

## CV of Frederick Charles Wellstood

Department of Physics, University of Maryland at College Park

### **Educational Background**

#### *Ph.D. in Physics*

University of California, Berkeley, CA, December, 1988.

Thesis Title: "Excess Noise in the dc SQUID; 4.2 K to 20 mK"

Advisor: Professor John Clarke

#### *A.B. in Physics*

University of California, Berkeley, CA, December 1979.

### **Employment Background:**

#### *Fellow of the Joint Quantum Institute*

Department of Physics, University of Maryland, College Park  
(from September 2006 to present).

#### *Professor of Physics*

Center for Nanophysics and Advanced Materials  
(Center's name changed from Center for Superconductivity Research on July 1, 2007)  
Department of Physics, University of Maryland, College Park  
(from July 2002 to present).

#### *Affiliate Professor*

Department of Electrical and Computer Engineering  
University of Maryland, College Park  
(From January 1, 2006 to June 30, 2009)

#### *Associate Chair for Undergraduate Education, Physics*

Department of Physics, University of Maryland, College Park  
(from July 1999 to July 2004).

#### *Associate Professor of Physics*

Center for Superconductivity Research  
Department of Physics, University of Maryland, College Park  
(from July 1997 to July 2002).

#### *Assistant Professor of Physics*

Center for Superconductivity Research  
Department of Physics, University of Maryland, College Park  
(half-time from January 1991 to June 1991, full-time from July 1991 to July 1997).

#### *Postdoctoral Fellow*

under Professor John Clarke, Department of Physics, University of California, Berkeley, CA; and Center for Advanced Materials, Material Sciences Division, Lawrence Berkeley Laboratory, Berkeley, CA 94720, (December 1988 to June 1991). Developed first multilayer interconnect technology for high- $T_c$  superconductors.

### *Graduate Student Research Assistant*

under Professor John Clarke, Department of Physics, University of California at Berkeley, and Materials and Chemical Sciences Division, Lawrence Berkeley Laboratory, Berkeley, CA 94720 (October 1982 to November 1988).

### *Graduate Student Teaching Assistant*

Department of Physics, University of California, Berkeley (September 1980 to June 1982.)

### *Student Intern*

under Dr. Darwin Ellis, Schlumberger-Doll Research Center, Ridgefield, Conn. 06877, (January 1980 to September 1980, and June 1979 to September 1979). Developed and used computer programs which simulated electron and gamma ray transport in oil well boreholes for the purpose of determining the chemical composition of the surrounding matrix.

## **2. Research, Scholarly, and Creative Activities**

### **2.a. Books**

none

### **2.b. Articles in refereed journals**

1. "[Integrated dc SQUID magnetometer with a high slew rate](#)", F. C. Wellstood, C. Heiden, and J. Clarke, Rev. Sci. Instrum. **55**, 952 (1984).
2. "[Low Frequency Noise in Nb-Al<sub>2</sub>O<sub>3</sub>-Nb Josephson Tunnel Junctions](#)", B. Savo, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **50**, 1757 (1987).
3. "Upper Limit on the Resistivity of La<sub>1.85</sub>Sr<sub>0.15</sub>CuO<sub>4</sub>", F. C. Wellstood, M. J. Ferrari, J. Clarke, A. M. Stacy, A. Zettl, and M. L. Cohen, Phys. Lett. A, **122**, 61 (1987).
4. "Excess Noise in dc SQUIDs from 4.2 K to 0.022 K", F. C. Wellstood, C. Urbina, and J. Clarke, IEEE Trans. Magn., **MAG-23**, 1662 (1987). [[PDF Full-Text \(488KB\)](#)]
5. "[Low Frequency Noise in dc Superconducting Quantum Interference Devices Below 1K](#)", F. C. Wellstood, C. Urbina, and J. Clarke, Appl. Phys. Lett., **50**, 772 (1987).
6. "Excess Noise in the dc SQUID: 4.2 K to 20 mK", F. C. Wellstood, Ph.D. Thesis, University of California, Berkeley (1988).
7. "[Response to ``Comment on `Low-frequency excess noise in Nb-Al<sub>2</sub>O<sub>3</sub>-Nb Josephson tunnel junctions`](#)", B. Savo, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **52**, 2001 (1988).
8. "[Magnetic flux noise in thin-film rings of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-d</sub>](#)", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. Clarke, P. A. Rosenthal, R. H. Hammond, and M. R. Beasley, Appl. Phys. Lett. **53**, 695 (1988).
9. "Particle Detection with Semiconductor Thermistors at Low Temperatures", N. Wang, J. Beeman, A. N. Cleland, A. Cummings, E. E. Haller, A. Lange, R. Ross, B. Sadoulet, H. Steiner, T. Shutt, and F. C. Wellstood, IEEE Trans. Nuc. Sci. **36**, 852 (1989). [[PDF Full-Text \(540KB\)](#)]
10. "Low Magnetic Flux Noise Observed in Laser-deposited *in situ* Films of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>y</sub> and Implications for High T<sub>c</sub> SQUIDs", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. Clarke, A. Inam, X. D. Wu, L. Nazar, and T. Venkatesan, Nature **341**, 723 (1989).

11. "Flux Noise and Flux Creep in YBCO Thin Films", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. Clarke, P. A. Rosenthal, R. H. Hammond, and M. R. Beasley, IEEE Trans. Magn., **MAG-25**, 806 (1989). [[PDF Full-Text \(320KB\)](#)]
12. "Hot Electron Effect in the dc SQUID", F. C. Wellstood, C. Urbina, and J. Clarke, IEEE Trans. Magn., **MAG-25**, 1001 (1989). [[PDF Full-Text \(356KB\)](#)]
13. "[Hot-electron limitation to the sensitivity of the dc superconducting quantum interference device](#)", F. C. Wellstood, C. Urbina, and J. Clarke, Appl. Phys. Lett. **54**, 2599 (1989).
14. "[Electrical and thermal properties of neutron-transmutation-doped Ge at 20 mK](#)", N. Wang, F. C. Wellstood, B. Sadoulet, E. E. Haller, and J. Beeman, Phys. Rev. B. **41**, 3761, (1990). [[PROLA Link](#)]
15. "[Distribution of Flux Pinning Energies in YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> and Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+x</sub> from Flux Noise](#)", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. Clarke, D. Mitzi, P. A. Rosenthal, C. B. Eom, T. H. Geballe, A. Kapitulnik, and M. R. Beasley, Phys. Rev. Lett. **64**, 72 (1990).
16. "[Multilayer YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>-SrTiO<sub>3</sub>-YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Films for Insulating Crossovers](#)", J. J. Kingston, F. C. Wellstood, P. Lerch, A. H. Miklich, and J. Clarke, Appl. Phys. Lett. **56**, 189 (1990).
17. "[Josephson weak links in thin films of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> induced by electrical pulses](#)", D. Robbes, A. H. Miklich, J. J. Kingston, P. Lerch, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **56**, 2240 (1990).
18. "[Superconducting Thin-Film Multiturn Coils of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>](#)", F. C. Wellstood, J. J. Kingston, and J. Clarke, Appl. Phys. Lett. **56**, 2336 (1990).
19. "[Superconducting thin-film flux transformers of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>](#)", F. C. Wellstood, J. J. Kingston, M. J. Ferrari, and J. Clarke, Appl. Phys. Lett. **57**, 1930 (1990).
20. "Reply to "Flux-Pinning Energies in High-T<sub>c</sub> Superconductors"", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. Clarke, D. Mitzi, P. A. Rosenthal, C. B. Eom, T. H. Geballe, A. Kapitulnik, and M. R. Beasley, Phys. Rev. Lett. **65**, 279 (1990). [[PROLA Link](#)]
21. "[Random telegraph signals in high-temperature superconductors](#)", M. Johnson, M. J. Ferrari, F. C. Wellstood, J. Clarke, M. R. Beasley, A. Inam, X. D. Wu, and T. Venkatesan, Phys. Rev. B **42**, Rapid Communications, 10792 (1990).
22. "[Erratum: Josephson weak links in thin films of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> induced by electrical pulses \[Appl. Phys. Lett. \*\*57\*\*, 1169 \(1990\)\]](#)", D. Robbes, A. H. Miklich, J. J. Kingston, Ph. Lerch, F. C. Wellstood, and John Clarke Appl. Phys. Lett. **57**, 1169 (1990)
23. "[Flux Noise from Superconducting YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Flux Transformers](#)", M. J. Ferrari, J. J. Kingston, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **58**, 1106 (1991).
24. "[Heteroepitaxial YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>-SrTiO<sub>3</sub>-YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> Trilayers Examined by Transmission Electron Microscopy](#)", M. E. Tidjani, R. Gronsky, J. J. Kingston, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **58**, 765 (1991).
25. "[Magnetic Flux Noise in High-T<sub>c</sub> Superconductors](#)", M. Johnson, M. J. Ferrari, F. C. Wellstood, and J. Clarke, Phys. Rev. Lett. **66**, 1799 (1991).
26. "Low Frequency Noise in Resonant Josephson Soliton Oscillators", J. B. Hansen, T. Holst, F. C. Wellstood, J. Clarke, IEEE Trans. on Magn., **MAG-27**, 3343 (1991). [[PDF Full-Text \(264KB\)](#)]
27. "Photolithographically Patterned Thin-film Multilayer Devices of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>", J. J. Kingston, F. C. Wellstood, D. Quan, and J. Clarke, IEEE Trans. on Magn., **MAG-27**, 974 (1991). [[PDF Full-Text \(400KB\)](#)]
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30. "Suppression of Magnetic Flux Noise in  $YBa_2Cu_3O_{7-x}$  by a Supercurrent", M. J. Ferrari, F. C. Wellstood, J. J. Kingston, and J. Clarke, Phys. Rev. Lett. **67**, 1346 (1991). [[PROLA Link](#)]
31. "[Sensitive  \$YBa\_2Cu\_3O\_{7-x}\$  thin-film magnetometer](#)", A. H. Miklich, J. J. Kingston, F. C. Wellstood, J. Clarke, M. S. Colclough, K. Char, and G. Zaharchuk, Appl. Phys. Lett. **59**, 988 (1991).
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33. "Thin-film High Temperature Superconducting Flux Transformers Coupled to SQUIDS", F. C. Wellstood, A. H. Miklich, J. J. Kingston, M. J. Ferrari, J. Clarke, M. S. Colclough, K. Char, and G. Zaharchuk, *Superconducting Devices and Their Applications*, eds. H. Koch and H. Lubbig, (W. de Gruyter Press, Berlin, 1992), p 162.
34. "Thin-film YBCO Magnetometer", A. H. Miklich, F. C. Wellstood, J. J. Kingston, J. Clarke, M. S. Colclough, K. Char, and G. Zaharchuk, Nature **352**, 482 (1991).
35. "The Virgin Curve for Microwave Magnetoabsorption in Micron-Size Powders of Cuprate Superconductors", A. Gould, S. M. Bhagat, F. C. Wellstood, and S. Tyagi, Solid State Communications **81**, 339 (1992).
36. "High- $T_c$  Superconducting Multilayers for SQUID Magnetometers", J. Clarke, J. J. Kingston, A. H. Miklich, and F. C. Wellstood, Physica Scripta T **42**, 51 (1992).
37. "[One-dimensional magnetic flux microscope based on the dc superconducting quantum interference device](#)", A. Mathai, D. Song, Y. Gim, and F. C. Wellstood, Appl. Phys. Lett. **61**, 598 (1992).
38. "High Resolution Magnetic Microscopy Using a dc SQUID", A. Mathai, D. Song, Y. Gim, and F. C. Wellstood, IEEE Trans. on Appl. Supercond. **3**, 2609 (1993). [[PDF Full-Text \(684KB\)](#)]
39. "SQUID Milliatovoltometry of  $YBa_2Cu_3O_7$  Thin Films: Dissipation in Low Magnetic Fields", F. C. Wellstood, M. J. Ferrari, J. J. Kingston, T. J. Shaw, and J. Clarke, Phys. Rev. Lett. **70**, 89 (1993). [[PROLA Link](#)]
40. "[Magnetic microscopy using a liquid nitrogen cooled  \$YBa\_2Cu\_3O\_7\$  superconducting quantum interference device](#)", R. C. Black, A. Mathai, F. C. Wellstood, G. Dantsker, A. H. Miklich, D. T. Nemeth, J. J. Kingston, and J. Clarke, Appl. Phys. Lett. **62**, 2128, (1993).
41. "[Electric field effect control of a superconducting  \$YBa\_2Cu\_3O\_7\$  inductor](#)", Y. Gim, C. Doughty, X. X. Xi, A. Amar, T. Venkatesan, and F. C. Wellstood, Appl. Phys. Lett. **62**, 3198 (1993).
42. "Magnetic Microscopy Using Superconducting Quantum Interference Devices", F. C. Wellstood, R. C. Black, A. Mathai, D. Song, Y. Gim, G. Dantsker, A. H. Miklich, D. T. Nemeth, J.J. Kingston, J. Clarke, INTERMAG '93, Digest of International Magnetism Conference, April 13-16, 1993, Pages:DA-02 - DA-02 [[PDF Full-Text \(136KB\)](#)]
43. "[Eddy current microscopy using a 77-K superconducting sensor](#)", R. C. Black, F. C. Wellstood, E. Dantsker, A. H. Miklich, J. J. Kingston, D. T. Nemeth and J. Clarke, Applied Physics Letters **64**, 100 (1994).
44. "[Hot-electron effects in metals](#)", F. C. Wellstood, C. Urbina, and J. Clarke, Phys. Rev. B **49**, 5942 (1994). [[PROLA Link](#)]
45. "Magnetic Flux Noise in Copper Oxide Superconductors", M. J. Ferrari, M. Johnson, F. C. Wellstood, J. J. Kingston, T. J. Shaw, and J. Clarke, Jour. Low Temp. Phys. **94**, 15 (1994).

46. "[2e to e periodic pair currents in superconducting Coulomb-blockade electrometers](#)", A. Amar, D. Song, C. J. Lobb and F. C. Wellstood, Phys. Rev. Lett. **72**, 3234, (1994).
47. "[Thin-film multilayer interconnect technology for  \$YBa\_2Cu\_3O\_{7-x}\$](#) ", Invited, Journal of Applied Physics (Applied Physics Reviews) **75**, 683 (1994).
48. "Experimental Determination of the Symmetry of the Order Parameter in YBCO", A. Mathai, Y. Gim, R. C. Black, A. Amar, and F. C. Wellstood, Journal of Superconductivity **8**, no 1, 1995.
49. "[Imaging radio-frequency fields using a scanning SQUID microscope](#)", R. C. Black, F. C. Wellstood, E. Danstker, A. H. Miklich, D. T. Nemeth, D. Koelle, F. Ludwig, and J. Clarke, Appl. Phys. Lett. **66**, 1267, (1995).
50. "Using a Scanning SQUID to Determine the Symmetry of the Order Parameter in YBCO", A. Mathai, Y. Gim, R. C. Black, A. Amar, and F. C. Wellstood, IEEE Trans. on Appl. Superconductivity **5**, 3233 (1995). [[PDF Full-Text \(384KB\)](#)]
51. "Advantages of Superconducting Coulomb-Blockade Electrometers", D. Song, A. Amar, C. J. Lobb and F. C. Wellstood, IEEE Trans. on Appl. Supercond. **5**, (1995). [[PDF Full-Text \(396KB\)](#)]
52. "High-Frequency Microscopy Using a High- $T_c$  SQUID", R. C. Black, F. C. Wellstood, E. Danstker, A. H. Miklich, D. Koelle, F. Ludwig and J. Clarke, IEEE Trans. on Appl. Superconductivity **5**, 2137 (1995). [[PDF Full-Text \(500KB\)](#)]
53. "[Experimental proof of a time-reversal-invariant order parameter with a pi shift in  \$YBa\_2Cu\_3O\_7\$](#) ", A. Mathai, Y. Gim, R. C. Black, A. Amar, and F. C. Wellstood, Phys. Rev. Lett. **74**, 4523, (1995). [[PROLA Link](#)]
54. "[Application of single electron tunneling: Precision capacitance ratio measurements](#)", A. F. Clark, Neil M. Zimmerman, Edwin R. Williams, A. Amar, D. Song, F. C. Wellstood, C. J. Lobb, and R. J. Soulen, Appl. Phys. Lett. **66**, 2588 (1995).
55. "[Microwave microscopy using a superconducting quantum interference device](#)", R. C. Black, F. C. Wellstood, E. Dantsker, A. H. Miklich, D. T. Nemeth, D. Koelle, F. Ludwig, J. Clarke, Appl. Phys. Lett, **66**, 99 (1995).
56. "Symmetry of the Phase of the Order Parameter in  $YBa_2Cu_3O_{7-\delta}$ ", Y. Gim, A. Mathai, R. C. Black, A. Amar, and F. C. Wellstood, Invited, Journal de Physique **6**, 2299 (1996).
57. "[Near-field scanning microwave microscope with 100  \$\mu\$  m resolution](#)", C. P. Vlahacos, R. C. Black, S. M. Anlage, A. Amar, and F. C. Wellstood, Appl. Phys. Lett. **69**, 3272 (1996).
58. "Scanning Microwave Microscopy of Active Superconducting Microwave Devices", S. M. Anlage C. P. Vlahacos, S. Dutta and F. C. Wellstood, IEEE Trans. on Applied Superconductivity **7**, 3686 (1997). [[PDF Full-Text \(1140KB\)](#)]
59. "35  $\hbar$  Two-stage SQUID System for Gravity Wave Detection", I. Jin, A. Amar, T. R. Stevenson, F. C. Wellstood, A. Morse, and W. W. Johnson, IEEE Trans. on Applied Superconductivity **7**, 2742 (1997). [[PDF Full-Text \(680KB\)](#)]
60. "Angular Dependence of the Symmetry of the Order Parameter in  $YBa_2Cu_3O_{7-\delta}$ ", Y. Gim, A. Mathai, R. Black, A. Amar, and F. C. Wellstood, IEEE Trans. on Appl. Superconductivity **7**, 2331 (1997). [[PDF Full-Text \(500KB\)](#)]
61. "Superconducting Coulomb-blockade Electrometers with Tunable Josephson Coupling", A. Amar, D. Song, C. J. Lobb, and F. C. Wellstood, IEEE Trans. on Appl. Superconductivity **7**, 3544 (1997). [[PDF Full-Text \(332KB\)](#)]
62. "Understanding the Behavior of Superconducting Coulomb Blockade Electrometers", D. Song, A. Amar, C. J. Lobb, and F. C. Wellstood, IEEE Trans. on Appl. Superconductivity **7**, 3532 (1997). [[PDF Full-Text \(384KB\)](#)]

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64. "[Distributed microwave damping filters for superconducting quantum interference devices](#)", I. Jin, A. Amar, and F. C. Wellstood, Appl. Phys. Lett. **70**, 2186 (1997).
65. "[Surface resistance imaging with a scanning near-field microwave microscope](#)", D. E. Steinhauer, C. P. Vlahacos, S. K. Dutta, F. C. Wellstood, and S. M. Anlage, App. Phys. Lett. **71**, 1736 (1997). cond-mat/9712142 [[abs](#), [ps](#), [pdf](#), [other](#)]
66. "Low Power Superconducting Microwave Applications and Microwave Microscopy", S. M. Anlage, C. P. Vlahacos, D. E. Steinhauer, S. K. Dutta, B. J. Feenstra, A. Thanawalla, and F. C. Wellstood, Particle Accelerators **61**, 321 (1998). cond-mat/9808195 [[abs](#), [ps](#), [pdf](#)]
67. "[Quantitative imaging of sheet resistance with a scanning near-field microwave microscope](#)", D. E. Steinhauer, C. P. Vlahacos, S. K. Dutta, B. J. Feenstra, F. C. Wellstood, and S. M. Anlage", Appl. Phys. Lett. **72**, 861 (1998). cond-mat/9712171 [[abs](#), [ps](#), [pdf](#), [other](#)]
68. "[Behavior of Al—Al<sub>2</sub>O<sub>3</sub>--Al single-electron transistors from 85 mK to 5 K](#)", M. Kenyon, A. Amar, D. Song, C. J. Lobb, and F. C. Wellstood, Appl. Phys. Lett. **72**, 2268 (1998).
69. "[Microwave electric-field imaging using a high-T<sub>c</sub> scanning superconducting quantum interference device](#)", S. Chatrathorn, E. F. Fleet, R. C. Black, and F. C. Wellstood, Appl. Phys. Lett. **73**, 984 (1998).
70. "[Quantitative topographic imaging using a near-field scanning microwave microscope](#)", C. P. Vlahacos, D. E. Steinhauer, S. K. Dutta, B. J. Feenstra, S. M. Anlage, and F. C. Wellstood, Appl. Phys. Lett. **72**, 1778 (1998). cond-mat/9802139 [[abs](#), [ps](#), [pdf](#)]
71. "[Microwave near-field imaging of electric fields in a superconducting microstrip resonator](#)", A. S. Thanawalla, S. K. Dutta, C. P. Vlahacos, D. E. Steinhauer, B. J. Feenstra, S. M. Anlage, and F. C. Wellstood, Applied Physics Letters **73**, 2491 (1998). cond-mat/9805239 [[abs](#), [ps](#), [pdf](#), [other](#)].
72. "Near-Field Scanning Microwave Microscopy: Measuring Local Microwave Properties and Electric Field Distributions", B. J. Feenstra, C. P. Vlahacos, Ashfaq S. Thanawalla, D. E. Steinhauer, S. K. Dutta, F. C. Wellstood, and Steven M. Anlage, IEEE MTT-S Int. Microwave Symp. Digest, p. 965 (1998). cond-mat/9802293 [[abs](#), [ps](#), [pdf](#), [other](#)] [[PDF Full-Text \(684KB\)](#)]
73. "[Imaging microwave electric fields using a near-field scanning microwave microscope](#)", S. K. Dutta, C. P. Vlahacos, D. E. Steinhauer, A. S. Thanawalla, B. J. Feenstra, F. C. Wellstood, and S. M. Anlage, Appl. Phys. Lett. **74**, 156 (1999). cond-mat/9811140 [[abs](#), [ps](#), [pdf](#), [other](#)].
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75. "Behavior of Charged Two-Level Fluctuators in an Al-AlO<sub>x</sub>-Al Single Electron Transistor in the Normal and Superconducting State", M. Kenyon, J. L. Cobb, A. Amar, D. Song, N. M. Zimmerman, C. J. Lobb, and F. C. Wellstood, IEEE Trans. Appl. Supercond. **9**, 4261 (1999). [[PDF Full-Text \(340KB\)](#)]
76. "HTS Scanning SQUID Microscope Cooled by a Closed Cycle Refrigerator", E. F. Fleet, S. Chatrathorn, F. C. Wellstood, S. M. Green and L. M. Knauss, IEEE Trans. Appl. Supercond. **9**, 3704 (1999). [[PDF Full-Text \(676KB\)](#)]



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78. "Imaging High-Frequency Magnetic and Electric Signals Using a High-Tc SQUID Microscope", S. Chatrathorn, E. F. Fleet, and F. C. Wellstood, IEEE Trans. Appl. Supercond. **9**, 4381 (1999).
79. "Design of a High Resolution HTS SQUID Magnetometer for Biomagnetic Imaging", A. Moya, F. Baudenbacher, F. C. Wellstood, and J. P. Wikswo Jr., IEEE Trans. Appl. Supercond. **9**, 3511(1999). [[PDF Full-Text \(304KB\)](#)]
80. "HTS Scanning SQUID Microscopy of Active Circuits", E. F. Fleet, S. Chatrathorn, F. C. Wellstood, S. M. Green and L. M. Knauss, IEEE Trans. Appl. Supercond. **9**, 4103 (1999). [[PDF Full-Text \(584KB\)](#)]
81. "Superconducting Materials Diagnostics using a Scanning Near-Field Microwave Microscope", S. M. Anlage, D. E. Steinhauer, C. P. Vlahacos, B. J. Feenstra, A. Thanawalla, W. Hu, S. K. Dutta, and F. C. Wellstood, IEEE Trans. Appl. Supercond. **9**, 4127 (1999). cond-mat/9811158 [[abs](#), [ps](#), [pdf](#)]. [[PDF Full-Text \(968KB\)](#)]
82. "Continuous Operation of a Two-stage dc SQUID System", I. Jin and F. C. Wellstood, IEEE Trans. Appl. Supercond. **9**, 2931 (1999). [[PDF Full-Text \(332KB\)](#)]
83. "Systematic study of anisotropic Josephson coupling between YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub> and PbIn using in-plane aligned a-axis films", I. Takeuchi, Y. Gim, F. C. Wellstood, C. J. Lobb, Z. Trajanovic, and T. Venkatesan, Phys. Rev. B **59**, 7205 (1999). [[PROLA Link](#)].
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130. "Measurements of Decoherence in Three dc SQUID Phase Qubits", Hanhee Paik, B. K. Cooper, S. K. Dutta, R. M. Lewis, R. C. Ramos, T. A. Palomaki, A. J. Przybysz, A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, *IEEE Trans. Appl. Supercond.* **17**, 120 (2007).
131. "Increasing spectroscopic coherence times of a dc SQUID phase qubits by increasing the well barrier height", R. M. Lewis, S. K. Dutta, Hanhee Paik, T. A. Palomaki, B. K. Cooper, A. J. Przybysz, A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, *IEEE Trans. Appl. Supercond.* **17**, 101 (2007).
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134. "Fast NDE of Superconducting Magnet Wires Using a Flow-Through SQUID Microscope", J. Matthews, F. C. Wellstood, and H. Weinstock, *IEEE Trans. on Appl. Supercond.* **17**, 776 (2007)

- 135.** "Measurements and modeling of quasiparticle poisoning effects in a Cooper pair box", C. A. Sanchez, B. S. Palmer, M. A. Manheimer, and F. C. Wellstood, submitted to Phys. Rev. B, 2007.
- 136.** "Dephasing and noise in dc SQUID phase qubits with variable isolation from the bias leads", Hanhee Paik, S. K. Dutta, R. M. Lewis, T. A. Palomaki, B. K. Cooper, R. C. Ramos,† H. Xu, A. J. Dragt, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, submitted to Phys. Rev. B (2008).

### **2.c. Monographs, Reports and Extension Publications**

1. "Report to Quantum Magnetics on Phase I Subcontract Work on NDE using High- $T_C$  SQUIDs from 9-1-93 to 12-15-93." F. C. Wellstood (1993).
2. "SQUID Microscope Design Study for Biological Samples", report to J. P. Wikswo on the design of a SQUID microscope for biological samples, F. C. Wellstood, 6-13-96

### **2.d. Book Reviews, Other Articles and Notes**

1. "Excess Noise in the dc SQUID: 4.2K to 20mK", F. C. Wellstood, Physics Ph.D. Thesis, University of California, Berkeley, (1988).

### **2.e. Talks, Abstracts, and Other Professional papers presented**

#### **2.e.i. Invited talks**

1. "Two Level Fluctuators in Charge and Phase Qubits", Linne Symposium, Chalmers University, Gothenburg, Sweden, February 21, 2008.
2. Member of a panel discussion on decoherence, Decoherence in superconducting quantum devices, Berkeley CA, December 7, 2007.
3. "Junctions and Atoms", Invited, Inaugural Symposium of the Joint Quantum Institute, March 12, 2007.
4. "The dc SQUID qubit", June 12, 2006, invited, MQC2 Conference, Naples, Italy.
5. "Quantum Computing Using Superconducting Devices: The dc SQUID qubit", Plasma 2006, London, England, July 17, 2006.
6. "Short Course on Quantum Computing using Superconducting Devices", invited for workshop at ASC 2006, Seattle, Washington, August 27, 2006.
7. "1, 2, 3, Superconducting Qubits", Physics Department Colloquium, University of Georgia, Athens, Sept. 8, 2005.
8. "1, 2, 3, Superconducting Qubits" Solid State Colloquium, Physics Department, University of Pennsylvania, Nov. 30, 2004.
9. "Microwave spectroscopy of Coupled Macroscopic Superconducting Qubits", 1 hour, invited, Physics Department, University of Chulalongkorn, Bangkok, Thailand, July 29, 2004.
10. "SQUID Microscopy of Integrated Circuits", 1 hour, invited, Physics Department, University of Chulalongkorn, Bangkok, Thailand, July 28, 2004.
11. "Evidence for Entangled Macroscopic Quantum States in Superconducting Qubits", 30 minutes, invited, March Meeting of the American Physical Society, March 23, 2004.
12. "Evidence of Entanglement in Josephson Junction Qubits", 15 minutes, Invited, given to the CMPS Academic Council, March 12, 2003.
13. "Evidence of Entanglement in Josephson Junction Qubits", 30 minutes, Invited, given at the Physics Faculty retreat, April 12, 2003.

14. "Evidence for quantum entanglement between two Josephson-junction qubits", Invited, 60 minutes, NIST AMO group colloquium, May 14, 2003.
15. "Microwave Spectroscopic Evidence for Entangled States in Two Coupled Josephson Junctions", Invited, 50 minutes, ISEC 2003, Sydney, Australia, July 11, 2003
16. "Ultimate limits of Scanning SQUID Microscopy", 20 minutes, Applied Superconductivity Conference, Houston, Texas, Sept. 2002.
17. "Using SQUIDs to Image Chips and Brains", 20 minutes, Ceremony for the dedication of the 160 channel MEG system at the University of Maryland, Feb. 20, 2002.
18. "Scanning SQUID Microscopy and Its Applications", 1 hour, Kanazawa Institute of Technology, Tokyo, Japan, January, 2002.
19. "Thoughts on the Technology Commercialization Process", Inventors Seminar, Office of Technology Commercialization, University of Maryland, October 23, 2001
20. "Scanning SQUID Microscopy of Integrated Circuits", Colloquium, University of Maryland, College Park, September 25, 2001 (1 hour).
21. "Scanning SQUID Microscopy", SQUID 2001, Sept. 2, 2001, Stenungsund, Sweden (20 minutes).
22. "High-Tc SQUID Microscopy of Active Corrosion and Electronic Defects", Quantitative Non-Destructive Evaluation 2001, Bowdoin College, Maine, July 30-August 3, 2001 (40 minutes).
23. "High-Tc SQUID Microscopy for the Non-destructive Testing of Integrated Circuits", F. C. Wellstood, E. Fleet, S. Chatraphorn, S. Y. Lee, and L. Knauss, June 20, 2001, International Superconducting Electronics Conference (ISEC) 2001, Osaka, Japan. (20 minutes).
24. "Scanning SQUID Microscopy", May 7, 2001, Solid State Colloquium, University of California at Berkeley (1 hour).
25. "From the Lab to Industry: Commercialization of the Scanning SQUID Microscope", Georgetown University, Department Colloquium, Sept. 14, 2000. (1 hour)
26. "High-Tc SQUID Microscope for Nondestructive Testing of Electronic Circuits", 13th International Symposium on Superconductivity, Tokyo, Japan, Oct. 16, 2000 (25 minutes).
27. "Magnetic Microscopy Using SQUIDs", Condensed Matter Seminar, University of Houston, February 16, 1999. (1 hour)
28. "Magnetic Microscopy Using SQUIDs", March Meeting of the American Physical Society, March 1998 (20 minutes).
29. "Single electron devices", Foundation and Frontiers of Physics course for beginning Physics grad students, Oct 19, 1998. (1 hour)
30. "Scanning SQUID Measurements of the Pairing Symmetry in YBCO", Gordon Research Conference, Ventura California, Jan. 15, 1997.
31. "A Simple Near-field Microwave Microscope", Laboratory for Physical Sciences, College Park, Maryland, Feb. 26, 1997.
32. "Magnetic Microscopy Using SQUIDs", Electrical Engineering Department Colloquium, University of Delaware, March 28, 1997.
33. "Magnetic Microscopy Using SQUIDs", F. C. Wellstood, Workshop on Sensitive Magnetometry (Magnetometrie Haute Sensibilite Et Application), Les Houches, France, June 9-13, 1997.
34. "Superconductivity - the Phenomena, the Open Questions and the Prospects", for the Foundation and Frontiers in Physics class at the University of Maryland (internal to the Department), November 17, 1997.
35. "Five Experiments", MRSEC IRG1 symposium (internal to the Department), October 22, 1997.

36. "Magnetic Microscopy Using SQUIDS", Physics Department Colloquium, University of Maryland, Sept. 24, 1996.
37. "Magnetic Microscopy Using SQUIDS", 1996 Applied Superconductivity Conference, Pittsburgh, PA, August 28, 1996.
38. "HTS SQUID Microscopes", ISTE, Invited talk, Morioka, Japan, June 25, 1996.
39. "Magnetic Microscopy Using Superconducting Sensors", Invited talk, AAAS meeting, Baltimore, February 12, 1996.
40. "Principles and Applications of the Scanning SQUID Microscope", Materials Science Colloquium, University of Virginia, Charlottesville, February 19, 1996.
41. "Magnetic Microscopy Using Superconducting Sensors", Harvard University, Condensed Matter Seminar, Solid State Seminar, December 2, 1995.
42. "Magnetic Microscopy Using Superconducting Sensors", XVIII ENFMC, 18 th National Conference on Condensed Matter Physics, Caxambu, Brazil, June 8, 1995.
43. "Using a Scanning SQUID and Time Reversal Invariance to Determine the Pairing Symmetry of YBCO", XVIII ENFMC, 18th National Conference on Condensed Matter Physics, Caxambu, Brazil, June 9, 1995.
44. "Using a Scanning SQUID and Time-Reversal Invariance to Determine the Pairing Symmetry of YBCO", Solid State Colloquium, Universidade Federal Fluminense, Instituto Fisica, Mitiroa, Brazil, June 13, 1995.
45. "Magnetic Microscopy Using Superconducting Sensors", California Institute of Technology, Solid State Seminar, March 27, 1995.
46. "Using a Scanning SQUID to Determine the Pairing symmetry of YBCO", Stanford Conference on Spectroscopies of Superconductors", Stanford, California, March 1995.
47. "Using Superconducting Sensors for Magnetic Microscopy and Measurements of the Pairing symmetry of YBCO", Solid State Colloquium, Ohio State University, April 11, 1995.
48. "Using Superconducting Sensors to Build a Magnetic Microscope", F. C. Wellstood, class on packaging, Mechanical Engineering Department, University of Maryland, College Park, Maryland (4-18-95).
49. "Magnetic Microscopy Using Superconducting Sensors", Solid State Colloquium, Applied Physics Lab, John Hopkins (10-14-94).
50. "Dissipation in High- $T_c$  Superconductors in the Low-Field Low-Current Limit", F. C. Wellstood, March Meeting of the American Physical Society, Pittsburgh (3-23-94).
51. "Magnetic Microscopy Using Superconducting Sensors", F. C. Wellstood, Introductory Seminar Series, Laboratory for Physical Sciences, College Park, Maryland (2-16-94).
52. "Magnetic Microscopy Using SQUIDS", Invited talk and paper, F. C. Wellstood, R. C. Black, A. Mathai, Y. Gim, D. Song, A. Amar, E. Danstker, A. H. Miklich, D. T. Nemeth, J. J. Kingston, D. Koelle, F. Ludwig and J. Clarke, Proceedings of the SPIE, Volume 2160, *Superconducting Devices and Circuits*, p118, Jan. 1994.
53. "Magnetic Microscopy Using Superconducting Sensors", F. C. Wellstood, Department of Physics Colloquium, College Park, Maryland (2-15-94).
54. "Magnetic Microscopy Using SQUIDS", Second Workshop for the Center for Atomically Engineered and Nano-Structured Materials, Laboratory for Physical Sciences, College Park, Maryland, (10-15-93).
55. "Magnetic Microscopy Using Superconducting Quantum Interference Devices", Condensed Matter Seminar, University of Chile, Santiago, Chile, (7-4-93).
56. "Magnetic Microscopy Using Superconducting Quantum Interference Devices", IMAG'93, Stockholm, Sweden, (4-14-93).



57. "Magnetic Microscopy Using High- $T_C$  and Low- $T_C$  SQUIDs", Global 93, International Superconductor Applications Convention, San Jose, California (2-3-93).
58. "Thin-film High- $T_C$  Flux Transformers Coupled to SQUIDs", SQUID '91, Berlin, Germany, (6-21-91).
59. "High-Temperature Superconducting Thin-film SQUID Magnetometers", Spring Meeting of the European Materials Research Society, Strasbourg, France, (5-31-91).
60. "Multilayer Structures and Applications to SQUID Magnetometers", March meeting of the American Physical Society, Division of Condensed Matter, (3-18-91 to 3-22-91).
61. "High- $T_C$  Flux Transformers and SQUIDs", Global 91, International Superconductor Applications Convention, San Diego, California (1-15-91).
62. "YBCO Thin-film Coils and Flux Transformers", Solid State Colloquium, University of California, Davis, California (10-25-90).
63. "Vortex Motion and Noise in YBCO Flux Transformers, Condensed Matter Colloquium, Department of Physics, University of Maryland, College Park, (9-6-90).

### **2.e.ii. Contributed talks**

Dr. Wellstood, his students, and collaborators have given many talks at the March meetings of the American Physical Society (APS) and at Applied Superconductivity Conferences (ASC). ASC talks contributed prior to 2006 are listed above under the corresponding refereed papers. For example, for the APS meeting, contributed talks include: 1 talk in 1987, 3 talks in 1989, 3 talks in 1990, 4 talks in 1991, 1 talk in 1992, 4 talks in 1993, 6 talks in 1994, 4 talks in 1995 (plus two invited talks given by students), and about 7 talks in 1998 at the APS, 4 talks in 2001, etc.

### **2.e.iii. Unrefereed Conference Proceedings**

1. "Investigation of Low-Frequency Excess Noise in Nb- $Al_2O_3$ -Nb Josephson Tunnel Junctions", B. Savo, F. C. Wellstood, and J. Clarke, Second Soviet-Italian Symposium on Weak Superconductivity, Napoli (1987), ed. Barone and Larkin, World Scientific Publishing.
2. "Magnetic Microscopy Using SQUIDs", F. C. Wellstood, R. C. Black, A. Mathai, Y. Gim, D. Song, A. Amar, E. Danstker, A. H. Miklich, D. T. Nemeth, J. J. Kingston, D. Koelle, F. Ludwig and J. Clarke, Proceedings of the SPIE, Volume 2160, *Superconducting Devices and Circuits*, p118, Jan. 1994.
3. "Magnetic Microscopy Using SQUIDs", F. C. Wellstood, Extended Abstracts for workshop on Sensitive Magnetometry (Magnetometrie Haute Sensibilite Et Application), Les Houches, France, June 9-13, 1997, p. L23.
4. "High- $T_C$  SQUID Microscopy for the Non-destructive Testing of Integrated Circuits", F. C. Wellstood, E. Fleet, S. Chatraphorn, S. Y. Lee, and L. Knauss, extended abstract of ISEC 2001, Osaka, Japan.

### **2.f Films, Tapes, Photographs, etc**

none

### **2.g Exhibits, Performances, Demonstrations, and Other Creative Activities**

none

### **2.h. Original Designs, Plans, Patents, and Inventions**

Patents have been received for high temperature superconducting microelectronic contacts, crossovers, coils, and flux transformers for work done while at the University of California..

US Patent Number 5,491,411

Wellstood, Mathai, Song, Black, "Method and Apparatus for Imaging Microscopic Spatial Variations in Small Currents and Magnetic Fields", February 13, 1996.

US Patent Number 5,894,220

Wellstood, Gim, Black, Green, "Apparatus for Imaging Electrical and Magnetic Properties of Room-Temperature Objects", April 13, 1999.

US Patent Number 5,900,618

Anlage, Wellstood, Vlahacos, Steinhauer, "Near-Field Scanning Microwave Microscope Having a Transmission Line with an Open End", May 4, 1999.

Scanning SQUID Microscope with Improved Spatial Resolution, Chatraphorn, Fleet, and Wellstood, US patent pending, 2001.

A provisional patent has been obtained for signal processing filters for the imaging of electronic circuits.

US patent Number 6,516,281

Wellstood, Kenyon and Lobb, "Single Electron Transistor Microscope for Imaging Ambient Temperature Objects", Feb 4, 2003.

US patent Number **#6,809,533**

"Quantitative imaging of dielectric permittivity and tenability, With Anlage, Vlahacos, et al.

US patent Number **#7,085,656**

"Method for suppressing edge artifacts in magnetic microscopy", August 1, 2006, Claudio Felipe Busko, John Matthews, Fred Wellstood.

US patent Number **#7,106,057**

"High frequency scanning Squid microscope and method of measuring high frequency magnetic fields", Sept 12, 2006, John Matthews, Fred Wellstood, Soun Pil Kwon.

US patent Number **#7,268,542**

"Scanning SQUID Microscope Having Position Noise Compensation", Sept 11, 2007, John Matthews and Fred Wellstood.

## **2.i. Contracts and Grants**

Sloan Foundation Fellowship, September 1992 to September 1994, \$30 k.

"Magnetic Microscopy Using Superconducting Quantum Interference Devices", NSF grant number DMR-9218373, 5-95 to 10-96, \$210 k.

"Acquisition of a UNV Sputtering System for Superconductor Research", NSF infrastructure grant DMR-9214579, PI is Steve Anlage, co-PIs are C. J. Lobb and F. Wellstood, \$155 k, 1993-1994.

Phase I SBIR subcontract from Quantum Magnetics, Inc., for SQUID-based NDE of aircraft wings, \$12 k, 5-93 to 11-93.

"Collaboration on Single Electron Transistors", joint with Professor Chris Lobb, 4-94 to 9-98, \$24 k per year.

"Superconducting Quantum Interference Devices for Gravity Wave Detection", NSF grant number PHY-9306982, 12-93 to 5-97, \$301 k.

Phase I SBIR subcontract from Neocera, Inc., for the development of a commercial room-temperature scanning SQUID microscope, 9-94 to 3-95, \$30 k.

"Imaging Microwave Frequency Currents in Operating Devices on Sub-nanosecond Time Scales and Micron Length Scales", grant number ECS-9632811, PI is Steve Anlage, co-PI is F. Wellstood, 7-96 to 7-99, \$315k.

Phase II SBIR subcontract from Neocera, Inc. for the development of a commercial room-temperature scanning SQUID microscope, began about 10-96, ending 10-98, about \$200k.

NSF MRSEC grant, Director is Prof. E. Williams, Wellstood was Co-PI with 19 other faculty members, approximately \$1.6M/year (August 1996 to September 1999).

Subcontract from Neocera, Inc (PAF-Sematech) for the development of a high-resolution scanning SQUID microscope, 12-98 to 12-99, about \$30k.

MIPS contract for installation and training for a commercial room-temperature scanning SQUID microscope, 2-99 to 2-00, about \$75k.

"Electric Field Microscopy of Computer Chips Using a Scanning Single Electron Transistor", with C. J. Lobb, NSF GOALI award, 6/99-6/02, \$291k.

"Quantum Computing with Superconducting Devices", with Anderson, Dragt and Lobb, DOD, 7/99 – 9/03, \$1.93 M.

"Non-Destructive Evaluation of Defects in Wires and other samples using an 8-channel high T<sub>c</sub> Scanning SQUID", DOD, 8/00-12/31/02, \$120k.

Subcontract from Neocera, Inc., for the development of a high-speed scanning SQUID microscope, 12-98 to 12-99, about \$30k.

Phase 2 Subcontract from Neocera, Inc., for the development of a high-speed scanning SQUID microscope, 6-01 to 6-02, about \$35k.

MIPS contract for the development of improved imaging techniques for the scanning SQUID microscope, 8-02 to 8-03, about \$100k.

“Development of a Flow-through SQUID system and Completion of a hand-held SQUID system”, AFOSR, 2/02-2/04, \$200k.

“Quantum Computing with Superconducting Devices - II”, with Anderson, Dragt and Lobb, DOD, 10/03 – 9/07, about \$1.40 M.

“Flow-through SQUID system for NDE of Superconducting Wire”, AFOSR, 2/04-2/06, \$100k.

"Imaging the Gauge Invariant Phase of a Superconductor on the Atomic Scale", with Wellstood, Anderson, and Lobb, NSF, 5/06-5/09, \$360 k.

"Phase 0 proposal on quantum information Science and Technology", Northrop Grumman Corporation, with Wellstood, Anderson, and Lobb, 3/06 - 9/06, \$100k

"Magnetic imaging using a fine magnetizable fiber", with L. Knauss, A. Orozco, and F. Wellstood, NSF subcontract from Neocera, 1/07 to 12/07, \$50 k

## **2.j. Fellowships, Prizes and Awards:**

- (1) Fellow of the American Physical Society (since 2003).
- (2) The 2001 Richard A. Ferrell Distinguished Faculty Fellowship. Presented by the Department of Physics, University of Maryland, September 20, 2001.
- (3) Award (with L. Knauss et al.) from the Electronic Device Failure Analysis Society for the best paper at the 26th International Symposium for Testing and Failure Analysis, 12-16 Nov. 1999, Bellevue, Washington, for our paper entitled "Detecting Power Shorts from Front and Backside of IC Packages Using Scanning SQUID Microscopy", L. A. Knauss, B. M. Frazier, H. M. Christen, S. D. Silliman, K. S. Harshavardhan, E. F. Fleet, F. C. Wellstood, M. Mahnapour, and A. Ghaemmaghami.
- (4) R&D 100 award from R&D 100 Award by R&D Magazine, for the invention of the Magma-C1 scanning SQUID microscope, with L. Knauss et al. at Neocera Inc.
- (5) Award for Outstanding Invention of 1998, presented by the Office of Technology Liaison, University of Maryland, College Park (April 15, 1999)
- (6) Award for Outstanding Invention of 1992, presented by the Office of Technology Liaison, University of Maryland, College Park (April 22, 1993)
- (7) Sloan Foundation Fellow (Sept. 1992 - Sept 1994)
- (8) Certificate of Merit, for outstanding efforts in technology transfer, Lawrence Berkeley Laboratory (1991).
- (9) IBM Pre-Doctoral Fellowship (September 1987 to June 1988).
- (10) Faculty Associate Award for excellence in teaching (June 1982).
- (11) Bachelor degree was awarded with great distinction in general scholarship (December 1979).

## **2.k. Editorships, Editorial Boards, and Reviewing Activities for Journals and Other Learned Publications**

Refereed for Physical Review Letters, Applied Physics Letters, IEEE Transactions on Applied Superconductivity, Journal of Applied Physics, Review of Scientific Instruments, and various conferences on superconductivity.

## 2.1. other

Fellow of the American Physical Society.

## 3. Teaching and Advising

### 3.a. Courses taught in the last five years

#### 3.a.i General

Physics 431 - Principles of Matter, (Fall 1992), approximately 10 students  
(Fall 1993), approximately 5 students

Physics 262A - Lab for Physics 262 - General Physics: Vibrations, Waves, Heat, Electricity and Magnetism

Fall 1994, Spring 1995, Fall 1995, approximately 250-150 students per semester (co-taught with Professor Jordan Goodman), Spring 1997 (co-taught with Professor Hassan Jawahery)

Physics 263A - Lab for Physics 263 - General Physics: Electrodynamics, Light, Relativity and Modern Physics Fall 1994, Spring 1995, Fall 1995, approximately 150-250 students per semester (co-taught with Professor Jordan Goodman), Spring 1997 (co-taught with Professor Hassan Jawahery)

Physics 420 - Principles of Modern Physics, (Spring 1996) - approximately 20 students

Physics 161 - General Physics: Mechanics and Particle Dynamics

(Fall 1996) - approximately 50 students  
(Spring 98) - approximately 150 students  
(Spring 99) - approximately 150 students  
(Fall 04) - approximately 150 students

Physics 174- Introductory Physics Lab –

(Fall 1997) (co-teaching with Professor Goodman) approximately 32 students,  
(Fall 1998) (co-teaching with Professor Anderson) approximately 50 students.  
(Spring 2002) (co-teaching with Professor Williams) approximately 40 students total.  
(Spring 2003) (co-teaching with Professor Lobb) approximately 40 students total.  
(Fall 2006) 1 section, approximately 8 students.

Physics 171H Honors section of Freshman Physics - (Fall 1997) (the main instructor was Ellen Williams, Wellstood handled the honors discussion section) - about 14 students.

Physics 170 – Professional Physics Seminar

(Fall 2000) – 11 students

Physics 260/260H – Physics for Engineers II

(Fall 2003) - 144 students  
(Fall 2005) - 120 students



Physics 275 - Experimental Physics 1

(Fall 99) approximately 10 students

(Spring 2000) 10 students

(Fall 2000) 18 students

(Fall 2001) 6 students

(Spring 2004) – 20 students (co-taught with Dr. Greene)

(Spring 2005) – 20 students (co-taught with Dr. Greene)

(Spring 2006) – about 20 students (co-taught with Dr. Greene)

(Spring 2007) – 20 students (co-taught with Dr. Greene)

(Fall 2007) – about 18 students (co-taught with Dr. Lobb)

(Spring 2008) – 18 students (co-taught with Dr. Greene)

Physics 276 - Experimental Physics 2 - Electricity and Magnetism

(Fall 2006) approximately 8 students

Physics 107 - Physics of Light Lab

(Spring 2001) - approximately 17 students in the section I taught, and about 100 total

(Fall 2001) - about 140 students

(Fall 2002) - about 100 students total

**3.a.ii Specialized**

none

**3.a.iii General Honors**

none

**3.a.iv Independent Study, Tutorial, Internship Supervision**

Physics 899 since fall 1991, Physics 799 for two masters students during last few years

**3.b. Course or Curriculum Development**

(i) Worked with Professor Jordan Goodman to rebuild Physics 262A and Physics 263A. These are introductory physics lab courses for engineers. Work included completely rewriting the lab manuals, introducing new experiments, introducing personal computers into the lab, introducing spreadsheet analysis and computerized data plotting, increasing the emphasis on error analysis, shortening the time spent on writing up lab reports, creating office hours in labs, increasing TA training. During Fall 1997, Dr. Wellstood worked with Professor Goodman on developing the first written lab manual for Physics 174, the introductory physics lab for physics majors and prepared a revised version of the manual in January 99.

(ii) During the Summer and Fall of 1999, I worked with Derek Boyd on a major revision to the Physics 275 lab. Among other things, we introduced two in-class practical examinations, developed 6 new experiments, brought in the use of force probes and sonic rangers, integrated spreadsheets into the course, and wrote a complete new lab manual. In Spring 2000, I did some comparatively minor revisions on the labs to iron out the bugs found during the first run-through the previous Fall. Dr. Greene and I completed an additional revision of the manual in Summer 2007.

(iii) As part of my job as Associate Chair, during the year I also worked with Chris Lobb, Ted Einstein and Robert Hudson to develop a new Meteorology Physics Area of Concentration

that allows students to get a B.S. in Physics with a specialization in Meteorology. This additional track, the first new track in the Department's history, was approved by the University in Fall 2000. With help from Chris Lobb, David Hammer, and Jordan Goodman and assistance from Scott Wolpert (CMPS Associate Dean) and the College of Education, I also put together an Education Physics Area of Concentration which was approved in Spring 2001.

### **3.c. Manuals, Notes, and Other Contributions to Teaching**

"Physics 275 Laboratory Manual", Summer 2007 revised edition, F. C. Wellstood and R. Greene, published and printed by the Department of Physics, University of Maryland.

"Physics 174 Laboratory Manual", Fall 1997 and Spring 99 revised editions, F. C. Wellstood and J. Goodman, published and printed by the Department of Physics, University of Maryland.

"Physics 262A Laboratory Manual", Spring 1994 and Fall 1995 revised editions, F. C. Wellstood and J. Goodman, published and printed by the Department of Physics, University of Maryland.

"Physics 263A Laboratory Manual", Spring 1994, Fall 1995, and Spring 1997 revised editions, F. C. Wellstood and J. Goodman, published and printed by the Department of Physics, University of Maryland.

### **3.d. Teaching Awards**

none

### **3.e. Advising (other than Research Direction)**

#### **3.e.i Undergraduates**

Advising physics undergraduates 1995-1999, about 3 students per year

#### **3.e.ii Graduates**

Advising incoming physics graduates 1993-1999, about 5 students per year

#### **3.e.iii Other**

none

### **3.f. Advising ( Research Direction)**

#### **i. Undergraduate**

Jan Gaudestad (finished May 2000)

#### **ii. Masters**

C. P. Vlahacos (finished 1999)

J. Gaudestad (finished 2001)

#### **iii. Doctoral**

Randall C. Black (finished August 1995)

Anna Mathai (finished September 1995)

Yonggyu Gim (finished August 1996)

Dian Song (finished Spring 1997)

Insik Jin (finished summer 1997)

Erin Fleet (finished Aug. 2000)

Sojiphong Chatraphorn (finished Dec 2000)  
Ashfaq Thanwalla (finished Dec. 2000)  
Matt Kenyon (co-advised with C. J. Lobb, finished summer 2001)  
Su-Young Lee (started Jan. 2000, finished spring 2004)  
Huizhong Xu (co-advised with J. R. Anderson and Chris Lobb, started fall 2000, fall 2004)  
S. Dutta (co-advised with Anderson Lobb, finished Dec 2006)  
Carlos Sanchez (finished Dec. 2005)  
Hanhee Paik (co-advised with Chris Lobb, finished Aug 2007).  
Tauno Palomaki (co-advised with J. R. Anderson and Chris Lobb, started Jan 2005)  
Benjamin Cooper (co-advised with J. R. Anderson and Chris Lobb, started Sept. 2005)  
Anthony Przybysz (co-advised with J. R. Anderson and Chris Lobb, started Sept 2005)  
Constantine Vlahacos (EE, Wellstood officially began advising Jan 2006)  
Hyeokshin Kwon (co-advised with J. R. Anderson and Chris Lobb, started June 2006)  
Zaeill Kim (Co-advised with Dr. Benjamin Palmer at LPS, started Jan 2007)  
Vitaley Zaretsky (Co-advised with Dr. Benjamin Palmer at LPS, started Sept 2007)

### **3.g. Extension Activities**

none

## **4. Service**

### **4.a. Professional**

#### **4.a.i. Offices and Committee Memberships held in professional organizations**

Member of the Program Committee of the Electronics section of the 1998 Applied Superconductivity Conference.

Co-chair of the Program Committee (with S. Anlage and C. Lobb) for the Electronics section of the year 2000 Applied Superconductivity Conference.

Ex-officio member of the executive board of the Applied Superconductivity Conference, Sept. 98 to Sept. 2000.

Co-chair of the Program Committee (with O. Mukanov and D. Van Vechten) for the Electronics section of the year 2004 Applied Superconductivity Conference.

Chair of the Program Committee for International Superconducting Electronics Conference (ISEC), June 10-14, 2007, in Washington D.C.

One of several technical editors for the year 2006 Applied Superconductivity Conference.

#### **4.a.ii. Unpaid reviewing activities for agencies**

- reviewed proposals for NSF
- reviewed management of Physics Division of NSF as part of the 1997 Committee of Visitors

#### **4.a.iii. Other unpaid services to local, state and federal agencies**

2004 member of the AAT Physics Writing Group. This committee was charged by the State with writing the common requirements for the Associate Arts in Teaching (2-year) degree for Physics, to be used by Community Colleges within the state of Maryland.

#### **4.a.iv. Other non-University Committees, Commissions and Panels, etc**

Chaired poster and oral sessions at several Applied Superconductivity Conferences in the last ten years and oral sessions at the March Meetings of the American Physical Society.

I served on the 1997 NSF Committee of Visitors. The purpose of this committee was to review the management and the peer review process in the Division of Physics (July 23-25, 1997). We spent two days at the NSF talking to program managers, examining how individual proposals were handled by referees and program managers, and generally trying to assess how the NSF was doing its job.

#### **4.a.v. International activities, not listed above**

I chaired the afternoon session on Superconductor Magnetometers at the Workshop on Sensitive Magnetometry (Magnetometrie Haute Sensibilite Et Application), Les Houches, France, June 10, 1997.

I co-chaired a session at the International Symposium on Superconductivity, Tokyo, Japan, Oct. 16, 2000.

I chaired a session at MQC2 in Naples Italy, June 2006.

#### **4.a.vi. Paid Consultancy**

Member of an NIH review panel for proposals, Washington DC, March 23, 2001.

Consulted for American Society for Engineering Education, ASEE-NIST Post-doctoral Fellowship Review Panel, Brookings Institute, Washington D.C., August 14, 1991.

Consulted for Superconductor Technologies Incorporated, Santa Barbara, CA, October 30, 1990.

### **4.b University**

#### **4.b.i. Departmental**

1. Ad Hoc Safety Advisor to the Center for Superconductivity Research since 1992.
2. Gave tours and superconductivity demonstrations to about 20 eleventh and twelfth grade students participating in the Maryland Junior Science and Humanities Symposium, March 27, 1992.
3. Helped set up superconductivity demonstrations and give tours at dedication for Center for Superconductivity Research, October 6, 1992.
4. Helped give tour of Center to a visiting delegation of British scientists, March 1, 1993.
5. Gave tours and superconductivity demonstrations to about 20 eleventh and twelfth grade students participating in the Maryland Junior Science and Humanities Symposium, March 12, 1993.
6. Helped give tours of Center and superconductivity demonstrations as part of Maryland Science Week, April 27, 1993.

7. Gave superconductivity demonstration to visiting State Delegate Morgan, October 29, 1993.
8. Gave tours and superconductivity demonstrations to about 20 eleventh and twelfth grade students participating in the Maryland Junior Science and Humanities Symposium, March 4, 1994.
9. Set up superconductivity demonstration for Open House, October 5, 1995.
10. Gave tours and superconductivity demonstrations to about 20 eleventh and twelfth grade students participating in the Maryland Junior Science and Humanities Symposium, March 15, 1996.
11. Helped give a tour of the Center to SPS students from Towson State, December 6, 1996.
12. Helped judge science fair projects at the Kettering Middle School, February 14, 1997.
13. I helped give demonstrations and tours of the Center for Superconductivity Research to about 25 high school students attending the Maryland Junior Science and Humanities Symposium, March 14, 1997.
14. I participated in the MRSEC tour for REU students of Goddard Space Flight Center, June 26, 1997.
15. I helped show superconductivity demos for two groups from the visiting Girls Summer Program, August 14, 1997.
16. I served on several Ph.D. defense committees, including for 8 of my own students.
17. I helped give a tour of the Center for Superconductivity Research to SPS students from Towson State, December 6, 1997.
18. Member of the MRSEC Executive Committee 1997-1999.
19. Member of the APT committee, Fall 1997.
20. Member of Undergraduate Education Committee, Fall 1996 - Spring 1998.
21. Co-chair (with Boyd and Goodman) of Physics Laboratory Committee, Spring 1997 to 1999.
22. Member of Physics Executive Council, 1993, Fall 1997.
23. Member of Salary Committee, Spring 1994 to Spring 1997.
24. Member of Extended Qualifier Committee 1994-2000.
25. Member of the search committee for nano-tech hire (Ellen Williams chairing), Fall 99.
26. Wrote one question for the Fall 2001 qualifier, wrote and graded one question for the Winter 1996 qualifier exam, wrote question for Winter 1994 Qualifier, graded problem for Winter 1992 qualifier.
27. Since 2000. as Associate Chair for Undergraduate Education, I help present the Department to prospective students. Typically there are about 10 open houses each year for prospective undergraduates and their families, for example at Visit Maryland Day, November 10, 2000. As another example in 2001, open house events were on Feb. 19, March 9, April 20, Oct 8, Oct 27, Nov 12, Nov. 17.
28. Participated in organizing and helping run the Physics Department's activities for Maryland day in March 2000 and March 2001.
29. Participated in a signing ceremony organized by Professor David Poeppel (Linguistics and Biology) and Stephen Crain, Chair of the Department of Linguistics at UMCP, announcing that they have obtained a commitment to put on campus a multi-channel SQUID system for imaging brain activity. The signing ceremony announcing the deal was held on May 10, 2001 in President Mote's office. Because of my research on SQUIDS, I was invited to attend the ceremony. I also give a tour of the Center on May 9 to visitors from the Kanazawa Institute of Technology who are building the system for the campus.
30. I served on Greg Sullivan's promotion committee, Fall 2000.



31. October 24, 2000. I met with the ABET committee reviewing the accreditation of the Computer Engineering program.
32. December 13, 2000. I gave a brief tour of the SQUID microscopes to President Mote during a visit to the Center for Superconductivity Research organized by R. Greene.
33. December 14, 2000. I gave a brief tour of the SQUID microscopes to the Dean of Life Sciences during a visit to the CSR organized by R. Greene.
34. I assisted with planning and running Maryland Day at the Physics Department since 2000.
35. Completed teaching peer review for Markus Luty and Michael Fuhrer.
36. Serving on the teaching interview committee, 2000-2006.
37. Grading one Qual problem for Sp 2006 qualifier.
38. Serving on the Undergraduate Education Committee (F-2005 to F 2006).
39. Serving on the APT committee (2005-2007).
40. I served on one Honors thesis defense (for Brian Bryce, advised by Bruce Kane) in Dec 2005.
41. In 2005 I served on Ph.D. defense committees for Atif Imtiaz, Dan Sullivan (chaired), Carlos Sanchez (chaired), Matt LaHaye, and Kenton Brown.

**In 2006:**

41. Chaired the Ph.D. defense committees for Sudeep Dutta.
42. Served on the APT Committee
43. Served on the Lab Sub-committee of the Phase 1 PSC Design Review Committee.
44. Served on the Teaching Interview Committee, helping to evaluate teaching ability of faculty candidates in 2006 and 2007
45. Served on the Executive Committee of the JQI, 5/06 to 12/06
46. Serving on the Executive Committee of the JQI, 1/07 to 12/07
47. Served on the JQI graduate Fellowship Committee 2006 and 2007
48. Serving on the JQI Inaugural Symposium Organizing Committee
49. Serving on the University's PACAA Committee (Provost's Advisory Committee on Admissions and Advising) since October, 2004.
50. Serving on the Campus CORE committee (Fall 2005-Fall 2007).

**In 2007:**

55. Served on the Teaching Interview Committee, helping to evaluate teaching ability of faculty candidates in 2007
56. Served on the Executive Committee of the JQI, 1/07 to 12/07
57. Served on the JQI graduate Fellowship Committee 2007
58. Served on the JQI Inaugural Symposium Organizing Committee, 2007
73. assisted Physics Undergraduate office in organizing fall Physics open house for undergraduate students
74. arranged tours of CSR labs for Maryland Day, April 2007
75. graded one problem for Fall 2007 graduate Physics qualifier exam
76. member of Organizing Committee for the Inaugural Symposium of the Joint Quantum Institute CMPS-Physics
77. member of APT committee (Fall 06 -Sp 07)
78. member of Teaching Interview Committee (for physics faculty searches)
79. member of JQI predoctoral fellowship selection committee
80. member of Search Committee for the Director of the Joint Quantum Institute
81. member of JQI Executive Committee CMPS-Physics

82. Faculty Advisor to the Society of Physics Students
83. Chair of the Lab Committee (2008).

#### **4.b.ii. College and Divisional**

1. A write-up of some of my groups research on SQUIDs and joint work with Chris Lobb and Steve Anlage on SETS and microwave imaging appeared in the Fall 2000 edition of the CMPS magazine the Continuum.
2. Served on the search committee for a CMPS Associate Dean for Undergraduate Education, Spring 2000.
3. May 30, 2000. Gave presentation to Steve Walker and Associates as part of a visit organized by Dean Steve Halperin to make contact with local industrial and technical companies.
4. November 8, 2000. Met with delegation of state and business leaders sponsored by Dean Steve Halperin and gave talk on SQUID microscopy applied to detecting circuit faults.
5. I participated in commencement exercises, including reading the names of all of the CMPS Ph.D. and Masters recipients in Fall 2000 during the ceremony.
6. In 2000, I served on the CMPS Scholarship Committee
7. On October 24, 2000. I met with the ABET committee reviewing the accreditation of the Computer Engineering program.
8. sat in for Chair at Academic Council meetings ( March 7, April 11, September 19, 2001)
9. Read names of finishing Ph.D. and M.S. students during CMPS graduation ceremony (Dec. 22, 2005, Spring and Fall 2006, 2007 and 2008 ceremonies).
10. Faculty member of Physical Sciences Complex Construction Management Technical Review Committee (since summer 2007)
11. member of search/selection committee for Construction Management firm for the new Physical Sciences Complex (fall 2007)
12. member of search committee for CMPS Director of Facilities Management (Spring 2008)
13. Reviewed candidate projects for the Dorman Prize, an award granted by CMPS to the best undergraduate research by a CMPS student.
14. Reviewed Student proposals for the Senior Summer Scholars Program, a competitive grant sponsored by the University Office of Undergraduate Studies.
15. Served on Presidents Advisory Committee on Academic Affairs (PACAA) through fall 2005- Sp 2007
16. Served on Campus CORE Committee Fall, 2005-Sp 2007.

#### **4.b.iii. Campus and University**

- Served on the Banneker-Key Selection committee for 2002, 2004-2007, 2008.
- Served on a state-wide committee as a member of the Physics Writing Group for the Secondary Associate in the Arts teaching degree for Physics (2003).
- Appointed to the University's PACAA Committee (Provost's Advisory Committee on Admissions and Advising) October, 2004. Serving on the PAAC (1-05 to 1-08).
- Serving on the Campus CORE committee (Fall 2005-Fall 2007).

#### **4.b.iv. Special Administrative Assignments**

- Served as Associate Chair for Undergraduate Education, Physics Department of Physics, University of Maryland, College Park (from July 1999 to July 2004).

#### **4.b.v. Other**

1. I helped judge science fair projects at the Kettering Middle School on February 14, 1997.
2. I helped judge science fair projects in the Senior Division at the PG County Science Fair on April 12, 1997.
3. Helped show Physics is Phun Demos at the Maryland State Fair, August 23, 1997.
4. I assisted Prof. Ellen Williams in giving a talk on Science Fair projects to interested parents at a meeting of the Kettering Middle School PTA, November 8, 1997.
5. I presented a Physics is Phun show on "Light and Optics" with Dr. Johan Feenstra at the Kettering Middle School on November 21, 1997 as part of MRSEC outreach to local schools. We did three separate 1-hour shows with a total attendance of about 65 students. The shows were very well received.
6. I served as a Science Fair Mentor at Kettering Middle School, 12-3-97 and 12-17-97 as part of MRSEC outreach to local schools.
7. November 1999, and November 30 and December 1, 2000, I helped give a presentation on "Weird Matter" and a laboratory on the zero of temperature to students at Northwest High School as part of the MRSEC outreach to local high schools.
8. I helped judge science fair projects at Montgomery Blair High School. February 2001, 2002, 2003.
9. I was the outside opponent for the Ph.D. Thesis defense of Raihan Rafique in Feb 2008, at Chalmers Univeristy, Gothenburg, Sweden.

#### **4.c. Awards and Honors**

See section 2j.

Frederick C. Wellstood  
*March 13, 2008*