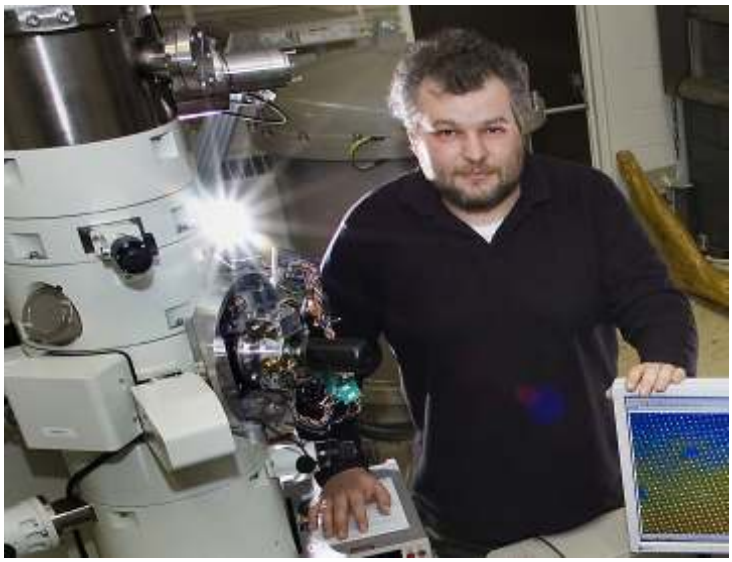
Marco Beleggia – Curriculum Vitae



Born:
Bologna, Italy, July 9, 1972
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EDUCATION and TRAINING

- Ph.D. Physics, University of Bologna, Italy (Feb. 13, 2001). Thesis title: "Transmission electron microscopy observation of electromagnetic fields". Advisor: Prof. Giulio Pozzi.
- Ms.D. Physics (graduated *cum laude*) University of Bologna, Italy (June 14, 1996). Thesis title: "Simulations of Foucault images of superconducting fluxons". Advisor: Prof. Giulio Pozzi.
- International School "Advances in Electron Microscopy in Materials Science", organized by University of Lecce and ISUFI, Lecce, Italy, Sep. 10-20, 2001.
- Summer School "National School on Condensed Matter Physics", organized by ISI Foundation and INFM, Villa Gualino, Torino, Italy, Sep. 4-15, 2000.
- Course "Quantitative High-Resolution Electron Microscopy and Electron Diffraction", Eurem2000, Brno, Czech Republic, July 9-14, 2000.
- Summer School "Superconducting Materials: Advances in Technology and Applications", International Advanced School "Leonardo da Vinci", Bologna, Italy, June 29–July 10, 1998.
- Course "Digital Imaging", Microscopy and Microanalysis '97, Cleveland OH, Aug. 10-14, 1997.
- Course "Modern Developments of Electron Microscopy in Material Science", XX Conference of the Italian Society of Electron Microscopy (SIME), Rimini, Italy, Sep. 11-14, 1995.

CAREER SUMMARY

2004-curr. ***Brookhaven National Lab., Center for Functional Nanomaterials*** **USA**
Associate scientist (tenure-track) in the group of Y. Zhu and in the nanomagnetism group (L. H. Lewis)

- Research focus: TEM observation and characterization of magnetic and electronic nanomaterials. Charge distributions and material defects at grain boundaries in superconductors. Analytical and numerical micro- and nano-magnetism. Electron imaging of radiation sensitive materials.
- Achievements: Development of magnetic phase diagrams for nano-rings, and of an analytical shape-shape magnetostatic interaction expression. Description of interfacial ferromagnetism in LaMnO-SrMnO multilayers. Interplay between dipolar and exchange couplings in ECC media. Assessed the influence of Zernike-type phase plates in single-molecule electron imaging with Cs-corrected electron microscopes.

2002-2003 ***Brookhaven National Lab., Materials Science Department*** **USA**
Research associate (post-doc) in the Nanoscale Structure of Advanced Materials group of Y. Zhu.

- Research focus: TEM observation and characterization of nanostructures.
- Achievements: Effect of shape anisotropy in phase computations and energetics of magnetic nanoparticles. Quantitative magnetization mapping of nanostructures by electron holography and micromagnetic simulations. Discovery of shape-induced ferromagnetic ordering in dipolar-dominated (e.g. colloidal) nanostructured systems.

2001 ***INFM – National Institute for the Physics of Matter*** **Italy**
Research fellow (post-doc) under the supervision of Prof. G. Pozzi.

- Research focus: Phase computations for superconducting vortices and p-n junctions.

- Achievements: Direct visualization of vortex pinning at columnar defects in high-T_c superconductors by phase-contrast methods. Electron-optical description of pancake vortices.

1999-2000 ***Hitachi Advanced Research Laboratory*** **Japan**

Visiting scientist at HARL in the group of Dr. A. Tonomura.

- Research focus: Electron holography of superconducting materials. Vortex dynamics.
- Achievements: Development and application of a reconstruction system for electron holography. Measurement of penetration depth in high-T_c superconductors by EH.

1996-2000 ***University of Bologna, Department of Physics*** **Italy**

Graduate student of Prof. G. Pozzi.

- Research focus: Phase contrast techniques for transmission electron microscopy: electron holography, Fresnel, Foucault, Coherent Foucault. Vortices in superconducting materials.
- Achievements: Development of a phase computation method for TEM observations. Applications to TEM image interpretation of superconducting vortices and p-n junctions.

GRANTS, AWARDS, MEMBERSHIPS, SCIENTIFIC ACTIVITIES

- Prize *SISM 2006* (Early Career Award), from Italian Society of Microscopy Sciences (SISM).
- Prize *Carla Milanesi*, from Italian Society of Electron Microscopy (SIME), for the outstanding contribution presented at the MCEM 5th conference (March 1st, 2002).
- Research Grant *Young Researcher Project* from University of Bologna ($2500, year 2001) to support collaboration with HARL group of Dr. A. Tonomura, Japan.
- Scolarship of INFM on "Phase contrast electron microscopy techniques for the observation of quantized flux lines", Feb. 1997 (*I had to refuse the award due to incompatibility with Ph.D. project*).
- Member of: Italian Society Microscopy Sciences, Microscopy Society of America, Materials Research Society.
- Peer-reviewer for several high-profile scientific journals: Phys. Rev. Lett., Phys. Rev. B, Phys. Rev. E, Nanoletters, Appl. Phys. Lett., J. Appl. Phys., Optics Comm., Ultramicroscopy, IEEE Trans. Mag., J. El. Micr., Physica B, etc.

TEACHING, ACADEMIC and SUPERVISORY ACTIVITIES

- Taught a series of lectures to fourth-year physics undergraduate students on "Advanced calculus applied to electron-optics, phase retrieval and phase contrast techniques". Bologna University, 1999-2001.
- Teaching Assistant for courses "Electron Optics" and "Electron Microscopy". Bologna University, 1999-2001.
- Taught a fourth year undergraduate "Electron Microscopy laboratory" course. Bologna University, 2000.
- Trained and supervised undergraduate and graduate students in their Ms.D. or Ph.D. research projects. Bologna University, Carnegie Mellon University, Brookhaven National Lab., 2000-2005.
- Gave a number of departimental colloquia, seminars, talks, where undergrad. and grad. students were involved.
- Member of the Ph.D. evaluation committee for S. Tandon, Carnegie Mellon University, 2004.
- Wrote Chapter 7 in the book "Modern Techniques for Characterizing Magnetic materials", edited by Y. Zhu, Kluwier Academic (2005). The book is intended as a methodological reference book for graduate students, university faculties, scientists and engineers who are interested in magnetic materials and their characterization.
- Taught a short course (10 hours) on "Advanced electron microscopy techniques applied to nanoscience" at the University of Bologna (Italy), Physics Department, to graduate students, 2006.

SCIENTIFIC EXPERTISE and SKILLS

- Micro- and nano-magnetism: analytical and numerical micromagnetism, magnetic nanostructures, local hysteresis, nanoscale interactions and energetics, shape anisotropy, finite-size effects, dipolar-dominated systems, magnetic phase diagrams, nanostructured arrays, multilayers and heterostructures, multiferroics.
- Superconductivity: vortices, flux pinning, flux-line-lattice dynamics, field topography, surface effects.
- Semiconductors: p-n junctions, doping profiling, electric field topography, surface effects.
- Electron optics; electron microscopy; electron holography; image formation theory; light optics.
- Modeling of electromagnetic fields and simulation of data, images and signals as observed in microscopes.
- Nano-science and technology: magnetic and ferroelectric nanostructures, strongly correlated electron systems.
- Single-molecule imaging with electrons; radiation sensitive materials; Zernike phase contrast.
- Image processing and computer programming.
- Finite-element modeling and numerical simulations: micromagnetic and semiconductor devices.
- Hands-on experience with Transmission El. Microscopes (Philips CM30, Philips Tecnai, Jeol 3000F, Jeol 2100F).
- *Language skills*: Italian (native), English (advanced), elements of Spanish, German, French, Japanese.
- *Programming languages*: Basic, Fortran77/90, Pascal, C/C++, Mathematica, AppleScript, TeX/LaTeX, IDL
- *Software packages*: Digital Micrograph, Mathematica, MS-Office, Photoshop, Acrobat, Illustrator, CodeWarrior, OOMMF, LLG-solver for micromagnetic simulations.

RESEARCH INTERESTS and COLLABORATIONS

Areas of interest

- Nanoscale physics: spin and charge distributions and their dynamics
- Nanotechnology: functionalization — characterization — application
- Synergy between electron-probe and photon-probe techniques
- Electron holography and interferometry; phase contrast and phase retrieval
- Advanced electron microscopy (Lorentz, EELS, STEM, in-situ)
- Shape- and finite-size effects in electronic and magnetic nanomaterials
- Dipolar interactions and dipolar-dominated (colloidal) systems
- Ferroelectrics and multiferroic materials
- Interface between physical, chemical, and life sciences
- Aharonov-Bohm effect and quantized flux-lines (vortices) in superconductors
- Hysteretic processes and systems
- Single-molecule and radiation-sensitive materials imaging

Research methodology and collaborations

- Constant interplay between physical modeling, experimental observations, interpretation
- Scientific exchange of ideas through conferences, seminars, collaborations, students
- International collaborations with major experts in the various research fields:
    - A. Tonomura: electron holography, Aharonov-Bohm effect, superconducting vortices
    - G. Pozzi: phase contrast and phase retrieval microscopy techniques, optics
    - Y. Zhu: electron diffraction, nanoscale characterization of advanced materials
    - M. De Graef: crystallography, Lorentz-TEM
    - M. Malac: nanolithography, EELS, Zernike phase plates for electrons
    - G. Merli: p-n junctions and semiconductors, SEM
    - G. Rowlands: fundamentals of micromagnetism, energetics of nanomagnets
    - Y. Millev: spin reorientation transitions, renormalization group theory
    - M. Freeman: time-resolved magneto-optical techniques
    - R. Klie: STEM and atomic-resolved EELS, grain boundaries
    - L. Lewis: magnetic materials, magnetic phase transitions, nanomagnetism
    - D. Arena: synchrotron, element-specific time-resolved x-ray spectroscopy and magnetic dichroism
    - G. Matteucci: electron holography, foundations of quantum mechanics, Aharonov-Bohm effect
    - L. Ferrari: phase transitions, statistical mechanics
    - J. Davenport: first-principle calculations, Heisenberg models
    - D. Vokoun: exchange-coupled composite media, magnetometry
    - J. Lau: magnetodynamics in shape-controlled nanostructured materials, surface roughness effects
    - M. Schofield: electron holography, spin and charge distributions in materials
    - Ch. Jooss: manganites, multiferroics, magneto-optical techniques

LIST OF PUBLICATIONS

PEER-REVIEWED JOURNALS

1. "Foucault imaging of superconducting fluxons". T. Yoshida, M. Beleggia, J. Endo, K. Harada, H. Kasai, T. Matsuda, G. Pozzi, A. Tonomura. *J. Appl. Phys.* **85**, 4096-4103 (1999).
2. "Recent results in the interpretation of Interference and Lorentz images of vortices in superconductors". M. Beleggia, S. Fanesi, R. Patti, G. Pozzi. *Mater. Charact.* **42**, 209-220 (1999).
3. "A model for the interpretation of holographic and Lorentz images of tilted reverse biased p-n junctions in a finite specimen". M. Beleggia, R. Capelli, G. Pozzi. *Philos. Mag. B* **80**, 1071-1082 (2000).
4. "Electron microscopy of reverse biased p-n junctions". M. Beleggia, D. Cristofori, P.G. Merli, G. Pozzi. *Micron* **31**, 231-236 (2000).
5. "Observation of superconducting vortices using advanced electron microscopy techniques". M. Beleggia, R. Patti, G. Pozzi, in *Superconducting materials, Advances in Technology and Applications*, World Scientific Press, Ed. A. Tampieri, G. Celotti (2000).
6. "On the calculation of the phase shift of superconducting fluxons: from the isolated to the lattice case". M. Beleggia and G. Pozzi. *Ultramicroscopy* **84**, 171-183 (2000).
7. "Observation of superconducting fluxons by transmission electron microscopy: a new Fourier space approach for calculating the electron optical phase shift". M. Beleggia and G. Pozzi. *Phys. Rev. B* **63**, 054507 (2001).
8. "Influence of the specimen surfaces on TEM images of reverse-biased p-n junctions". M. Beleggia, G.C. Cardinali, P.F. Fazzini, P.G. Merli, G. Pozzi. *Inst. Phys. Conf. Ser.* **169**, 427-430 (2001).
9. "Transmission Electron Microscopy observation of Electromagnetic fields". M. Beleggia. *Ph.D. thesis*. University of Bologna, Italy (2001).
10. "Phase shift and phase-contrast images of pancake superconducting vortices". M. Beleggia and G. Pozzi. *J. Electron Microsc.* **51**, S73 (2002).
11. "Direct Evidence of the Anisotropic Structure of Vortices Interacting with Columnar Defects in High-Temperature Superconductors through the Analysis of Lorentz Images". O. Kamimura, H. Kasai, T. Akashi, T. Matsuda, K. Harada, J. Masuko, T. Yoshida, N. Osakabe, A. Tonomura, M. Beleggia, G. Pozzi, Y. Nakayama, J. Shimoyama, K. Kishio, T. Hanaguri, K. Kitazawa, M. Sasase, S. Okayasu. *J. Phys. Soc. Jpn.* **71**, 1840-1843 (2002).
12. "TEM phase contrast images of reverse-biased p-n junctions: the effect of charged oxide layers". M. Beleggia, P.F. Fazzini, P.G. Merli, G. Pozzi. *Microscopia elettronica* **23(2)**, 37-42 (2002).
13. "Interpretation of experimental Lorentz microscopy observations of superconducting vortices in high-temperature superconductors with columnar defects". M. Beleggia, G. Pozzi, J. Masuko, N. Osakabe, K. Harada, T. Yoshida, O. Kamimura, H. Kasai, T. Matsuda, A. Tonomura. *Phys. Rev. B* **66**, 174518 (2002).
14. "A Fourier approach to fields and electron optical phase shifts calculations". M. Beleggia, P.F. Fazzini, G. Pozzi. *Ultramicroscopy* **96**, 93-103 (2003).
15. "Influence of charged oxide layers on TEM imaging of reverse biased p-n junctions". M. Beleggia, P.F. Fazzini, P.G. Merli, G. Pozzi. *Phys. Rev. B* **67**, 045328 (2003).
16. "Electron-optical phase shift of magnetic nanoparticles, part I: basic concepts". M. Beleggia and Y. Zhu. *Philos. Mag.* **83**, 1045-1055 (2003).
17. "Electron-optical phase shift of magnetic nanoparticles, part II: polyhedral particles". M. Beleggia, Y. Zhu, S. Tandon, M. De Graef. *Philos. Mag.* **83**, 1143-1161 (2003).
18. "Profile structure of magnetic flux lines in type-II superconductor froma rectangular electron hologram". K. Harada, M. Beleggia, J. Endo, H. Kasai, Y. Togawa, T. Matsuda, A. Tonomura. *J. Electron Microsc.* **52(4)**, 369-373 (2003).
19. "Quantitative comparison of magnetic field mapping in TEM with micromagnetic simulations". M. Beleggia, M.A. Schofield, Y. Zhu, M. Malac, Z. Liu, M. Freeman. *Appl. Phys. Lett.* **83**, 1435-1437 (2003).
20. "On the computation of the Demagnetization Tensor Field for an arbitrary particle shape using a Fourier space approach". M. Beleggia and M. De Graef. *J. Magn. Magn. Mater.* **263**, L1-L9 (2003).
21. "Atomic scale model of the grain boundary potential in Perovskite Oxides". R.F. Klie, M. Beleggia, Y. Zhu, J.P. Buban, N.D. Browning. *Phys. Rev. B* **68**, 214101 (2003).
22. "On the computation of the demagnetization tensor for uniformly magnetized particles of arbitrary shape. Part I: analytical approach". S. Tandon, M. Beleggia, Y. Zhu, M. De Graef. *J. Magn. Magn. Mater.* **271**, 9-26 (2004).

23. "On the computation of the demagnetization tensor for uniformly magnetized particles of arbitrary shape. Part II: numerical approach". S. Tandon, M. Beleggia, Y. Zhu, M. De Graef. *J. Magn. Magn. Mater.* **271**, 27-38 (2004).
24. "Modeling Superconducting vortices in High-T_c materials for TEM observations". M. Beleggia, G. Pozzi, A. Tonomura. *J. Magn. Magn. Mater.* **272-276**, E143-E144 (2004).
25. "Electron optical phase shift of a Josephson vortex". M. Beleggia. *Phys. Rev. B* **69**, 014518 (2004).
26. "Direct evidence of negative grain boundary potential in Ca-doped and undoped $YBa_2Cu_3O_{7-x}$". M.A. Schofield, M. Beleggia, Y. Zhu, K. Guth, C. Jooss. *Phys. Rev. Lett.* **92**, 195502 (2004).
27. "On the magnetostatic interactions between nanoparticles of arbitrary shape". M. Beleggia, S. Tandon, Y. Zhu, M. De Graef. *J. Magn. Magn. Mater.* **278**, 270-284 (2004).
28. "On the computation of the demagnetization tensor for particles of arbitrary shape". M. Beleggia, S. Tandon, Y. Zhu, M. De Graef. *J. Magn. Magn. Mater.* **272-276**, E1197-E1199 (2004).
29. "A Fourier Space Approach to the Computation of Magnetostatic Interactions between Arbitrarily Shaped Particles". M. Beleggia. *IEEE Trans. Mag*. **40**, 2149-2151 (2004).
30. "Direct measurements of electrostatic potentials at grain boundaries: mechanism for current improvement in high-T_c superconductors". Ch. Joos, K. Guth, M.A. Schofield, M. Beleggia, Y. Zhu, *Phys. C* **408-410**, 443-444 (2004).
31. "On the Transport of Intensity technique for phase retrieval". M. Beleggia, M.A. Schofield, V.V. Volkov, Y. Zhu. *Ultramicroscopy* **102**, 37-49 (2004).
32. "Model of superconducting vortices in layered materials for the interpretation of transmission electron microscopy images". M. Beleggia, G. Pozzi, A. Tonomura, H. Kasai, T. Matsuda, K. Harada, T. Akashi, T. Matsui, S. Tajima. *Phys. Rev. B* **70**, 184518 (2004).
33. "General magnetostatic shape-shape interactions". M. Beleggia and M. De Graef. *J. Magn. Magn. Mater.* **285**, L1-L10 (2005).
34. "Nanoscale magnetic phase imaging and induction mapping using advanced electron microscopy techniques". M. Beleggia and Y. Zhu, chapter 7 in *Modern techniques for characterizing magnetic materials* (Kluwer academic, 2005).
35. "Direct Correlation of Reversal Rate Dynamics to Domain Configurations in Micron-sized Permalloy Elements". J.W. Lau, M. Beleggia, M.A. Schofield, Y. Zhu, G.F. Neumark. *J. Appl. Phys.* **97**, 10E702 (2005).
36. "Electron optical phase shifts by Fourier methods: analytical versus numerical calculations". P.F. Fazzini, G. Pozzi, M. Beleggia. *Ultramicroscopy* **104**, 193-205 (2005).
37. "Demagnetization factors for elliptic cylinders". M. Beleggia, M. De Graef, Y.T. Millev, D.A. Goode and G. Rowlands. *J. Phys. D: Appl. Phys.* **38**, 3333-3342 (2005). Selected by the Editors for inclusion in the special collection "IOP Select".
38. "Shape-induced ferromagnetic ordering in a triangular array of magnetized disks". M. Beleggia, S. Tandon, Y. Zhu and M. De Graef. *Appl. Phys. Lett.* **87**, 202504-202506 (2005).
39. "Energy barrier to magnetic vortex nucleation". J.W. Lau, J.K. Bording, M. Beleggia, Y. Zhu. *Appl. Phys.Lett.* **88**, 012508-012510 (2005).
40. "Phase diagram for magnetic nano-rings". M. Beleggia, J.W. Lau, M.A. Schofield, Y. Zhu, S. Tandon and M. De Graef. *J. Magn. Magn. Mater.* **301**, 131-146 (2006).
41. "The equivalent ellipsoid of a magnetized shape". M. Beleggia, M. De Graef and Y.T. Millev. *J. Phys. D: Appl. Phys.* **39**, 891-899 (2006).
42. "Demagnetization factors of the general ellipsoid: An alternative to the Maxwell approach". M. Beleggia, M. De Graef and Y.T. Millev. *Philos. Mag.* **86**, 2451-2466 (2006).
43. "Quantitative Shadow technique for the investigation of magnetic domain wall widths". G. Pozzi, M. Beleggia, M.A. Schofield, Y. Zhu. *Appl. Phys. Lett.* **88**, 152506 (2006).
44. "The fluxgate ring-core demagnetization field". M. De Graef and M. Beleggia, *J. Magn. Magn. Mater.* **305/2**, 403-409 (2006).
45. "Bright-field TEM imaging of single molecules: Dream or near future?". M. Malac, M. Beleggia, R. Egerton, and Y. Zhu. *Ultramicroscopy* **107**, 40-49 (2007).
46. "Retrieving the complex degree of coherence of electron beams", J. Carrasquilla-Alvarez, R. Castaneda, J. Garcia-Sucerquia, M.A. Schofield, M. Beleggia, Y. Zhu and G. Matteucci. *Optik.* (2007) in press.
47. "Quantitative domain wall width measurement with coherent electrons". M. Beleggia, M.A. Schofield, Y. Zhu, G. Pozzi. *J. Magn.Magn. Mater.* (2007) in press [doi:10.1016/j.jmmm.2006.10.995].
48. "Characterization of JEOL 2100F Lorentz-TEM for low-magnification electron holography and magnetic imaging". M.A. Schofield, M. Beleggia, J.W. Lau, Y. Zhu. *Ultramicroscopy* (2007) submitted.

49. "Imaging of radiation sensitive samples in transmission electron microscopes equipped with Zernike phase plate". M. Malac, M. Beleggia, R. Egerton, Y. Zhu. *Ultramicroscopy* (2007) submitted.
50. "Dipolar-exchange coupled composite media for perpendicular magnetic recording". M. Beleggia, D. Vokoun, C.H. Lai, T. Rahman, L. H. Lewis, Y. Zhu. *Phys. Rev. Lett.* (2007) submitted.
51. "The Effect of dipolar interactions in the exchange coupled composite media". D. Vokoun, M. Beleggia, C.H. Lai, T. Rahman, Y. Zhu. *Appl. Phys. Lett.* (2007) submitted.
52. "Common magnetization reversal mechanisms and the correlation of transient domain configurations to the field relaxation rate in patterned Permalloy films". J. Lau, M. Beleggia, Y. Zhu. *J. Appl. Phys.* (2007) in preparation.
53. "Interplay of multiferroic behaviour, phase separation and colossal resistance effects in manganites". Ch. Jooss, L. Wu, T. Beetz, R. Klie, M.A. Schofield, S. Schramm, J. Hoffmann, Y. Zhu. *Science* (2007) in preparation.
54. "Spontaneous magnetic reversals in μm-sized permalloy ultra-thin disks". M. Beleggia, M.A. Schofield, Y. Zhu. *Phys. Rev. B* (2007) in preparation.

INVITED TALKS and SEMINARS

t1. "Dipolar Interactions and Shape Anisotropy in Magnetic Nanoparticles". M. Beleggia. Physics Department and National Institute for Nanotechnology, University of Alberta, Edmonton, Canada. August 8, 2003, invited seminar (hosts: Prof. M. Freeman and Dr. M. Malac).

t2. "Dipolar Interactions and Shape Anisotropy in Magnetic Nanoparticles. Recent Developments of the Fourier-space approach for phase computations". M. Beleggia. Physics Department, University of Bologna, Italy, December 12, 2003, invited seminar (host: Prof. G. Pozzi).

t3. "Observation of Dipolar Ferromagnetism by TEM techniques". M. Beleggia, S. Tandon, Y. Zhu and M. De Graef. Conference of the Microscopy Society of America, Savannah, GA, Aug. 1-5, 2004, invited talk.

t4. "Characterization of artificially patterned arrays of magnetic elements by Transmission Electron Microscopy", M. Beleggia, Meeting of the National Institute for the Physics of Matter, Genova, Italy, June 8-10, 2004, invited talk.

t5. "Transmission Electron Microscopy of Vortices in Superconducting Materials". M. Beleggia. Iowa State University, Physics Department, April 15th, 2005, invited seminar (host: Prof. J.R. Clem).

t6. "The phase diagram for magnetic nano-rings". M. Beleggia, J.W. Lau, M.A. Schofield, Y. Zhu, S. Tandon and M. De Graef. The Minerals, Metals & Materials Society Annual Meeting, San Francisco, CA, Feb. 13-17, 2005, invited talk.

t7. "Electron Holography of magnetic nanostructures", M. Beleggia, J.W. Lau, M.A. Schofield and Y. Zhu. Microscopy Conference 2005, Davos, Switzerland, Aug 28-Sep 2, 2005, invited talk.

t8. "Electron Holography: how to explore the nanoworld with coherent electrons". M. Beleggia. National Institute for Nanotechnology, Edmonton, Canada. July 29, 2006, invited seminar (host: Dr. M. Malac).

t9. "Magnetic phenomena at the nanoscale revealed by Electron Holography". M. Beleggia. Hitachi Advanced Research Laboratory, Hatoyama, Saitama, Japan. August 31, 2006, invited talk (host: Dr. K. Harada).

t10. "Observing nanoscale phenomena with coherent electrons". M. Beleggia. University of Göttingen, Germany. December 18, 2006, invited seminar (host: Prof. Dr. Schönhammer).

CONFERENCE PROCEEDINGS – EXTENDED ABSTRACTS

c1. "Experiments on Foucault images of superconducting fluxons". T. Yoshida, J. Endo, K. Harada, H. Kasai, T. Matsuda, M. Beleggia, G. Pozzi, A. Tonomura. *Microsc. Microanal.* **3**, Suppl. 2, 507-508 (1997).

c2. "Theoretical Foucault images of superconducting fluxons". M. Beleggia, G. Pozzi, K. Harada, H. Kasai, T. Matsuda, T. Yoshida, A. Tonomura. *Microsc. Microanal.* **3**, Suppl. 2, 509-511 (1997).

c3. "One-dimensional theoretical Foucault images of superconducting fluxons". M. Beleggia, G. Pozzi, J. E. Bonevich, K. Harada, H. Kasai, T. Matsuda, T. Yoshida, A. Tonomura, Proc. 11th Eur. Congr. on El. Micr., Electron Microscopy **96(2)**, Comm. of Eur. Soc. of Micr. Publ. - Brussels, 105-106 (1998).

c4. "Theoretical coherent Foucault images of fluxon lattice", M. Beleggia, G. Pozzi, K. Harada, H. Kasai, T. Matsuda, T. Yoshida. A. Tonomura. *Electron Microscopy 1998*, vol 2, Mat. Science 1, 531-532 (1998).

c5. "Interpretation of holographic and Lorentz images of an array of reverse biased p-n junctions in a semi-infinite specimen". M. Beleggia, R. Capelli, and G. Pozzi. *Microsc. Microanal*. **5**, Suppl. 2, 954-955 (1999).

c6. "A Fourier space approach for calculating the electron optical phase shift of superconducting fluxons", M. Beleggia, G. Pozzi and A. Tonomura. *Eurem2000 proceedings* **3(I)**, 127-128 (2000).

c7. "On the calculation of the phase shift of a superconducting flux line lattice", M. Beleggia, G. Pozzi and A. Tonomura. *Microsc. Microanal.* **6**, Suppl. 2, 1032-1033 (2000).

c8. "TEM phase contrast images of reverse-biased p-n junctions: the effect of charged oxide layers", M. Beleggia, P.F. Fazzini, P.G. Merli and G. Pozzi. *5th MCEM meeting proceedings*, 307-308 (2001).

c9. "Image interpretation of magnetic domains in $Nd_2Fe_{14}B$ hard magnets", M. Beleggia, M.A. Schofield, V.V. Volkov and Y. Zhu. *Microsc Microanal.* **8**, Suppl. 2, 512CD (2002).

c10. "Vortex modeling in High-T_c anisotropic materials", M. Beleggia, J. Masuko, N. Osakabe, G. Pozzi and A. Tonomura. *Microsc. Microanal.* **8**, Suppl. 2, 528CD (2002).

c11. "Phase contrast images of superconducting pancake vortices", M. Beleggia, G. Pozzi and A. Tonomura. *Microsc. Microanal.* **8**, Suppl. 2, 530CD (2002).

c12. "Modeling of magnetic stripe domains by Fourier methods: Phase shift and phase-contrast images", M. Beleggia, P.F. Fazzini and G. Pozzi. *ICEM2002 proceedings* 307-308 (2002).

c13. "Electron Holography and Micromagnetic Simulations for TEM magnetization mapping", M. Beleggia, M. A. Schofield, Y. Zhu, M. Malac, Z. Liu and M. Freeman. *Microsc. Microanal.* **9**, Suppl. 2, 778CD (2003).

c14. "Phase Retrieval and Induction Mapping Artificially Structured Nanometric Magnetic Arrays", Y. Zhu, V.V. Volkov, M. Schofield, M. Beleggia, J. Lau and M. Malac. *Microsc. Microanal.* **9**, Suppl. 2, 308CD (2003).

c15. "Measurement of Charge at Grain-Boundary Edge Dislocations in Ca-doped and Undoped YBCO by Electron Holography", M.A. Schofield, M. Beleggia, Y. Zhu, K. Guth, Ch. Jooss. *Microsc. Microanal.* **9**, Suppl. 2, 784CD (2003).

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