

CV of Frederick Charles Wellstood
Department of Physics, University of Maryland at College Park
Associate Professor and Associate Chair

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:

Associate Chair for Undergraduate Education, Physics

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

Professor of Physics

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

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 bore-holes 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-Al₂O₃-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_{1.85}Sr_{0.15}CuO₄", 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).
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. "Response to Comment on Low-frequency Excess Noise in Nb-Al₂O₃-Nb Josephson Tunnel Junctions", B. Savo, F. C. Wellstood, and J. Clarke, Appl. Phys. Lett. **52**, 2001 (1988).
7. "Magnetic Flux Noise Observed in Thin-film Rings of YBa₂Cu₃O_{7-d}", 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).
8. "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).
9. "Low Magnetic Flux Noise Observed in Laser-deposited *in situ* Films of YBa₂Cu₃O_y and Implications for High T_c 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).
10. "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).
11. "Hot Electron Effect in the dc SQUID", F. C. Wellstood, C. Urbina, and J. Clarke, IEEE Trans. Magn., **MAG-25**, 1001 (1989).
12. "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).
13. "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).
14. "Distribution of Flux Pinning Energies in YBa₂Cu₃O_{7-x} and Bi₂Sr₂CaCu₂O_{8+x} 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).
15. "Multilayer YBa₂Cu₃O_{7-x}-SrTiO₃-YBa₂Cu₃O_{7-x} Films for Insulating Crossovers", J. J. Kingston, F. C. Wellstood, P. Lerch, A. H. Miklich, and J. Clarke, Appl. Phys. Lett. **56**, 189 (1990).

16. "Josephson Weak Links in Thin Films of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ 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).
17. "Superconducting Thin-Film Multiturn Coils of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ", F. C. Wellstood, J. J. Kingston, and J. Clarke, *Appl. Phys. Lett.* **56**, 2336 (1990).
18. "Superconducting Thin-Film Flux Transformers of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ", F. C. Wellstood, J. J. Kingston, M. J. Ferrari, and J. Clarke, *Appl. Phys. Lett.* **57**, 1930 (1990).
19. "Reply to "Flux-Pinning Energies in High- T_c 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).
20. "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).
21. "Flux Noise from Superconducting $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ Flux Transformers", M. J. Ferrari, J. J. Kingston, F. C. Wellstood, and J. Clarke, *Appl. Phys. Lett.* **58**, 1106 (1991).
22. "Heteroepitaxial $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ - SrTiO_3 - $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ 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).
23. "Comment on "Theory of $1/f$ Magnetic Flux Noise in High- T_c Superconductors"", M. Johnson, M. J. Ferrari, F. C. Wellstood, and J. Clarke, *Phys. Rev. Lett.* **66**, 1799 (1991).
24. "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).
25. "Photolithographically Patterned Thin-film Multilayer Devices of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ", J. J. Kingston, F. C. Wellstood, D. Quan, and J. Clarke, *IEEE Trans. on Magn.*, **MAG-27**, 974 (1991).
26. "Thin-film Flux Transformers of $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ ", F. C. Wellstood, J. J. Kingston, M. J. Ferrari, and J. Clarke, *IEEE Trans. on Magn.*, **MAG-27**, 2569 (1991).
27. "High- T_c Thin-film Magnetometer", A. H. Miklich, F. C. Wellstood, J. J. Kingston, J. Clarke, M. S. Colclough, A. H. Cardona, L. C. Bourne, W. L. Olson, and M. M. Eddy, *IEEE Trans. on Magn.*, **MAG-27**, 3219 (1991).
28. "Suppression of Magnetic Flux Noise in $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ by a Supercurrent", M. J. Ferrari, F. C. Wellstood, J. J. Kingston, and J. Clarke, *Phys. Rev. Lett.* **67**, 1346 (1991).
29. "Sensitive $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ 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).
30. "Suppression of Magnetic Flux Noise in $\text{YBa}_2\text{Cu}_3\text{O}_{7-x}$ Flux Transformers", M. J. Ferrari, F. C. Wellstood, J. J. Kingston, M. Johnson, and J. Clarke, *Superconducting Devices and Their Applications*, eds. H. Koch and H. Lubbig, (W. de Gruyter Press, Berlin, 1992), p 49.
31. "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.
32. "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).
33. "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).
34. "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).

35. "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).
36. "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).
37. "SQUID Milliatovoltometry of YBa₂Cu₃O₇ 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).
38. "Magnetic Microscopy Using a Liquid Nitrogen Cooled 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).
39. "Electric Field Effect Control of a Superconducting YBa₂Cu₃O₇ Inductor", Y. Gim, C. Doughty, X. X. Xi, A. Amar, T. Venkatesan, and F. C. Wellstood, *Appl. Phys. Lett.* **62**, 3198 (1993).
40. "Eddy Current Microscopy Using a 77K 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).
41. "Hot Electron Effects in Normal Metals", F. C. Wellstood, C. Urbina, and J. Clarke, *Phys. Rev. B* **49**, 5942 (1994)
42. "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).
43. "2e and 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).
44. "Thin-Film Multilayer Interconnect Technology for YBa₂Cu₃O_{7-x}", Invited, *Journal of Applied Physics (Applied Physics Reviews)* **75**, 683 (1994).
45. "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.
46. "Imaging Radio-Frequency Fields Using a Scanning SQUID Microscope", R. C. Black, F. C. Wellstood, E. Dantsker, A. H. Miklich, D. T. Nemeth, D. Koelle, F. Ludwig, and J. Clarke, *Appl. Phys. Lett.* **66**, 1267, (1995).
47. "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).
48. "Advantages of Superconducting Coulomb-Blockade Electrometers", D. Song, A. Amar, C. J. Lobb and F. C. Wellstood, *IEEE Trans. on Appl. Supercond.* **5**, (1995).
49. "High-Frequency Microscopy Using a High-T_c SQUID", R. C. Black, F. C. Wellstood, E. Dantsker, A. H. Miklich, D. Koelle, F. Ludwig and J. Clarke, *IEEE Trans. on Appl. Superconductivity* **5**, 2137 (1995).
50. "Experimental Proof of Time-Reversal Invariant d_{x²-y²} Pairing in YBCO", A. Mathai, Y. Gim, R. C. Black, A. Amar, and F. C. Wellstood, *Phys. Rev. Lett.* **74**, 4523, (1995).
51. "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).
52. "Microwave Microscopy Using a Superconducting Quantum Interference Device", R. C. Balck, F. C. Wellstood, E. Dantsker, A. H. Miklich, D. T. Nemeth, D. Koelle, F. Ludwig, J. Clarke, *Appl. Phys. Lett.* **66**, 99 (1995).
53. "Symmetry of the Phase of the Order Parameter in YBa₂Cu₃O_{7-δ}", Y. Gim, A. Mathai, R. C. Black, A. Amar, and F. C. Wellstood, Invited, *Journal de Physique* **6**, 2299 (1996).

54. "Near-field Scanning Microwave Microscope with 100 μm Resolution", C. P. Vlahacos, R. C. Black, S. M. Anlage, A. Amar, and F. C. Wellstood, *Appl. Phys. Lett.* **69**, 3272 (1996).
55. "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).
56. "35 h 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).
57. "Angular Dependence of the Symmetry of the Order Parameter in $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ ", Y. Gim, A. Mathai, R. Black, A. Amar, and F. C. Wellstood, *IEEE Trans. on Appl. Superconductivity* **7**, 2331 (1997).
58. "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).
59. "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).
60. "Magnetic Microscopy Using SQUIDS", Invited, F. C. Wellstood, Y. Gim, A. Amar, R. C. Black, and A. Mathai, *IEEE Trans. on Applied Supercond.* **7**, 3134 (1997).
61. "Distributed Microwave Damping Filters for Superconducting Quantum Interference Devices", I. Jin, A. Amar, and F. C. Wellstood, *Appl. Phys. Lett.* **70**, 2186 (1997).
62. "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).
63. "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).
64. "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).
65. "Behavior of an Al- AlO_x -Al single electron transistor 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).
66. "Microwave Electric-Field Imaging Using a High- T_c Scanning Superconducting Quantum Interference Device", S. Chatrathorn, E. F. Fleet, R. C. Black, and F. C. Wellstood, *Appl. Phys. Lett.* **73**, 984 (1998).
67. "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).
68. "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 (1999).
69. "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).
70. "Microwave Nonlinearities in High- T_c Superconductors: The truth is out there" S. M. Anlage, W. Hu, C. P. Vlahacos, D. Steinhauer, B. J. Feenstra, S. K. Dutta, A. Thanawalla, and F. C. Wellstood, *Journal of Superconductivity* **12**, 353 (1999).

71. "Behavior of Charged Two-Level Fluctuators in an Al-AlO_x-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).
72. "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).
73. "Frequency Following Imaging of Electric Fields from Resonant Superconducting Devices using a Scanning Near-Field Microwave Microscope", A. Thanawalla, B. J. Feenstra, W. Hu, D. E. Steinhauer, S. K. Dutta, S. M. Anlage, and F. C. Wellstood, *IEEE Trans. Appl. Supercond.* **9**, 3042 (1999).
74. "Imaging High-Frequency Magnetic and Electric Signals Using a High-T_c SQUID Microscope", S. Chatrathorn, E. F. Fleet, and F. C. Wellstood, *IEEE Trans. Appl. Supercond.* **9**, 4381 (1999).
75. "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).
76. "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).
77. "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).
78. "Continuous Operation of a Two-stage dc SQUID System", I. Jin and F. C. Wellstood, *IEEE Trans. Appl. Phys.* **9**, 2931 (1999).
79. "Non-Contact Imaging of Dielectric Constant with a Near-Field Scanning Microwave Microscope", C. P. Vlahacos, D. E. Steinhauer, S. K. Dutta, J. B. Feenstra S. M. Anlage, and F. C. Wellstood, p13, *Microscopy and Analysis*, January (2000).
80. "Systematic Study of anisotropic Josephson coupling between YBCO 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).
81. "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. Ghaemmaghani, *ISFTA 99, Proc. Intl. Symp. on testing and Failure Analysis (Materials Park, OH; ASM Int.)* p. 11 (1999).
82. "Imaging of Microwave Permittivity, Tunability, and Damage Recovery in (Ba, Sr)TiO₃ Thin Films", D. E. Steinhauer, C. P. Vlahacos, C. Cnaedy, A. Stanishevsky, J. Melngailis, R. Ramesh, F. C. Wellstood, and S. M. Anlage, *Appl. Phys. Lett.* **75**, 3180 (1999).
83. "Imaging Microwave Intermodulation Fields in a Superconducting Microstrip Resonator", W. Hu, A. Thanawalla, B. J. Feenstra, F. C. Wellstood, and S. M. Anlage, *Appl. Phys. Lett.* **75**, 2824 (1999).
84. "Beyond Moore's Law: Quantum Computing with rf SQUIDs", J. R. Anderson, A. J., Dragt, F. C. Wellstood, M. Gubrud, M. Ejrnaes, M. M. Gorsak, and T. Busin, in *Cluster and Nanostructure Interfaces*, Edited by P. Jena, S. N. Khanna, and B. K. Rao, World Scientific Publishing, pp. 241-248 (2000).
85. "Scanning SQUID Microscopy of Integrated Circuits", S. Chatrathorn, E. F. Fleet, F. C. Wellstood, L. A. Knauss, T. M. Eiles, *Appl. Phys. Lett.* **76**, 2304 (2000).

86. "Magnetic Permeability imaging of metals with a scanning near-field microwave microscope", S-C. Lee, C. P. Vlahacos, B. J. Feenstra, A. Schwartz, D. E. Steinhuaer, F. C. Wellstood, and S. M. Anlage, *Appl. Phys. Lett.* **77**, 4404 (2000).
87. "Temperature dependence of low-frequency noise in Al-Al₂O₃-Al single-electron transistors", M. Kenyon, C. J. Lobb, and F. C. Wellstood, *Jour. Appl. Phys.* **88**, 6536 (2000).
88. "Paramagnetic Misner Effect in Multiply-connected Superconductors", A. P. Nielsen, A. B. Cawthorne, P. Barbara, F. C. Wellstood, C. J. Lobb, R. S. Newrock, and M. G. Forester, *Phys. Rev. B* **62**, 14380 (2000).
89. "Two Stage Superconducting Quantum Interference Device Amplifier in a High-Q Gravitational Wave Transducer", G. M. Harry, I. Jin, H. J. Paik, T. R. Stevenson, and F. C. Wellstood, *Appl. Phys. Letts.* **76**, 1446 (2000).
90. "Quantitative Imaging of Dielectric Permittivity and Tunability with a Near-field Scanning Microwave Microscope", D. E. Steinhauer, C. P. Vlahacos, F. C. Wellstood, S. M. Anlage, C. Canedy, R. Ramesh, A. Stanishevsky, J. Melngailis, *Rev. of Scientific Instruments* **71**, 2751 (2000).
91. "Sub-gap leakage in Nb/AlO_x/Nb and Al/AlO_x/Al Josephson Junctions", M. A. Gubrud, M. Ejrnaes, A. J. Berkley, R. C. Ramos, I. Jin, J. R. Anderson, A. J. Dragt, C. J. Lobb, and F. C. Wellstood, *IEEE Trans. on Appl. Supercond.* **11**, 1002 (2001).
92. "Design for Effective Thermalization of Junctions for Quantum Coherence", R. C. Ramos, M. A. Gubrud, A. J. Berkley, J. R. Anderson, C. J. Lobb and F. C. Wellstood, *IEEE Trans. on Appl. Supercond.* **11**, 998 (2001).
93. "Imaging Defects in Cu-Clad Nb-Ti wire using a high-T_c scanning SQUID microscope", E. Fleet, A. Gilbertson, S. Chatrathorn, N. Tralshwala, H. Weinstock, and F. C. Wellstood, *IEEE Trans. on Appl. Supercond.* **11**, 215 (2001).
94. "Noise and Spatial Resolution in SQUID Microscopy", S. Chatrathorn, E. F. Fleet, F. C. Wellstood, and L. A. Knauss, *IEEE Trans. on Appl. Supercond.* **11**, 234 (2001).
95. "Determination of Magnetic Properties Using a Scanning SQUID Microscope", E. F. Fleet, S. Chatrathorn, F. C. Wellstood and C. Eylem, *IEEE Trans. on Appl. Supercond.* **11**, 1180 (2001).
96. "Closed-Cycle refrigerator-cooled scanning SQUID microscope for room-temperature samples", E. F. Fleet, S. Chatrathorn, F. C. Wellstood, L. A. Knauss, S. M. Green, *Review of Scientific Instruments* **72**, 3281 (2001).
97. "Dynamics of a charged fluctuator in an Al-AlO_x-Al Single Electron Transistor", M. Kenyon, J. L. Cobb, A. Amar, D. Song, N. M. Zimmerman, C. J. Lobb, and F. C. Wellstood, to be published in *Jour. Low Temp. Phys.* (2001).
98. "Scanning SQUID Microscopy for Current Imaging", L. A. Knauss, A. B. Cawthorne, N. Lettsome, S. Kelly, F. C. Wellstood, W. E. Van Der Linde, *Milcroelectronics Reliability* **41**, 1211 (2001).
99. "The Relationship Between Spatial Resolution and Noise in Scanning SQUID Microscopy", S. Chatrathorn, E. F. Fleet and F. C. Wellstood, *Jour. Appl. Phys.* **92**, 4731 (2002)
100. "Capacitively Coupled Josephson Junctions: a Two-Qubit System", R. C. Ramos, F. W. Strauch, P. R. Johnson, A. J. Berkley, H. Xu, M. A. Gubrud, J. R. Anderson, C. J. Lobb, A. J. Dragt and F. C. Wellstood, to appear in the Proceedings of the 2002 Applied Superconductivity Conference.
101. "Analysis of Energy Level Quantization and Tunneling from the Zero-Voltage State of a Current-Biased Josephson Junction", H. Xu, A. J. Berkley, M. A. Gubrud, R. C. Ramos, J. R. Anderson, C. J. Lobb, and F. C. Wellstood, , to appear in the Proceedings of the 2002 Applied Superconductivity Conference.

102. "Characterization of an LC-Isolated Josephson Junction Qubit", A. J. Berkley, H. Xu, M. A. Gubrud, R. C. Ramos Jr., J. R. Anderson, C. J. Lobb, F. C. Wellstood, to appear in the Proceedings of the 2002 Applied Superconductivity Conference.
103. "Ultimate Limits to Magnetic Imaging" F. C. Wellstood, J. Matthews, and S. Chatrathorn, to appear in the Proceedings of the 2002 Applied Superconductivity Conference.
104. "Multi Channel High-T_c Scanning SQUID Microscope" J. Matthews, S. Y. Lee, F. C. Wellstood, A. F. Gilbertson, G. E. Moore, and S. Chatrathorn, to appear in the Proceedings of the 2002 Applied Superconductivity Conference.
105. "Single and Double Bit Quantum Gates by Manipulating Four-fold Degeneracy", T. Hakioglu, J. R. Anderson, and F. C. Wellstood, *Phys. Rev. B* **66**, 115324 (2002).
106. "Spectroscopy of capacitively coupled Josephson-junction qubits", Philip R. Johnson, Frederick W. Strauch, Alex J. Dragt, Roberto C. Ramos, C. J. Lobb, J.R. Anderson, and F. C. Wellstood, *PRB* **67**, 020509(Rapid) (2003).
107. "Identification of novel compositions of ferromagnetic shape-memory alloys using composition spreads", I. Takeuchi, O. O. Famodu, J. C. read, M. A. Aronova, K. -S. Cahng, C. Craciunescu, S. E. Lofland, M. Wuttig, F. C. Wellstood, L. Knauss, and A. Orozco, *Nature Materials*, published on-line Feb 2, 2003 on Nature Materials, Advance Online Publication/www.nature.com/naturematerials.
108. "Escape Rate Limited Lifetime of Quantum States in a Josephson-Junction Qubit", A. J. Berkley, H. Xu, M. A. Gubrud, R. C. Ramos, Jr., J. R. Anderson, C. J. Lobb, and F. C. Wellstood, submitted to PRL.
109. "Spectroscopic evidence for entangled macroscopic states in two superconducting qubits", A. J. Berkley, H. Xu, R. C. Ramos, M. A. Gubrud, F. W. Strauch, P. R. Johnson, J. R. Anderson, A. J. Dragt, C. J. Lobb & F. C. Wellstood, submitted to Nature (Feb 28, 2003).

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
3. "SQUID Microscopy", in *SQUID Handbook*, Editors J. Clarke and A. Braginski (Wiley, Berlin), in preparation.

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. "Ultimate limits of Scanning SQUID Microscopy", 20 minutes, Applied Superconductivity Conference, Houston, Sept. 2002.
2. "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.
3. "Scanning SQUID Microscopy and Its Applications", 1 hour, Kanazawa Institute of Technology, Tokyo, Japan, January, 2002.
4. "Thoughts on the Technology Commercialization Process", Inventors Seminar, Office of Technology Commercialization, University of Maryland, October 23, 2001

5. "Scanning SQUID Microscopy of Integrated Circuits", Colloquium, University of Maryland, College Park, September 25, 2001 (1 hour).
6. "Scanning SQUID Microscopy", SQUID 2001, Sept. 2, 2001, Stenungsund, Sweden (20 minutes).
7. "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).
8. "High-Tc SQUID Microscopy for the Non-destructive Testing of Integrated Circuits", F. C. Wellstood, E. Fleet, S. Chatrathorn, S. Y. Lee, and L. Knauss, June 20, 2001, International Superconducting Electronics Conference (ISEC) 2001, Osaka, Japan. (20 minutes).
9. "Scanning SQUID Microscopy", May 7, 2001, Solid State Colloquium, University of California at Berkeley (1 hour).
10. "From the Lab to Industry: Commercialization of the Scanning SQUID Microscope", Georgetown University, Department Colloquium, Sept. 14, 2000. (1 hour)
11. "High-Tc SQUID Microscope for Nondestructive Testing of Electronic Circuits", 13th International Symposium on Superconductivity, Tokyo, Japan, Oct. 16, 2000 (25 minutes).
12. "Magnetic Microscopy Using SQUIDS", Condensed Matter Seminar, University of Houston, February 16, 1999. (1 hour)
13. "Magnetic Microscopy Using SQUIDS", March Meeting of the American Physical Society, March 1998 (20 minutes).
14. "Single electron devices", Foundation and Frontiers of Physics course for beginning Physics grad students, Oct 19, 1998. (1 hour)
15. "Scanning SQUID Measurements of the Pairing Symmetry in YBCO", Gordon Research Conference, Ventura California, Jan. 15, 1997.
16. "A Simple Near-field Microwave Microscope", Laboratory for Physical Sciences, College Park, Maryland, Feb. 26, 1997.
17. "Magnetic Microscopy Using SQUIDS", Electrical Engineering Department Colloquium, University of Delaware, March 28, 1997.
18. "Magnetic Microscopy Using SQUIDS", F. C. Wellstood, Workshop on Sensitive Magnetometry (Magnetometrie Haute Sensibilite Et Application), Les Houches, France, June 9-13, 1997.
19. "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.
20. "Five Experiments", MRSEC IRG1 symposium (internal to the Department), October 22, 1997.
21. "Magnetic Microscopy Using SQUIDS", Physics Department Colloquium, University of Maryland, Sept. 24, 1996.
22. "Magnetic Microscopy Using SQUIDS", 1996 Applied Superconductivity Conference, Pittsburgh, PA, August 28, 1996.
23. "HTS SQUID Microscopes", ISTECH, Invited talk, Morioka, Japan, June 25, 1996.
24. "Magnetic Microscopy Using Superconducting Sensors", Invited talk, AAAS meeting, Baltimore, February 12, 1996.
25. "Principles and Applications of the Scanning SQUID Microscope", Materials Science Colloquium, University of Virginia, Charlottesville, February 19, 1996.
26. "Magnetic Microscopy Using Superconducting Sensors", Harvard University, Condensed Matter Seminar, Solid State Seminar, December 2, 1995.
27. "Magnetic Microscopy Using Superconducting Sensors", XVIII ENFMC, 18 th National Conference on Condensed Matter Physics, Caxambu, Brazil, June 8, 1995.

28. "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.
29. "Using a Scanning SQUID and Time-Reversal Invariance to Determine the Pairing Symmetry of YBCO", Solid State Colloquium, Universidade Federal Fluminense, Instituto Física, Mitiroa, Brazil, June 13, 1995.
30. "Magnetic Microscopy Using Superconducting Sensors", California Institute of Technology, Solid State Seminar, March 27, 1995.
31. "Using a Scanning SQUID to Determine the Pairing symmetry of YBCO", Stanford Conference on Spectroscopies of Superconductors", Stanford, California, March 1995.
32. "Using Superconducting Sensors for Magnetic Microscopy and Measurements of the Pairing symmetry of YBCO", Solid State Colloquium, Ohio State University, April 11, 1995.
33. "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).
34. "Magnetic Microscopy Using Superconducting Sensors", Solid State Colloquium, Applied Physics Lab, John Hopkins (10-14-94).
35. "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).
36. "Magnetic Microscopy Using Superconducting Sensors", F. C. Wellstood, Introductory Seminar Series, Laboratory for Physical Sciences, College Park, Maryland (2-16-94).
37. "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.
38. "Magnetic Microscopy Using Superconducting Sensors", F. C. Wellstood, Department of Physics Colloquium, College Park, Maryland (2-15-94).
39. "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).
40. "Magnetic Microscopy Using Superconducting Quantum Interference Devices", Condensed Matter Seminar, University of Chile, Santiago, Chile, (7-4-93).
41. "Magnetic Microscopy Using Superconducting Quantum Interference Devices", IMAG'93, Stockholm, Sweden, (4-14-93).
42. "Magnetic Microscopy Using High- T_C and Low- T_C SQUIDs", Global 93, International Superconductor Applications Convention, San Jose, California (2-3-93).
43. "Thin-film High- T_C Flux Transformers Coupled to SQUIDs", SQUID '91, Berlin, Germany, (6-21-91).
44. "High-Temperature Superconducting Thin-film SQUID Magnetometers", Spring Meeting of the European Materials Research Society, Strasbourg, France, (5-31-91).
45. "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).
46. "High- T_C Flux Transformers and SQUIDs", Global 91, International Superconductor Applications Convention, San Diego, California (1-15-91).
47. "YBCO Thin-film Coils and Flux Transformers", Solid State Colloquium, University of California, Davis, California (10-25-90).
48. "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 2001 are listed above under the corresponding refereed papers. 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-Al₂O₃-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-Tc SQUID Microscopy for the Non-destructive Testing of Integrated Circuits", F. C. Wellstood, E. Fleet, S. Chatrathorn, 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, Chatrathorn, 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.

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_c 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.

2.j. Fellowships, Prizes and Awards:

- (1) Fellow of the American Physical Society (to be awarded at the 2003 March meeting of the APS).
- (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

Member 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

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.

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 275 - Experimental Physics 1

(Fall 99) approximately 10 students

(Spring 2000) 10 students

(Fall 2000) 18 students

(Fall 2001) 6 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.

(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", Fall 1999 and Spring 2000 revised editions, F. C. Wellstood and D. Boyd, 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

R. C. Black (finished August 1995)

A. Mathai (finished September 1995)

Y. Gim (finished August 1996)

D. Song (finished Spring 1997)

I. Jin (finished summer 1997)

E. Fleet (finished Aug. 2000)

S. Chatraphorn (finished Dec 2000)

A. Thanwalla (finished Dec. 2000)

M. Kenyon (co-advised with C. J. Lobb, finished summer 2001)

M. Gubrud (started Sept. 98)

S.-Y. Lee (started Jan. 2000)

H. Xu (co-advised with J. R. Anderson and Chris Lobb, started fall 2000)

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.

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

- every few years, I sort abstracts for the March Meeting of the American Physical Society.

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

none

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.

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 running Maryland Day at the Physics Department, April 28, 2001. More than 1000 people attended the event. Also with 2002 event and with planning for 2003 event.
35. I served on one masters thesis defense (Jan Gaudestad) and one Ph.D defense (John Matthews) 2001.
36. Completed teaching peer review for Markus Luty and Michael Fuhrer
37. Conducted teaching interviews for faculty candidate Dorland, Spring 2001.

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)

4.b.iii. Campus and University

Served on the Banneker-Key Selection committee for 2002.

4.b.iv. Special Administrative Assignments

none

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.

4.c. Awards and Honors

See section 2j.

Frederick C. Wellstood
February 4, 2003