Raman Microprobe Analysis During the Direct-Laser Writing of Silicon Microstructures," Appl. Phys. Lett. **48**, 195 (1986). https://doi.org/10.1063/1.96941

33. I. P. Herman, F. Magnotta, and D. E. Kotecki, "Direct-Laser Writing of Silicon Microstructures: Raman Microprobe Diagnostics and Modeling the Nucleation

Phase of Deposition," J. Vac. Sci. Technol. A **4**, 659 (1986). doi.org/10.1116/1.573824

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36. I. P. Herman and A. F. Bernhardt, "Advances in Isotope Separation," chapter in Energy in Physics, War and Peace, edited by H. Mark and L. Wood (Kluwer, Dordrecht, 1988), p. 237.

37. G. D. Pazionis, H. Tang, L. Ge, and I. P. Herman, "Stokes/Anti-Stokes Raman Microprobe Analysis of Laser-Heated Silicon Microstructures on Silicon Dioxide," Mat. Res. Soc. Sym. Proc. **101**, 113 (1988). doi.org/10.1557/PROC-101-113

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39. D. E. Kotecki and I. P. Herman, "A Real-Time Monte Carlo Simulation of Thin Film Nucleation in Localized-Laser Chemical Vapor Deposition," J. Appl. Phys. **64**, 4920 (1988). doi.org/10.1063/1.342442

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41. I. P. Herman, "Direct-Laser Writing," chapter in Laser Chemical Processing for Microelectronics, edited by K. Ibbs and R. M. Osgood, Jr., (Cambridge University, London, 1989), p. 61.

42. I. P. Herman, K. Takeuchi, and Y. Makide, "Laser Separation of Tritium", chapter in Laser Applications in Physical Chemistry, edited by D.K. Evans (Marcel Dekker, New York, 1989), p. 173.

43. G. D. Pazionis, H. Tang, and I. P. Herman, "Raman Microprobe Analysis of Temperature Profiles in cw Laser Heated Silicon Microstructures," IEEE J. Quantum Electron. **25**, 976 (1989). doi 10.1109/3.27988

44. J. A. Tuchman, L. P. Welsh, and I. P. Herman, "Thermally Induced Stresses and Strains in Laser Processing of Thin Films," Mat. Res. Soc. Symp. Proc. **130**, 333 (1989). doi.org/10.1557/PROC-130-333

45. I. P. Herman, "Laser Deposition of Thin Films from Gas-Phase and Adsorbed Molecules," Chem. Rev. **89**, 1323 (1989). doi cr00096a005

46. H. H. Burke, I. P. Herman, V. Tavitian, and J. G. Eden, "Laser Photochemical Deposition of Germanium-Silicon Alloy Thin Films," Appl. Phys. Lett. **55**, 253 (1989). doi.org/10.1063/1.102384

47. H. Tang and I. P. Herman, "Laser-Induced and Room-Temperature Etching of Copper Films by Chlorine with Analysis by Raman Spectroscopy," J. Vac. Sci. Technol. A **8**, 1608 (1990). doi.org/10.1116/1.576774

48. T.J. Licata, D.V. Podlesnik, H. Tang, I.P. Herman, R.M. Osgood, Jr., and S.A. Schwarz, "CW Laser Doping of Micrometer-Sized Features in GaAs Using a Dimethylzinc Ambient," J. Vac. Sci. Technol. A **8**, 1618 (1990). doi.org/10.1116/1.576775

49. J.A. Tuchman, Z. Sui, I.P. Herman, R.L. Gunshor, L.A. Kolodziejski, D.A. Cammack, and M. Shone, "Photoluminescence of ZnSe Epilayers on GaAs Under Hydrostatic Pressure," Mat. Res. Soc. Symp. Proc. **161**, 471 (1990). doi.org/10.1557/PROC-161-471

50. H. Tang and I.P. Herman, "Local Laser Induced Etching of Copper Films by Chlorine," Mat. Res. Soc. Symp. Proc. **158**, 331 (1990). doi.org/10.1557/PROC-158-331

51. H. Tang and I. P. Herman, "Raman Microprobe Scattering of Solid Silicon and Germanium at the Melting Temperature," Phys. Rev. B **43**, 2299 (1991). doi.org/10.1103/PhysRevB.43.2299

52. Z. Sui, I. P. Herman, and J. Bevk, "Raman Analysis of Si/Ge Strained Layer Superlattices under Hydrostatic Pressure," Appl. Phys. Lett. **58**, 2351 (1991). doi.org/10.1063/1.104894

53. I. P. Herman, H. Tang, and P. P. Leong, "Real Time Optical Diagnostics in Laser Etching and Deposition," Mat. Res. Soc. Symp. Proc. **201**, 563 (1991). doi.org/10.1557/PROC-201-563

54. Z. Sui, I. P. Herman, and J. Bevk, "Raman Study of Strain and Confinement Effects in Si/Ge Strained Layer Superlattices under Hydrostatic Pressure," Mat. Res. Soc. Symp. Proc. **220**, 333 (1991). doi.org/10.1557/PROC-220-333

55. H. Tang and I. P. Herman, "Polarization Raman Microprobe Analysis of Laser Melting and Etching in Silicon." J. Appl. Phys. **71**, 3492 (1992). doi.org/10.1063/1.350903.pdf

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57. J. A. Tuchman and I. P. Herman, "General Trends in Changing Epilayer Strains through the Application of Hydrostatic Pressure," Phys. Rev. B **45**, 11,929 (1992). doi.org/10.1103/PhysRevB.45.11929

58. H. Tang and I. P. Herman, "Anomalous Laser Etching of Copper by Chlorine." Appl. Phys. Lett. **60**, 2164 (1992). doi.org/10.1063/1.107071

59. I. P. Herman, "Raman Scattering as an in situ Optical Diagnostic." SPIE **1594**, 298 (1992). doi.org/10.1117/12.566433

60. Z. Sui, P. P. Leong, I. P. Herman, G. S. Higashi, and H. Temkin, "Analysis of the Structure of Porous Silicon by Raman Scattering". Mat. Res. Soc. Symp. Proc. **256**, 13 (1992). doi.org/10.1557/PROC-256-13

61. J. A. Tuchman, S. Kim, Z. Sui and I. P. Herman, "Exciton Photoluminescence of Bulk ZnSe and ZnSe Epilayers under Hydrostatic Pressure." Phys. Rev. B **46**, 13371 (1992). doi.org/10.1103/PhysRevB.46.13371

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63. Z. Sui, H. H. Burke, and I. P. Herman, "Raman Scattering in Germanium-Silicon Alloys under Hydrostatic Pressure," Phys. Rev. B **48**, 2162 (1993). doi.org/10.1103/PhysRevB.48.2162

64. H. H. Burke and I. P. Herman, "Temperature Dependence of Raman Scattering in Ge-Si Alloys." Phys. Rev. B **48**, 15016 (1993). doi.org/10.1103/PhysRevB.48.15016

65. Z. Sui and I. P. Herman, "Effect of Strain on Phonons in Si, Ge, and Si/Ge Heterostructures." Phys. Rev. B **48**, 17938 (1993). doi.org/10.1103/PhysRevB.48.17938

66. J. W. McCamy, D. H. Lowndes, J. D. Budai, G. E. Jellison, Jr., I. P. Herman, and S. Kim, "Epitaxial ZnS, ZnSe and ZnS-ZnSe Superlattices Grown on (001) GaAs by Pulsed-Laser Ablation," Mat. Res. Soc. Symp. Proc. **285**, 471 (1993). doi.org/10.1557/PROC-285-471

67. I. P. Herman, V. M. Donnelly, K. V. Guinn, and C. C. Cheng, "Laser Induced Thermal Desorption as an *in situ* Surface Probe During Plasma Etching," Phys. Rev. Lett. **72**, 2801 (1994). doi.org/10.1103/PhysRevLett.72.280179082

68. C. C. Cheng, K. V. Guinn, V. M. Donnelly, and I. P. Herman, "*in situ* Pulsed Laser-Induced Thermal Desorption Measurements of Silicon Chloride Layer Thicknesses During Silicon Etching in High Density Plasmas of Cl_2 and Cl_2/O_2 Mixtures," J. Vac. Sci. Technol. A **12**, 2630 (1994). doi.org/10.1116/1.579082

69. V. M. Donnelly, K. V. Guinn, C. C. Cheng, and I. P Herman, "Chemical Topography of Si Etching in a Cl_2 Plasma, Studied by X-ray Photoelectron Spectroscopy and Laser-induced Thermal Desorption." Mat. Res. Soc. Symp. Proc. **334**, 425 (1994). doi.org/10.1557/PROC-334-425

70. R. Eryigit, Z. Sui and I. P. Herman, "Lattice Properties of Ge and GaAs Strained Layers on Si", Mat. Res. Soc. Symp Proc. **356**, 295 (1995). doi.org/10.1557/PROC-356-295

71. C. C. Cheng, K. V. Guinn, I. P. Herman, and V. M. Donnelly, "Competitive Halogenation in HBr/Cl_2 Plasmas Studied with X-ray Photoelectron Spectroscopy and In-Situ, Real-Time, Pulsed Laser-Induced Thermal Desorption," J. Vac. Sci. Technol. A **13**, 1970 (1995). doi.org/10.1116/1.579638

72. S. Kim, I. P. Herman, J. A. Tuchman, K. Doverspike, L. B. Rowland, and K. Gaskill, "Photoluminescence of Wurtzite GaN under Hydrostatic Pressure," Appl. Phys. Lett. **67**, 380 (1995). doi.org/10.1063/1.114635

73. I. P. Herman, "Optical Thermometry during Semiconductor Processing," invited paper to J. Selected Topics in Quantum Electronics **1**, 1047-1053 (1995). doi 10.1109/2944.488681

74. S. Kim, I. P. Herman, K. Moore, D. G. Hall, and J. Bevk, "Use of Hydrostatic Pressure to Resolve Phonon Replicalike Features in the Photoluminescence Spectrum of Beryllium-doped Silicon," Phys. Rev. B **52**, 16309 (1995). doi.org/10.1103/PhysRevB.52.16309

75. M. B. Freiler, G. F. McLane, S. Kim, M. Levy, R. Scarmozzino, I. P. Herman, and R. M. Osgood, Jr., "Luminescence Properties of Submicrometer Features Fabricated by using Magnetron Reactive Ion Etching with Different Sample Biases," Appl. Phys. Lett. **67**, 3883 (1995). doi.org/10.1063/1.115305

76. R. Eryigit and I. P. Herman, "Lattice Properties of Strained GaAs and Ge using a Modified Bond Charge Model," Phys. Rev. B **53**, 7775 (1996). doi.org/10.1103/PhysRevB.53.7775

77. S. Kim, I. P. Herman, K. L. Moore, D. G. Hall, and J. Bevk, "Hydrostatic Pressure Dependence of Isoelectronic Bound Excitons in Beryllium-doped Silicon," Phys. Rev. B **53**, 4434 (1996). doi.org/10.1103/PhysRevB.53.4434

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79. M. B. Freiler, M. C. Shih, S. Kim, M. Levy, I. P. Herman, R. Scarmozzino, and R. M. Osgood, Jr., "Pattern Transfer and Photoluminescence Damage-Assessment of Deep-Submicrometer Features Etched by Photon-Induced Cryoetching," Appl. Phys. A **63**, 143 (1996). doi.org/10.1007/BF01567642

80. I. P. Herman, V. M. Donnelly, C.-C. Cheng, and K. V. Guinn, "Surface Analysis during Plasma Etching by Laser Induced Thermal Desorption," Jpn. J. Appl. Phys. **35**, 2410 (1996); shorter version Proceedings of the 17th Symposium on Dry Process, p. 155 (1995). Also, V. M. Donnelly, I. P. Herman, C. C. Cheng, and K. V. Guinn, "Surface Chemistry during Plasma Etching of Silicon," Pure & Appl. Chem. **68**, 1071 (1996). doi 10.1351/pac199668051071

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166. J. Hu, B. Pan, T. Makihara, R. D. J. Garcia, and I. P. Herman, "Brewster Angle Optical Reflection Observation of Self-limiting Nanoparticle Monolayer Self-Assembly at a Liquid/Liquid Interface," AIP Advances **9**, 065022 (2019). doi.org/10.1063/1.5099487

167. J. Hu, E.W. C. Spotte-Smith, B. Pan, R. J. Garcia, C. Colosqui, and I. P. Herman, "Spatiotemporal Study of Iron Oxide Nanoparticle Monolayer Formation at Liquid/Liquid Interfaces by Using In Situ Small-Angle X-ray Scattering" J. Phys. Chem. C **124**, 43, 23949–23963 (2020). doi: 10.1021/acs.jpcc.0c07024

168. X. Hua, D. Zhang, B. Kim, D. Seo, K. Kang, E.-H. Yang, J. Hu, X. Chen, H. Liang, K. Watanabe, T. Taniguchi, J. Hone, Y. D. Kim and I. P. Herman, "Stabilization of CVD-grown WS_2 at Elevated Temperature with *h*-BN Encapsulation" ACS Appl. Mater. Interfaces 2021, **13**, 26, 31271–31278 (2021). doi: 10.1021/acsami.1c06348

169. H. Kim, Y. D. Kim, T. Wu, Q. Cao, I. P. Herman, J. Hone, J. Guo, and K. L. Shepard, "Electroluminescence of Atoms in a Graphene Nanogap" Sci. Adv. **8**(3) (2022). doi: 10.1126/sciadv.abj1742

170. X. Hua, T. Axenie, M. N. Goldaraz, K. Kang, E.-H. Yang, K. Watanabe, T. Taniguchi, J. Hone, B. Kim, and I. P. Herman, "Improving the optical quality of $MoSe_2$ and WS_2 monolayers with complete *h*-BN encapsulation by high temperature annealing" ACS Appl. Mater. Interfaces, **14**, 1, 2255–2262 (2022). doi: 10.1021/acsami.1c18991.

Books Published

Coming Home to Math: Become Comfortable with the Numbers that Rule Your Life (World Scientific, Singapore, 2020).
https://doi.org/10.1142/11540, ISBN: 978-981-120-984-0 (hardcover); 978-981-121-126-3 (softcover)
Questions and Answers at: https://www.irvingpherman.com/coming-home-to-math/

Physics of the Human Body, Second Edition (Springer, Berlin Heidelberg New York, 2016). ISBN-13: 978-3-319-23930-9 (print) / 978-3-319-23932-3 (Online) DOI 10.1007/978-3-319-23932-3

Physics of the Human Body (Springer, Berlin Heidelberg New York, 2007); Third printing, corrected (2009). [Translated into Japanese (2009), Greek (2009), Russian (in progress)].

Optical Diagnostics for Thin Film Processing (Academic Press, San Diego, 1996). ISBN: 9780123420701 (hardcover) / ISBN: 9780080538082 (ebook)

Process Module Metrology, Control, and Clustering, co-editor with C. J. Davis and T. R. Turner, SPIE Vol. 1594 (SPIE, Bellingham, 1992).

Photon, Beam and Plasma Stimulated Chemical Processes at Surfaces, co-editor with V. M. Donnelly and M. Hirose (Materials Research Society, Pittsburgh, 1987).

Miscellaneous

"Direct-Laser Writing of Silicon Microstructures: Raman Microprobe Diagnostics and Modeling the Nucleation Phase of Deposition," (paper 33) included in Selected Papers on Laser Beam Diagnostics, SPIE (Vol. MS 126), Ed. R. N. Hindy and J. H. Hunt, 1996.

Book Reviews

Review of Laser Processing of Thin Films and Microstructures: Oxidation, Deposition and Etching of Insulators, in MRS Bulletin, 14 (3), 64 (1989).

Review of Laser Microfabrication: Thin Film Processes and Lithography, in MRS Bulletin, 15 (5), 57 (1990).

Patents

J. B. Marling and I. P. Herman, "Deuterium Enrichment by Selective Photoinduced Dissociation of a Multihalogenated Organic Compound," U. S. #4,257,860, allowed 1981.

I. P. Herman and J. B. Marling, "Laser-assisted Isotope Separation of Tritium: Reacting a Deuterated Halomethane with Tritiated Water and Irradiating to Dissociate the Tritiated Product," U. S. #4,411,755, allowed 1983.

I. P. Herman and M. Islam, "Method of Electric Field Assisted Deposition of Films of Nanoparticles," U.S. #7,510,638, allowed 2009.

I. P. Herman and S. Banerjee, “Controlled “Dielectrophoretic Alignment of Carbon Nanotubes in Functional Devices”, provisional patent filed, March 10, 2006.

I. P. Herman, S. J. Akey, and C. Lu, “Controlled “Ordered Assembly of Nanoparticles in Spatially Defined Regions”, provisional patent filed, November 24, 2010.

T. J. Kramer, I. P. Herman, J. Kymissis, "On-chip fabrication of high surface area polymer morphology for photoactive applications", Invention Report (IR) # M11-083 filed, March 21, 2011.

Short Courses Taught at Professional Meetings

"Laser Processing," at CLEO'90 meeting, May, 1990.

"Laser Processing in Microelectronics and Optoelectronics," at CLEO'91 meeting, May, 1991.

Presentation Materials

Wrote, 2014-15: Virtual Time Capsules Celebrating Each of the Fifteen Decades of Columbia Engineering, http://seas150.columbia.edu/multimedia

Recent Invited Talks/Presentations at Meetings

Modes of Assembling Quantum Dots in Two and Three Dimensions, 4th Northeast Complex Fluids and Soft Matter Workshop, Stony Brook University, June 12, 2015.

Similarities and Differences in Medical, Engineering, Professional and Research Ethics, The Eighth International Conference on Ethics in Biology & Medicine, SUNY Downstate Medical Center/St. Francis College, Brooklyn, NY, April 24-26, 2015.

Incorporating Quantum Dots into Photovoltaic Device Structures, EMN (Energy Materials Nanotechnology)/Photovoltaics Meeting, Orlando, FL, Jan. 12-15, 2015.

Fabrication and Optical Properties of Nanocrystal Materials, 8th International Conference on Photo-Excited Processes and Applications (ICPEPA-8), Rochester, NY, August 15, 2012.

Nanomaterials Composed of Nanocomponents: Nanoparticle Supercrystals and Hybrids, 240th Annual ACS National Meeting-Honoring Exxon-Mobil Award Winner Sarbajit Banerjee, Boston, MA, August 24, 2010.

Investigating Nanomaterials Composed of Nanocomponents: Ordered Arrays of Nanoparticles and Nanoparticle-Carbon Nanotube Hybrids, HUJI NanoConference, Ashkelon, Israel, June 21/22, 2010.

Bringing Materials Science to New York City High Schools, ACS National Meeting, New Orleans, LA, April 8, 2008.

Research and Other Experiences for Teachers at the Columbia MRSEC, ACS National Meeting, Anaheim CA, March 29, 2004.

Electrophoretic Deposition of Multifunctional Nanocrystal Films, ICCE-10 (International Conference on Composites/Nano Engineering), New Orleans, July 22, 2003.

Fabricating Thin Films from Interacting Nanocparticles Films, NSF/EC (European Community) Workshop on "From Nanomaterials to Nanotechnology," British Consulate, Cambridge, MA, December 6, 2002.

Electrodeposition of Patterned Nanocrystal Films using Thermaly Charged Nanocrystals, Fall 2002 MRS Meeting, Boston, MA, Symposium F, December 3, 2002.

Phonons in Nanocrystals and Vibrations in Nanocrystal Films, International Workshop on Electron-Phonon Effects in Nanosystems, Montauk Point, NY, September 24, 2002.

Applications of Functional Nanomaterials, Discussion presenter/leader, Brookhaven Nanocenter Workshop, March 8, 2002.

The Synthesis and Properties of Cerium Dioxide Nanoparticles, and Related Nanoparticle Research at Columbia University (with S. W. Chan), ExxonMobil Strategic Research, Clinton NJ, November 9, 2001.

Activities in the Columbia MRSEC on Nanoparticles and Nanostructured Thin Films, The Frontier: A Workshop on Nanoscience and Technology, Brookhaven National Laboratory, December 20, 2000.

Understanding ICP Etching by Probing the Surface Layer using Laser-induced Thermal Desorption and by Optical Analysis of the Plasma, 22nd Dry Process Symposium, Tokyo, Japan, November 9, 2000.

Probing Surface Layers during Inductively Coupled Plasma Etching using Laser Thermal Desorption and Other Optical Techniques, 46th American Vacuum Society International Meeting, Seattle, WA, October 26, 1999.

Optical Diagnostics of the Plasma and Surface during Inductively Coupled Plasma Etching, 52nd Annual Gaseous Electronic Conference, Norfolk, VA, October 5, 1999.

Materials Research and Education at Columbia, National Educator's Workshop, Update '98, Symposium on Materials Science, Engineering, and Technology, Columbia University, November 1, 1998.

Optical Probing of Surfaces during Plasma Etching and Other Thin Film Processes, Optical Diagnostics for Thin Film Processing Session, Rocky Mountain American Vacuum Society Symposium 1998, August 20, 1998.

Invited Discussion Leader (with presentation) for the *in situ* Optical Diagnostics of Surfaces during Deposition and Etching session at the 1997 Gordon Conference on Electronic Materials: Chemistry, Excitation and Processing, July 9, 1997.

Laser-induced Thermal Desorption during Plasma Processing, the 17th Dry Processing Symposium, Tokyo, Japan, November 1, 1995.

Invited Discussion Leader (with presentation) for the Diagnostics session at the 1995 Gordon Conference on Chemistry of Electronic Materials, August 4, 1995.

Optical Diagnostics during Film Processing of Micro- and Nanostructures, Optical Society of American topical meeting on The Microphysics of Surfaces: Nanoscale Processing, Sante Fe, New Mexico, February 10, 1995.

Highly Localized Optical Diagnostics of Thin Film Processing, LEOS '92, Boston, November 16, 1992.

Laser Microprobes of Photon-assisted Surface Modifications, CLEO '92, Anaheim, May 14, 1992.

Raman Microprobe Spectroscopy during Surface Modifications, presented at the Interdisciplinary Laser Science Conference (ILS -VII) on Sept. 25, 1991.

Raman Scattering as an in-situ Optical Diagnostic, presented at the SPIE meeting on Process Module, Control, and Clustering (Conference 1594) Sept. 13, 1991.

Real Time Optical Diagnostics in Laser Etching and Deposition, 1990 Materials Research Society Fall Meeting, Nov. 28, 1990.

Laser Chemical Processing of Semiconductors, 1988 American Chemical Society Midwest Meeting, Nov. 17, 1988.

Excimer Laser Photochemical Vapor Deposition of Germanium-Silicon Alloys: Thin Film Growth and Characterization, International Laser Science Conference/ American Vacuum Society National Meeting, Atlanta, Oct. 4, 1988.

Optical Probing and Nucleation Effects During Direct Laser Writing, American Physical Society March Meeting, New York, March 16, 1987.

In-situ Raman Microprobe Analysis of Direct Laser Writing, Optical Society of America Topical Conference on Lasers in Material Diagnostics, Albuquerque, Feb. 12, 1987.

Direct Laser Writing: Raman Microprobe Analysis, Nucleation Effects, and Applications, International Laser Science Conference/Optical Society Annual Meeting, Seattle, Oct. 24, 1986.

Other Recent Invited Talks/Colloquia

Assembling Nanomaterials in 2D and 3D, Texas A&M, Chemistry Seminar, November 17, 2015.

Physics of the Body, By the Body, and For the Body, Santa Fe Institute, November 12, 2015.

Fabrication and Properties of Nanocrystal Materials, Boston University, Physical Chemistry/Physics/Chemistry Seminar, December 5, 2012.

Fabrication and Properties of Nanocrystal Materials, Harvard University, Materials Science Seminar, November 1, 2012.

Fabrication and Properties of Nanocrystal Materials, Northeastern University, Physics Department Colloquium, October 11, 2012.

Fabrication and Properties of Nanocrystal Materials, Rowland Institute at Harvard, October 4, 2012.

Nanomaterials Composed of Nanocomponents: Assembly, Optics, Catalysis, and Thermoelectrics, Physics Department Colloquium, Queens College, CUNY, October 17, 2011.

Nanomaterials Composed of Nanocomponents: Nanocrystal Superlattices and Hybrids, Chemical Engineering Seminar, University of Houston, March 22, 2011.

Nanomaterials Composed of Nanocomponents: Nanocrystal Superlattices and Hybrids, Laboratory of Surface Modification (LSM) Seminar Series, Rutgers University, October 21, 2010.

Routes to Photovoltaics: Electrical and Optical Coupling in Hybrid Nanomaterials, Seidman Family Memorial Lecture, Department of Materials Engineering, Technion, Haifa, Israel, June 16, 2010.

Order from Chaos: Three-dimensional Nanocrystal Superlattices, Seidman Family Memorial Lecture, Department of Materials Engineering, Technion, Haifa, Israel, June 15, 2010.

The World of Nano: Electric Field-Assisted Assembly of Nanomaterials, Seidman Family Memorial Lecture, Department of Materials Engineering, Technion, Haifa, Israel, June 13, 2010.

Field-Assisted Assembly of Nanomaterials and their Optical, Mechanical, and Electrical Properties, Vanderbilt University, VINSE Seminar Series, April 1, 2009.

Field-Assisted Assembly of Nanomaterials and their Optical, Mechanical, and Electrical Properties, Stevens Institute of Technology, Nanotechnology Seminar Series, Jan. 30, 2008.

The Fabrication of Nanomaterials and their Optical, Mechanical, and Electrical Properties, North Carolina A&T, May 9, 2007.

Overview of the Columbia Center for Nanostructured Materials (MRSEC) and the Department of Applied Physics and Applied Mathematics, Xavier University of Louisiana, March 15, 2007.

Field-Assisted Assembly of Nanomaterials and their Optical, Mechanical, and Electrical Properties, Solid Mechanics/Materials Science Colloquium, Brown University, Oct. 20, 2006.

Nanocrystals, Directed Assembly of Nanocomponent Films, and Maybe More, Materials Science and Engineering Department Seminar, Drexel University, Nov. 2, 2004.

Nanocrystals, Directed Assembly of Nanocrystal Films, and Maybe More, Chemistry Department Seminar, Southern Illinois University, Sept. 12, 2003.

Nanocrystals, Directed Assembly of Nanocrystal Films, and Maybe More, Chemistry Department Seminar, State University of New York at Stony Brook, May 1, 2003.

Nanocrystals, Nanocrystal Films, Surfaces, and Maybe More, Surface Science Seminar, Laboratory for Surface Modification, Physics Department, Rutgers University, October 11, 2002.

Properties and Self-Assembly of Semiconductor and Oxide Nanocrystals, Chemical Physics Seminar, Tel Aviv University, May 10, 2001.

Understanding ICP Etching by Probing the Surface Layer using Laser-induced Thermal Desorption and by Optical Analysis of the Plasma, Plasma Group Seminar, Tel Aviv University, May 10, 2001.

Properties and Self-Assembly of Semiconductor and Oxide Nanocrystals, Bar Ilan University, May 3, 2001.

Properties and Self-Assembly of Semiconductor and Oxide Nanocrystals, Technion - Israel Institute of Technology, April 19, 2001.

Properties and Self-Assembly of Semiconductor and Oxide Nanocrystals, Department of Physical Chemistry Seminar, Hebrew University of Jerusalem, March 19, 2001.

Properties and Self-Assembly of Semiconductor and Oxide Nanocrystals, Departments of Materials and Interfaces, and Chemical Physics Seminar, Weizmann Institute, February, 28, 2001.

Properties and Self Assembly of CdSe Nanocrystals, RIKEN,

The Institute of Physical and Chemical Research, Japan, November 6, 2000.

A Holistic View of Plasma Etching using Optical Diagnostics, University of Wisconsin, Engineering Research Center for Plasma-Aided Manufacturing Seminar Series, May 5, 2000.

Optical Probes of Semiconductor Surfaces During Etching, Department of Materials Engineering Seminar, Technion - Israel Institute of Technology, January 14, 1999.

Optical Probes of Semiconductor Surfaces During Plasma Etching, Physical Chemistry Seminar, Hebrew University, Jerusalem, Israel, January 11, 1999.

Optical Diagnostics for Thin Film Processing, Department of Materials Engineering Seminar, Technion - Israel Institute of Technology, January 7, 1999.

Optical Probing of Surfaces during Etching, Chemical Structure and Dynamics Seminar, William R. Wiley Environmental Molecular Sciences Laboratory, Battelle Pacific Northwest National Laboratory, July 23, 1998.

Real-time Optical Diagnostics of Semiconductor Surfaces during Thin Film Processing, Joint Chemistry and Materials Science Division seminar, Argonne National Laboratory, June 30, 1997.

Optical Probes for Surface Analysis during Etching, Photonics Engineering Seminar, City College, CUNY, April 4, 1997.

Real-time Optical Diagnostics of Semiconductor Surfaces during Thin Film Processing, Laboratory for Atomic, Molecular, and Optical Science and Engineering Seminar, University of Maryland, December 6, 1996.

Optical Spectroscopies for Real-time Analysis of Semiconductor Surfaces and Strains during Thin film Processing, NIST/JILA/University of Colorado, Semiconductor Seminar, June 28, 1994.

Optical Probes of Surfaces and Strains during Thin film Processing, Yale University, Solid State Seminar, November 12, 1993.

Tuning, Optically Probing, and Modeling Strains in Semiconductor Heterostructures, AT&T Bell Laboratories, November 1, 1993.

Optical Diagnostics of Microelectronics Materials during Laser Processing and under other Unusual Conditions, California Institute of Technology, May 15, 1992.

Laser Spectroscopy of ZnSe and Ge/Si-based Heterostructures under Hydrostatic Pressure, Hughes Research Laboratory, Malibu, CA, May 13, 1992.

IBM East Fishkill, Aug. 6, 1991

US Army Electronics Tech and Devices Lab, Fort Monmouth, July 30, 1991

IBM East Fishkill Facility, Jan. 16, 1990

State University of New York, Stony Brook, Oct. 3, 1989.

IBM East Fishkill Facility, March 14, 1989.

Allied-Signal, Dec. 6, 1988.

Naval Research Laboratory, June 7, 1988.

Cornell University, Department of Materials Science and Engineering, May 26, 1988.

IBM East Fishkill Facility, March 30, 1988.

IBM T. J. Watson Research Center, March 4, 1988.

Columbia University Presentations include:

"Herman's Third Book and Isaac Asimov", Department of Applied Physics and Applied Mathematics Research Conference, December 3, 2021.

"The Math of Herman's Leviticus", Department of Applied Physics and Applied Mathematics Research Conference, September 27, 2019.

"Serendipity, Physics and Me", Society of Physics Students presentation, February 1, 2018.

"Nanomaterials, Optics, and the TBoH", Department of Applied Physics and Applied Mathematics Research Conference, October 20, 2017.

"The Optics of 2D Nanostructures: Now You See Them, Now You Don't (and vice versa)", Department of Applied Physics and Applied Mathematics Research Conference, September 30, 2016.

"The Physics and Optics of Nanomaterials and The Physics of the Human Body", Society of Physics Students presentation, November 5, 2015.

"Nanomaterials, Optics, and Your Body", Department of Applied Physics and Applied Mathematics Research Conference, October 9, 2015.

"Nanocrystals, Graphene, and Life, and Hot on the Heels of Newton", Department of Applied Physics and Applied Mathematics Research Conference, October 3, 2014.

"Intelligent Physics and Assembly of Nanomaterials: Better Living Through Nanocrystals", Department of Applied Physics and Applied Mathematics Research Conference, October 14, 2013.

"Designing Nanomaterials and Their Collective Properties", Department of Physics Graduate Student Seminar, March 8, 2013.

"Designing Nanomaterials and Their Collective Properties", Department of Applied Physics and Applied Mathematics Research Conference, November 9, 2012.

"Edward Teller: Friend or Fiend?", Department of Applied Physics and Applied Mathematics Research Conference, October 14, 2011.

"Nanomaterials Composed of Nanocomponents: Assembly, Optics, Catalysis, and Thermoelectrics", Department of Applied Physics and Applied Mathematics Research Conference, September 23, 2011.

"Coupling in the Formation and Properties of Nanomaterials", Department of Applied Physics and Applied Mathematics Research Conference, September 15, 2010.

"Assembling Nanomaterials and Investigating their Optical, Electrical, and Mechanical Properties or Nanocrystal Skyscrapers and Pretzel Sticks", Physics Department students presentation, November 13, 2009.

"Nanocrystal Skyscrapers and Pretzel Sticks", Department of Applied Physics and Applied Mathematics Research Conference, October 9, 2009.

"Assembly and Properties of Nanomaterials, and Other Updates V11.21.08", Department of Applied Physics and Applied Mathematics Research Conference, November 21, 2008.

"Physics of the Human Body and Other Nanomaterials", Department of Applied Physics and Applied Mathematics Research Conference, October 5, 2007.

"The Assembly and Optical, Mechanical, and Electrical Properties of Nanomaterials" and "How to Become Rich and Famous by Writing a Book", Department of Applied Physics and Applied Mathematics Research Conference, September 8, 2006.

"Electric-Field-Assisted Assembly of Nanocrystals and Carbon Nanotubes; The Resulting Optical and other Properties of these Assemblies; and "Physics of the Human Body" - The Book", MRSEC REU talk, June 7, 2006.

"Should I Add Dr. Abner Sedgwick to my CV as a Mentor?, The Journey from PHD to PHB, and Why is Sanford Braun Popping up all of the Time?" Professor Koberstein Dormitory Student Group, March 24, 2005.

"Laser Safety", for MRSEC and NSEC students, October 15, 2004.

"Optical Spectroscopy of Nanocrystals, Electric-Field-Assisted Assembly of Nanomaterials, Abstract Art, and Why a Textbook is Not a Monograph", Department of Applied Physics and Applied Mathematics Research Conference, October 15, 2004.

"Dr. Abner Sedgwick, Sanford Braun, Lasers, Nanogaveesh, "They Are Still Electric Fields", and Dr. Abner Sedgwick", MRSEC/NSEC REU Presentation, June 17, 2004

"Nano + Optical + Materials Physics", Department of Applied Physics and Applied Mathematics Research Conference, September 26, 2003.

"Nanocrystals: Raman Scattering and Formation of Films", MRSEC Grad Student/Postdoc Seminar, September 25, 2003.

"The Optics of Ellipsometry", MRSEC Special Seminar, September 19, 2002.

"Activities in the Columbia MRSEC on Nanoparticle and Nanostructured Films", The Frontiers: Workshop on Nanoscience and Technology, Brookhaven National Laboratory, Dec. 20, 2000

"Optical Interactions with Nanostructured Materials and during Plasma Etching", Department of Applied Physics and Applied Mathematics Research Conference, September 29, 2000.

"From Nanocrystals to Optics to Artificial Dirt to Film Processing", Department of Applied Physics and Applied Mathematics Research Conference, December 10, 1999.

Faculty Speaker, Columbia SEAS Undergraduate Open House, ~April, 1999

"The Center of My Attention", Department of Applied Physics and Applied Mathematics Research Conference, October 16, 1998.

Keynote Speaker, Columbia SEAS Undergraduate Open House, ~ April, 1998

"Optical Probing of Semiconductor Surfaces during Etching" and "Canonization of the First Book of Herman", Department of Applied Physics Research Conference, November 22, 1996.

"Laser Diagnostics and Laser Modifications of Processes" and "Optical Spectroscopy of Solid-State Structures", Department of Applied Physics Research Conference, October 29, 1993.

Presentations at the APAM Junior/Senior Seminar (A.P. E4901/4903) (presented several times, including the dates given)

Applying for Graduate School (September 22, 2011, September 4, 2013, September 12, 2016, September 6, 2017)

Edward Teller: Friend or Fiend? (October 18, 2011, November 6, 2013, December 12, 2016, September 30, 2020)

Estimating in Nanotechnology (October 2009; September 27, 2011, October 9, 2013, October 10, 2016)

Estimating in Energy (October 2009; October 4, 2011, October 28, 2013, October 26, 2016)

Lasers (October 20, 2011, October 16, 2013, October 5, 2016)

Responsible Conduct of Research and Professional Ethics (see below, September 22, 2010, September 30, 2013, September 28, 2016, September 25, 2017)

Linear and Nonlinear Optics (Nov. 13, 2013, October 19, 2016)

Light Detection (c. 1996)

Physics of Baseball (c. 1996)

Physics of Medical Imaging (c. 1996)

Physics of the Body (October 17, 2016)

Thermometry (c. 1995)

Who Invented the Laser?: A Play in Four Acts (c. 2000, October 24, 2016)

Writing Technical Books: A Personal Perspective (November 4, 2020)

Other General and Recurring Presentations at Columbia University and elsewhere

Developed and led seminar on Plagiarism 101: What is Plagiarism? and Why you one must not commit it!, attended by APAM department MSE masters students, Feb. 24, 2015; October 13, 2015, November 10, 2016, October 16, 2017 October 12, 2018, October 18, 2019.

Developed and led seminar on Engineering and Professional Ethics, attended by APAM department MSE masters students and to REU students, Nov. 18, 2014, April 8, 2016, March 20, 2017, March 20, 2018, April 5, 2019, February 28, 2020, April 26, 2022.

Developed/Revised and led seminar on Research and Professional Ethics, attended by APAM department doctoral students, May 11, 2007; May 9, 2008; May 8, 2009; May 7, 2010; May 6, 2011; May 4, 2012; May 3, 2013; May 2, 2014; May 1, 2015, April 29, 2016, April 28, 2017, April 27, 2018, May 3, 2019, May 3, 2022 (and to AP juniors/seniors, see above).

Developed and led seminar on Research and Professional Ethics, attended by REU students, July 24, 2008; June 18, 2015.

Edward Teller: Friend or Fiend? (to APAM graduate students, Fall 2011; to APAM juniors and seniors in A.P. E4901/4903, Fall 2011 and Fall 2016, see above)

Taught minicourse at Hebrew University in Jerusalem, Spring, 2001, on Optical Analysis of Surfaces and Thin Films

Who Invented the Laser?: A Play in Four Acts (to APAM graduate students, c. 1995)

Recent Selected Outreach Activities

Co-developed presentations for the Columbia Engineering Outreach Programs office: the Banana Kelly High School from the Bronx on May 2, 2017 (team of 10, including the teacher) and from Thornton HS from Mt. Vernon, NY on May 4, 2017 (team of ~27, including teachers); New Canaan, CT public schools, April 24, 2018 (20 7th grade students); NYC Museum High School, March 13, 2019 (30 students), Visit from the Hostos Community College, Nov. 15, 2019 (~20 students).

Developed and led a presentation for 20-25 students from the middle school Urban Assembly Academy for Future Leaders: Engineering 101: Engineering and the Smartphone, as part of the Middle School College Fair on March 16, 2017 at Columbia University run by the New York City Department of Education College Access for All: Middle School, for 500 7th graders from 20 schools in Harlem and the Bronx.

Columbia Engineering School Outreach program made lesson plans for hands-on engineering activities for K-12 teachers and students to give them a taste of the scientific research being done at SEAS, in light of the public health crisis. One of the lessons "Applied Physics: Nanomaterials, Light, and Wavelengths" is made based on our outreach materials in the past. (2020)

Columbia University Service on Committees and Panels

1995 – 1996	University Security Committee
1997 – present	University Laboratory Safety Committee
1999 – 2005	Faculty Advisory Council, Columbia-Barnard Hillel
2000 – 2002	University Science Space Committee
2000 – 2001	University Standing Committee on Copyright Policy
2005- present	Institutional Health & Safety Council
2006- present	EHS Steering Committee Meeting
~2000-2012	CISE Executive Committee
~2000-2015	Clean Room Committee
2011-2014	Shared Materials Characterization Laboratory Committee (chair)
2012-present	Joint A&S/SEAS Task Force on Shared Facilities for Nanoscience

2013-2014	SEAS 150th Anniversary Planning Committee (developed slide-show, virtual time capsules of for the 15 SEAS decades)
2013	SEAS Presidential Fellowship Selection Committee
2015-2018	Shared Facilities and Electron Microscopy Committees
2016 - 2020	Served on the "The Tenure Process Panel" in the Columbia University "SEAS Path to the Professorship Workshop" for graduate students (10/28/16, 10/27/17, 11/2/18, 11/22/19, 10/23/20.)
2017-2021	Columbia University Senate, Member 2017-20 Committees: Education; Faculty Affairs, Academic Freedom, and Tenure; SPS Subcommittee (2018-9), Sustainability Task Force (2020-)

APAM Department service has included: Chair for nine years; Vice Chair for six years; Head of Graduate Committee and Admissions; Undergraduate Advisor; Faculty Search Committees, including the 2015 APAM Materials Search Committee (chair), 2018-19 APAM Medical Physics Search Committee (chair)

Other Professional Activities

Currently: Referee for Applied Physics Letters, Journal of Applied Physics, Applied Physics, Journal of Vacuum Science and Technology, Journal of Chemical Physics.

2016: Queens College of CUNY, Department of Physics advisory committee

2016: Texas A&M materials advisory committee

2005-2009: Advisory Committee: Univ. of Wisconsin, Madison MRSEC

2006, 2008, 2010, 2013, 2016, 2018: Served on NSF panel.

2005: Served on NSF NER panel.

2002: Chair, MRSEC Directors' Working Group on Facilities

2002: Served on NSF Career Award panel.

2002: Served on NSF NIRT review panel.

1997, 1998: Served on Lawrence Livermore National Laboratory - Materials Research Institute review panel.

1997 Session Leader during Diagnostics session in Gordon Conference on Electronic Materials: Chemistry, Excitation and Processing.

1997: Served on NSF Major Research Instrumentation review panel.

1996 Consultant to the Department of Justice on laser development.

1996 Served on NSF Career Awards review panel.

1995 Session Leader during Diagnostics session in Gordon Conference on Chemistry in Electronics Materials.

1988 - 1991: Advisory Board Member for the improvement of 9th grade science education in New York City (NSF grant on Partnership in Technology for the Physical Sciences).

1987 - 1990: Interviewer for Fannie and John Hertz Foundation.

Group Awards

Nicholas Fuller, November 1, 2001 awarded the John Coburn and Harold Winters Student Award from the Plasmas Sciences and Technology Division of the American Vacuum Society and "is presented to the student whose paper is judged to be most outstanding based on technical content and quality of presentation."

Nicholas Fuller, May, 2001, American Vacuum Society Graduate Research Award. This award was established to recognize and encourage excellence in graduate studies in the sciences and technologies of interest to the AVS.

Ph.D. Theses Supervised (21)

David E. Kotecki, Nucleation and Growth of Silicon Thin Film Microstructures by Localized Laser Chemical Vapor Deposition, University of California, Davis, 1988. (Prof., EE, University of Maine)

Hua Tang, The Raman Diagnostics and Process Physics of Laser-Induced Surface Modifications, Columbia University, 1992. (was at Novellus)

Judah A. Tuchman, The Effect of Hydrostatic Pressure on II-VI Strained Layer Heterostructures, Columbia University, 1992. (Nobska Ventures)

Zhifeng Sui, The Effects of Strain and Confinement on the Optical Properties of Group IV Semiconductor Structures, Columbia University, 1993. (Applied Materials)

Hubert H. Burke, Optical Spectroscopy and Growth of GeSi Alloys, Columbia University, 1995. (was Prof. at Rutgers, now Lecturer at Trent University)

Sangsig Kim, The Effect of Hydrostatic Pressure on Light Emitting Semiconductors, Columbia University, 1996. (Prof., EE, Korea University)

Resul Eryigit, Theoretical Analysis of the Optical Properties of GaAs(001) Surfaces and the Strain-Dependent Lattice Properties of Semiconductors, Columbia University, 1997. (Prof., Physics, Abant Izzet Baysal University)

Jae Young Choe, Optical Monitoring of Surface Adlayers by Laser Induced Thermal Desorption During the Plasma Etching of Semiconductors, Columbia University, 1999. (Army Research Lab)

Bosang Kim, Optical Properties of Three-Dimensional Arrays of Semiconductor Nanocrystals, Columbia University, 2000. (was at IBM)

Jonathan Spanier, Optical and Electrochemical Properties of Nanoscale Materials, Columbia, University, 2001. (Assoc. Prof., Materials Science and Engineering, Drexel University)

Nicholas Fuller, Controlling the Relative Rates of Adlayer Formation and Removal during Etching in Inductively Coupled Plasmas, Columbia, University, 2002. (IBM)

Mohammad Islam, Electrophoretic Deposition of Multifunctional Nanocrystal Films, Columbia University, 2003. (was Assistant Prof., Physics, American University of Sharjah, now Assistant Prof. SUNY Oswego)

Richard Robinson, Phase Transitions in Metal Oxide Nanoparticles as Studied by Raman Scattering, Columbia University, 2004. (Assistant Prof., Materials Science and Engineering, Cornell)

Shengguo Jia, Mechanism of the Electrophoretic Deposition of CdSe Nanocrystal Films and Their Mechanical Properties, Columbia University, 2008. (was Postdoc, Texas A&M)

Wei Wang, The Formation and Optics of Nanomaterials: The Synthesis and Assembly of CdSe Nanorods and Catalytic Study of Au-doped Nano Ceria, Columbia University, 2009. (was Postdoc, Houston)

Austin Akey, Nanomaterials from Nanocomponents: Synthesis and Properties of Hybrid Nanomaterials, Columbia University, 2011. (Postdoc, Harvard/MIT)

Theodore (Dory) Kramer, Functional Nanocomposites formed by Two-step Back-Filling Methods, Columbia University, 2013. (Exponent)

Datong Zhang, Hybridization of van der Waals Materials and Close-Packed Nanoparticle Monolayers, Columbia University, 2016. (Hermes Microvision)

Dennis Zi-Ren Wang (shared), Optical and Electronic Studies of Air-Sensitive van dee Waals Materials Encapsulated by Hexagonal Boron Nitride, Columbia University, 2018.

Jiayang Hu, Two-Dimensional Self-Assembly of Nanoparticles at Liquid Interfaces, Columbia University, 2021.

Xiang Hua, Processing and Properties of van der Waals Materials at Elevated Temperature, Columbia University, 2022.

Postdoctoral Scientists Supervised (7)

Gregory Pazionis (European Patent Office) 1987-89

Sylvana Mercone (Assistant Prof., Univ. Paris) 2006

Sarbajit Banerjee (tenured Associate Prof., Chemistry, Buffalo University, SUNY; now Prof. Chem, Texas A&M) 2004-07

Youjin Lee 2010-12

Chenguang Lu (and Associate Research Scientist, now National Center for Nanoscience and Technology) 2010-13

James Dickerson (was tenured Associate Prof., Physics and Astronomy, Vanderbilt University; Associate Director, Nanocenter, BNL; now Chief Scientific Officer, Consumer Reports) 2011-13

Seung Whan Lee (Institution: National Fusion Research Institute) 2012-2013

Other Students recently working in the Herman Group (U: undergrad, REU, M: masters)

Academic 1987: Alfredo Cubina (U)

Academic 1994-1995: Laurie Gertner (now Calvet) (U)

Summer 1999: Pablo Goldenzweig (REU), Elliot Doomes (REU)

Academic 1999-2000: Andrew Miller (U)

Summer 2000: James Munro (REU)

Academic 2000-2001: Joseph Zinter (U)

Summer 2001: Timothy McDonald (REU), Benjamin Jarvis (REU)

Academic 2001-2002: Dae Kim (M), Matthew Xia (U), Juan Hodelin (U), Jerome Hyun (U)

Summer 2002: Matthew Xia (U), Ashley Smith (REU), Ben Kraines (REU)

Academic 2002-2003: Dae Kim (M), Matthew Xia (U), Robert Broesler (U), Jeremy Stein (M), Sean Polvino (M)

Summer 2003: Matthew Xia (U), Ben Smith (REU)

Academic 2003-2004: Dae Kim (M), Matthew Xia (U), Robert Broesler (U), Andrea Young (U)

Summer 2004: Matthew Xia (U), Chris Cheng (REU)

Academic 2004-2005: Yikang Deng (M); Robert Broesler (U), Emily Hwang (U)

Summer 2005: Emily Hwang (REU)

Academic 2005-2006: Emily Hwang (U), Blake Rego (U), Manav Malhatro (U)
Summer 2006: Kellen Petersen (REU)
Academic 2006-2007: Blake Rego (U), Manav Malhatro (U), Edmond Cheng (U), Nathan Weiss (U), Ying Yi Dang (U), Jonathan BenTov (U)
Summer 2007: Kareem Douglas (REU)
Academic 2007-2008: Ivy Chen (U), Clayton Dahlman (U), Mitchell Rubenstein (U)
Summer 2008: John Thompson (REU)
Academic 2008-2009: Josie Bailey (U), Ivy Chen (U), Nathan Weiss (U)
Academic 2009-2010: Clayton Dahlman (U), Dylan Liu (U), Po-I WU (M), Guanghui He (M)
Academic 2010-2011: Clayton Dahlman (U), Annabel Chew (U), Derek Huang (U), Rohit Prasanna (U), Po-I Wu (M), Guanghui He (M)
Academic 2011-2012: Annabel Chew (U), Clayton Dahlman (recent U), Derek Huang (U), Jonathan Liu (U)
Summer 2012: Eric Borczuk (U), Jonathan Liu (U)
Academic 2012-2013: Annabel Chew (U), Derek Huang (U), Jonathan Liu (U), William Deng (U), Sloka Gundala (U), Wei Shen (M), Isaac Wu (M)
Summer 2013: William Deng (U), Sloka Gundala (U), Jonathan Liou (U), Jonathan Liu (U)
Academic 2013-2014: Richard Creswell (U), Jonathan Liu (U), William Deng (U), Sloka Gundala (U), Brandon Jonathan Liou (U); Brady Pan (U); Wei Shen (M), Isaac Wu (M), Xiaodi Zhong (M), Fan Ye (M), Yitao Chen (M), Jiayang Hu (M), Brandon Yu-Chen Huang (U)
Summer 2014: Jiayang Hu (M)
Academic 2014-2015: Richard Creswell (U), Kathleen Kennedy (U), Robyn Ridley (U), Elizabeth Cheyeon Yoo (U); Fall: Xiaodi Zhong (M), Fan Ye (M), Yitao Chen (M), Jiayang Hu (M); Spring: Lin Liu (M), Xianda Chen (M), Haoran Liang (M), Yuanye Huang (M)
Summer 2015: Kathleen Kennedy (U)
Academic 2015-2016: Kathleen Kennedy (U), Adam Jaffe (U); Fall: Lin Liu (M), Xianda Chen (M), Haoran Liang (M), Yuanye Huang (M); Spring: Fangchao Jian (M); Qingrui Cao (M); Qi Shao (visiting PhD student from HKST)
Summer 2016: Kori Smyser (U, REU), Jing Luo (U)
Academic 2016-2017: Evan Walter Clark Spotte-Smith (U); Fall: Fangchao Jian (M); Qingrui Cao (M); Zilong Wang (MS); Ge Chen (M); Ni Huo (M)
Summer 2017: Jason Cardarelli (U, REU), Brady Pan (U), Christian Adrian Cruz Godoy (U)

Academic 2017-2018: Evan Walter Clark Spotte-Smith (U), Brady Pan (U), Roy Garcia (U), Mateo Navarro Goldaraz (U), Theodor Axenie (U); Fall: Ni Huo (M), Shuhan Bao (M), Yujia Meng (M)
Summer 2018: Takuma Makihara (U, REU), Yujia Meng (M)
Academic 2018-2019: Evan Walter Clark Spotte-Smith (U), Roy Garcia (U), Mateo Navarro Goldaraz (U), Theodor Axenie (U); Michael Wahrman (U), Shuhan Bao (M), Yujia Meng (M)
Academic 2019-2020: Mateo Navarro Goldaraz (U), Theodor Axenie (U); Michael Wahrman (U)

Teachers working in the Herman Group during the summer:
Mary-Anne Garcia (1999, 2000)
Tonya Springer-Caudal (2003, 2004)
EDwin Cher Chuan Lim, Victoria Junior College (Singapore) (2005)
Ghulam Firdaus (2005, 2006)
(Michael) Low Kuan Meng, Serangoon Junior College (Singapore) (2006)
(Jonathan) Scott Misner (2007, 2008)
(Kerry) Paige Teamey (2010, 2011)
Sabrina Hussain (2013)

Courses Taught at Columbia University

Term	Course Number	Course Name	Enrollment
Spring '87	A.P. E4112	Quantum Electronics	26
Fall '87	A.P. E6110*	Laser Interactions with Matter	18
Spring '88	A.P. E4112	Quantum Electronics	23
Fall '88	A.P. E4110**	Modern Optics	12
Spring '89	A.P. E4112	Quantum Electronics	33
Fall '89	A.P. E4110	Modern Optics	13
Spring '90	A.P. E4112	Quantum Electronics	28
	E.E. E6403	Electromagnetic Theory	6
Fall '90	A.P. E4100*	Quantum Physics of Matter	19
Spring '91	A. P. E6110	Laser Interactions with Matter	19
Fall '91	A.P. E4100	Quantum Physics of Matter	22
Spring '92	A.P. E4018	Applied Physics Laboratory	12
Fall '92	A.P. E4100	Quantum Physics of Matter	13

	A.P. E9142	Seminar: Optical Diagnostics in Thin Film Processing	10
Spring '93	A.P. E4018	Applied Physics Laboratory	10
Fall '93	A.P. E4100	Quantum Physics of Matter	12
	Met. Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	36
Spring '94	sabbatical leave		
Fall '94	A.P. E4100	Quantum Physics of Matter	20
	A.P. E4901/4903	Seminar in Applied Physics	14
Spring '95	A.P. E4018	Applied Physics Laboratory	14
	A.P. E6110	Laser Interactions with Matter	11
Fall '95	A.P. E4100	Quantum Physics of Matter	19
	Met. Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	27
Spring '96	A.P. E4018	Applied Physics Laboratory	10
Fall '96	A.P. E4100	Quantum Physics of Matter	16
	A.P. E4901/4903	Seminar in Applied Physics	9
Spring '97	A.P. E1300***	Physics of the Human Body	14
	A.P. E4112	Quantum Electronics	14
Fall '97	A.P. E4100	Quantum Physics of Matter	11
	A.P. E4901/4903	Seminar in Applied Physics	11
Spring '98	A.P. E1300	Physics of the Human Body	46
Fall '98	A.P. E4100	Quantum Physics of Matter	20
Spring '99	A.P. E4018	Applied Physics Laboratory	17
	A.P. E1300	Physics of the Human Body	44
Fall '99	A.P. E4100	Quantum Physics of Matter	16
	A.P. E6110	Laser Interactions with Matter	16
Spring '00	A.P. E1300	Physics of the Human Body	26
Fall '00	A.P. E4100	Quantum Physics of Matter	10
Spring '01	sabbatical leave		
Fall '01	A.P. E4100	Quantum Physics of Matter	13
Spring '02	A.P. E4018	Applied Physics Laboratory	9
	A.P. E1300	Physics of the Human Body	28
Fall '02	A.P. E4100	Quantum Physics of Matter	12
Spring '03	A.P. E1300	Physics of the Human Body	32
Fall '03	A.P. E4100	Quantum Physics of Matter	20

Spring '04	A.P. E4112	Laser Physics	8
	A.P. E1300	Physics of the Human Body	40
Fall '04	A.P. E4100	Quantum Physics of Matter	22
Spring '05	A.P. E1300	Physics of the Human Body	24
Fall '05	A.P. E4100	Quantum Physics of Matter	23
Spring '06	A.P. E1300	Physics of the Human Body	17
	A.P. E3100****	Introduction to Quantum Mechanics	26
	A.P. E4018*****	Applied Physics Laboratory	18
Fall '06	A.P. E4100	Quantum Physics of Matter	27
Spring '07	A.P. E1300	Physics of the Human Body	18
Fall '07	A.P. E4100	Quantum Physics of Matter	29
Spring '08	A.P. E1300	Physics of the Human Body	12
Fall ’08	A.P. E4110	Modern Optics	10
Spring '09	A.P. E1300	Physics of the Human Body	17
Fall ’09	MSE/A.P. E4090	Nanotechnology	15
	A.P. E4901/4903******	Seminar in Applied Physics	17
Spring '10	A.P. E1300	Physics of the Human Body	14
Fall ’10	MSE/A.P. E4090	Nanotechnology	12
Spring '11	A.P. E1300	Physics of the Human Body	11
Fall ’11	A.P. E4901/4903	Seminar in Applied Physics	29
Spring '12	A.P. E3100	Introduction to Quantum Mechanics	13
Fall '12 sabbatical leave			
Spring ’13	A.P. E1300	Physics of the Human Body	12
	A.P. E3100	Introduction to Quantum Mechanics	13
Fall ’13	A.P. E4901/4903	Seminar in Applied Physics	21
	A.P. E6110	Laser Interactions with Matter	13
Spring ’14	A.P. E3100	Introduction to Quantum Mechanics	12
Fall ’14	A.P. E4100	Quantum Physics of Matter	21
Spring ’15	A.P. E3100	Introduction to Quantum Mechanics	17
Fall '15 sabbatical leave			
Spring ’16	A.P. E3100	Introduction to Quantum Mechanics	13
	A.P. E3400	Physics of the Human Body	10
Fall ’16	A.P. E4901/4903	Seminar in Applied Physics	24
	A.P. E6110	Laser Interactions with Matter	11
Spring ’17	A.P. E3100	Introduction to Quantum Mechanics	10
	MSAE *E4201******	Materials Thermodynamics	

		and Phase Diagrams	39
Fall ’17	A.P. E4901/4903	Seminar in Applied Physics	23
	Met. Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	21
Spring ’18	A.P. E3100	Introduction to Quantum Mechanics	12
Fall ’18	Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	13
Spring ’19	A.P. E3100	Introduction to Quantum Mechanics	21
Fall ’19	Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	13
Spring ’20	A.P. E3100	Introduction to Quantum Mechanics	14
Fall ’20	Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	19
Spring ’21	A.P. E3100	Introduction to Quantum Mechanics	16
Fall ’21	Mat. Sci. E3111	Thermodynamics, Kinetic Theory, and Statistical Mechanics	14
Spring ’22	A.P. E3100	Introduction to Quantum Mechanics	13

* Introduced new course.

** Co-introduced new course with T. C. Marshall.

*** Introduced new course targeted for freshmen/sophomores.

**** Co-taught with Pedersen; IPH taught ~85%.

***** Co-taught with Pedersen and Mauel; IPH taught ~15%.

****** Co-taught with Venkataraman; IPH taught ~50%.

******* Co-taught with Noyan, IPH taught ~1/3; 8 lectures, on Stat Mech