

Chia-Ling Chien

Jacob L. Hain Professor of Physics

Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD 21218
(410) 516-8092 (office), (410) 516-7239 (fax), clc@pha.jhu.edu

Education:

1965 B.S. Tunghai University, Taiwan (Physics)
1968 M.S. Carnegie-Mellon University (Physics)
1972 Ph.D. Carnegie-Mellon University (Physics)
Thesis Advisor: Sergio DeBenedetti (deceased)

Experience:

1973-74 Research Associate, The Johns Hopkins University
1974-75 Associate Research Scientist, The Johns Hopkins University
1975-76 Visiting Assistant Professor of Physics, The Johns Hopkins University
1976-79 Assistant Professor of Physics, The Johns Hopkins University
1979-83 Associate Professor of Physics, The Johns Hopkins University
1983-present Professor of Physics, The Johns Hopkins University
2007-present Professor of Materials Science and Engineering

1980 IBM Yorktown Heights Research Center, Summer faculty position
1980-81 Member, International Advisory Committee, International Conference on Amorphous Systems Investigated by Nuclear Methods
1985-2011 Advisory Committee of Conference on Magnetism and Magnetic Materials
1986 Local Chairman, 31st Magnetism and Magnetic Materials Conference
1987 Co-organizer, Focused Session on Granular Materials, 1987 APS March Meeting
1989 Member, International Advisory Committee, International Conference On the Applications of the Mössbauer Effect, Budapest, Hungary
1991 Member, International Advisory Committee, International Conference On the Applications of the Mössbauer Effect, China
1991-95 Member, International Advisory Board of the *Journal of Materials, Chemistry and Physics*
1995 Program Co-Chairman, 40th Conference on Magnetism and Magnetic Materials
1996-2003 Advisory Committee, Hong Kong University of Science and Technology
1996-2002 Associate Editor, *"Methods in Materials Research : A Current Protocols Publication"* (Wiley)
1997-present Director, Materials Research Science and Engineering Center (MRSEC) at Johns Hopkins University
1998 Co-organizer, Focused Session on magnetic nanostructures, 1998 APS Meeting
2002 General Chairman, Conference on Magnetism and Magnetic Materials (2002).
2002-present Member, Advisory Committee, Institute of Physics, Academia Sinica, Taiwan.
2003 Chair, Advisory Committee, Conference on Magnetism and Magnetic Materials
2007 Member, Department of Physics and Astronomy Academic Performance Evaluation Committee, National Tsinghua University, Hsinchu Taiwan
2010- Associate Editor, *"Methods in Materials Research: A Current Protocols Publication"* (Wiley)

- 2011(1-8) Distinguished Visiting Research Fellow, Institute of Physics, Academia Sinica
2011(1-8) Visiting Professor, Center for Condensed Matter Sciences, National Taiwan Univ.

Honors and Distinction:

- Jacob L. Hain Professor of Physics
1989 Fellow (American Physical Society)
1996- Honorary Professor, Nanjing University, Nanjing, China
1996- Honorary Professor, Lanzhou University, Lanzhou, China
1998- Advisory Professor, Fudan University, Shanghai, China
2004 David Adler Award of American Physical Society
2005 IEEE Magnetics Society Distinguished Lecturer
2006- Honorary Chair Professor, National Tsinghua University, Taiwan
2007 Tunghai University Distinguished Alumnus Award
2010 Fellow of the American Association for the Advancement of Sciences (AAAS)
2012 First recipient of AUMS (Asian Union of Magnetics Societies) Award

Professional Activities:

- Fellow: American Physical Society
Member: IEEE Magnetics Society
Member: Materials Research Society
Fellow: American Association for the Advancement of Science

Patents:

1. C. L. Chien, G. Xiao, and S. H. Liou, "Metal-Insulator Composites having Improved Properties and Method for Their Preparation," U.S. Patent No. 4,973,525 (Nov. 27, 1990).
2. C. L. Chien, P. C. Searson, and K. Liu. "Arrays of Semi-metallic Bi Nanowires and Fabrication Techniques Therefor," U.S. Patent No. 6,187,165 (February 13, 2001).
3. F. Y. Yang, K. Liu, C. L. Chien and P. C. Searson, "Bismuth Thin Films structure and Method of Construction," U. S. Patent No. 6,358,392 (March 19, 2002).
4. T. P. Weihs, R. C. Cammarata, C. L. Chien, and C. H. Shang, "High Performance Nanostructured Materials and Methods of Making the Same," US patent 6,596,101 (July 22, 2003)
5. F. Q. Zhu and C. L. Chien, "Ferromagnetic Nanorings, Mediums Embodying Same Including Devices and Methods Related Thereto," US patent 7,983,074 (July 19, 2011).

Pending Patents: 3

Publications: Over 390 papers and book chapters.

Invited Talks, Colloquia, and Seminars: Over 250.

Total Citations: 15,000+

Hirsch Citation Index: 61

- 1 publication with 1200+ citations
- 2 publications with 750+ citations

33 publications with 100+ citations

Graduate Students Supervised

J. H. Hsu (Professor, National Taiwan University)
K. M. Unruh (Professor, University of Delaware)
S. H. Liou (Professor, University of Nebraska)
G. Xiao (Professor, Brown University)
J. R. Childress (Hitachi Global Storage Technologies)
A. Gavrin (Associate Professor and Associate Dean, Indiana University at Indianapolis)
J. Q. Xiao (Professor, University of Delaware)
J. S. Jiang (Principal Physicist, Argonne National Lab)
T. Ambrose (Seagate Research Lab)
N. J. Gökemijer (Seagate Research Lab)
K. Liu (Professor, UC Davis)
F. Y. Yang (Associate Professor, Ohio State University)
Y. Ji (Assistant Professor, University of Delaware)
X. M. Cheng (Assistant Professor, Bryn Mawr College)
J. Valentine (US Patent and Trademark Office)
T. Y. Chen (Assistant Professor, Arizona State University)
F. Q. Zhu (Hitachi Global Storage Technologies)
D. L. Fan (Assistant Professor, University of Texas at Austin)

Post-Doctoral Advisees

G. Xiao (Professor, Brown University)
J. Q. Xiao (Professor, University of Delaware)
T. H. Kim (Associate Professor, Ewha University, Korea)
J. W. Cai (Professor, Physics Institute, China)
G. J. Strijkers (Associate Professor, Eindhoven Institute of Technology)
F. Y. Yang (Associate Professor, Ohio State University)
L. Sun (Associate Professor, University of Houston)
S. Urazhdin (Assistant Professor, Emory University)
W. L. Lee (Assistant Research Fellow, Institute Of Physics, Academia Sinica, Taiwan)
F. Q. Zhu (Hitachi Global Storage Technologies)
D. L. Fan (Assistant Professor, University of Texas at Austin)
T. Y. Chen (Assistant Professor, Arizona State University)
W. G. Wang (Assistant Professor, University of Arizona)

Recent Research Areas and Representative Publications (since 1992)

Giant Magnetoresistance in Granular Systems: After the discovery of giant magnetoresistance (GMR) by Fert and Grünberg (2007 Nobel Prize in Physics) in 1988, we have discovered GMR in granular systems in 1992 demonstrating that GMR is a general phenomena in magnetic nanostructures with a non-aligned spin structure for mediating spin-dependent scattering.

173. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Giant Magnetoresistance in Non-Multilayer Magnetic Systems," *Phys. Rev. Lett.* **68**, 3749 (1992).
181. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Giant Magnetoresistance in Granular Co-Ag System," *Phys. Rev.* **B46**, 9266 (1992).
185. P. Xiong, G. Xiao, J. Q. Wang, J. Q. Xiao, J. S. Jiang, and C. L. Chien, "Extraordinary Hall Effect and Giant Magnetoresistance in Granular Co-Ag System," *Phys. Rev. Lett.* **69**, 3220 (1992).
187. J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Magnetic Properties and Giant Magnetoresistance of Granular Permalloy in Silver," *Appl. Phys. Lett.* **61**, 2362 (1992).
194. L. Piraux, M. Cassart, J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Magneto-thermal Transport Properties of Granular Co-Ag," *Phys. Rev. (Rapid Commun.)* **B48**, 638 (1993).
209. C. L. Chien, "Magnetism and Giant Magneto-Transport Properties in Granular Solids," *Annual Review of Materials Science*, **25**, 129 (1995).

Arrays of Magnetic Nanowires: In 1993, they have pioneered arrays of magnetic nanowires fabricated by electrodeposition through nanopore templates [*Science*, 261, 1316 (1993)]. These nanowires may be single-material or multi-segmented [*Phys. Rev. (Rapid Commun.) B* **51**, 7381 (1995)]. The magnetic nanowires exhibit unique magnetic properties dictated by the high aspect ratio and the small diameter in tens of nanometer. They exhibit a wide variety of conducting [*Phys. Rev. B* **58** (*Rapid Communications*), 14681 (1998).], magnetic properties [*Appl. Phys. Lett.* **74**, 2803 (1999), *Phys. Rev. B* **61** (*Rapid Commun.*) R6463 (2000), *Appl. Phys. Lett.* **79**, 4429 (2001), *IBM J. Res. and Develop.*, **49**, 79 (2005), *Phys. Rev. B (Rap. Comm.)* **71**, 012417 (2005).]

196. T. M. Whitney, J. S. Jiang, P. C. Searson, and C. L. Chien, "Fabrication and Magnetic Properties of Arrays of Metallic Nanowires," *Science*, **261**, 1316 (1993).
210. K. Liu, K. Nagodawithana, P. C. Searson, and C. L. Chien, "Perpendicular Giant Magnetoresistance of Multilayered Co/Cu Nanowires," *Phys. Rev. (Rapid Commun.)* **B51**, 7381 (1995).
250. Kai Liu, C. L. Chien, and P. C. Searson, "Finite-Size Effects in Bismuth Nanowires," *Phys. Rev. B* **58** (*Rapid Communications*), 14681 (1998).
258. L. Sun, P. C. Searson, and C. L. Chien, "Electrochemical Deposition of Nickel Nanowire Arrays in Single Crystal Mica Films," *Appl. Phys. Lett.* **74**, 2803 (1999).
265. L. Sun, C. L. Chien and P. C. Searson, "Fabrication of Nanoporous Single Crystal Mica Templates for Electrochemical Deposition of Nanowire Arrays," *J. Materials Science*, **35**, 1097-1103 (2000).
267. L. Sun, P. C. Searson and C. L. Chien, "Finite-Size Effects in Nickel Nanowire Arrays," *Phys. Rev. B* **61** (*Rapid Commun.*) R6463 (2000).
289. L. Sun, C. L. Chien, and P. C. Searson, "Magnetic Anisotropy in Prismatic Ni Nanowires," *Appl. Phys. Lett.* **79**, 4429 (2001).
334. L. Sun, Y. Hao, C. L. Chien. And P. C. Searson, "Tuning the properties of magnetic nanowires," *IBM J. Res. and Develop.*, **49**, 79 (2005).
335. L. Sun, P. C. Searson, and C. L. Chien, "Asymmetry of magnetic hysteresis in exchange-biased multilayers with out-of-plane applied field," *Phys. Rev. B (Rap. Comm.)* **71**, 012417 (2005).

Proximity Effects in Superconductor/Ferromagnet Multilayers: We have revealed the intriguing interactions occurring in the proximity of a superconductor and a ferromagnet [*Phys.*

Rev. Lett. **76**, 1727 (1996)], π -phase coupling [*Phys. Rev. Lett.* **74**, 314 (1995)], and interlayer coupling across a superconducting layer.

- 206. J. S. Jiang, D. Davidovic, D. H. Reich and C. L. Chien, "Oscillatory Superconducting Transition Temperature in Nb/Gd Multilayers," *Phys. Rev. Lett.* **74**, 314 (1995).
- 217. J. Q. Xiao and C. L. Chien, "Proximity Effects of Superconductor/Magnetic Semiconductor NbN/GdN Multilayers," *Phys. Rev. Lett.* **76**, 1727 (1996).
- 227. J. S. Jiang, D. Davidovic, D. H. Reich and C. L. Chien, "Superconducting Transition in Nb/Gd/Nb Trilayers," *Phys. Rev. B* **54**, 6119 (1996).
- 260. C. L. Chien and D. H. Reich, "Proximity Effects in Superconducting/Magnetic Multilayers," *J. Mag. Mag. Mat.* **200**, 83-94 (1999).

Physics of Exchange Bias: Exchange bias occurring across the interface between a ferromagnet and an antiferromagnet is an intriguing phenomenon of scientific and technological importance. We have uncovered some of the rich physics of exchange bias, including the finite size effect in thin antiferromagnet [*Phys. Rev. Lett.* **76**, 1743 (1996)], exchange bias in the paramagnetic state [*Phys. Rev. Lett.* **81**, 2795 (1998)], exchange across a spacer layer [*Phys. Rev. Lett.* **79**, 4270 (1997)], memory effect [*Phys. Rev. B* **60**, 3033 (1999)], spiraling spin structure [*Phys. Rev. Lett.*, **85**, 2597 (2000)], and oscillatory exchange bias [*Phys. Rev. Lett.* **90**, 147201 (2003)], and antiferromagnet spin rotation [*Phys. Rev. B* **71**, 220410 (*Rapid Commun.*) (2005)], and the existence of exchange spring [*Phys. Rev. B* **73**, 184428 (2006)].

- 219. T. Ambrose and C. L. Chien, "Finite-Size Effects and Uncompensated Magnetization in Thin Antiferromagnetic CoO Layers," *Phys. Rev. Lett.* **76**, 1743 (1996).
- 235. N. J. Gokemeijer, T. Ambrose, and C. L. Chien, "Long-Range Exchange Bias Across a Spacer Layer," *Phys. Rev. Lett.* **79**, 4270 (1997).
- 248. X. W. Wu and C. L. Chien, "Exchange Coupling in Ferromagnet/Antiferromagnet Bilayers with Comparable T_C and T_N ," *Phys. Rev. Lett.* **81**, 2795 (1998).
- 249. S. M. Zhou, Kai Liu, and C. L. Chien, "Exchange Coupling and Macroscopic Domain Structure in a Wedged Permalloy/FeMn Bilayer," *Phys. Rev. B* **58** (*Rapid Communications*) 14717 (1998).
- 263. N. J. Gokemeijer, J. W. Cai, and C. L. Chien, "Memory Effects of Exchange Coupling in Ferromagnet/Antiferromagnet Bilayers," *Phys. Rev. B* **60**, 3033 (1999).
- 264. V. I. Nikitenko, V. S. Gornakov, A. J. Shapiro, R. D. Shull, Kai Liu, S. M. Zhou, and C. L. Chien, "Asymmetry in the Elementary Events of Magnetization Reversal in Ferromagnetic/Antiferromagnetic Bilayers," *Phys. Rev. Lett.* **84**, 765 (2000).
- 274. F. Y. Yang and C. L. Chien, "Spiraling Spin Structure in an Exchange-Coupled Antiferromagnetic Layer," *Phys. Rev. Lett.*, **85**, 2597 (2000).
- 280. N. J. Gokemeijer, R. L. Penn, D. R. Veblen, and C. L. Chien, "Exchange Coupling in Epitaxial CoO/NiFe Bilayers with Compensated and uncompensated Interfacial Spin Structures," *Phys. Rev. B* **63**, 174422 (2001).
- 313. F. Y. Yang and C. L. Chien, "Oscillatory Exchange Bias due to an Antiferromagnet with Incommensurate Spin Density wave," *Phys. Rev. Lett.* **90**, 147201 (2003).
- 340. S. Urazhdin and C. L. Chien, "Effects of antiferromagnetic spin rotation on the anisotropy of ferromagnetic/antiferromagnetic bilayers," *Phys. Rev. B* **71**, 220410 (*Rapid Commun.*) (2005).
- 354. V. S. Gornakov, Yu. P. Kabanov, O. A. Tikhomirov, V. I. Nikitenko, S. V. Urazhdin, F. Y. Yang, C. L. Chien, A. J. Shapiro, and R. D. Shull, "Experimental study of the microscopic mechanisms of magnetization reversal in FeNi/FeMn exchange-biased ferromagnet/antiferromagnet polycrystalline bilayers using the magneto-optical indicator film technique," *Phys. Rev. B* **73**, 184428 (2006).

Andreev Reflection Spectroscopy and Half-metals: Chien's group has been instrumental in establishing quantitative Andreev reflection spectroscopy (ARS) [*Phys. Rev. B* **63**, 104510 (2001), *Phys. Rev. B* **81**, 214444 (2010).], which is a ballistic transport phenomenon occurring at the interface between a metal and a superconductor. ARS can quantitatively measure the spin polarization of a metal as well as the superconducting gap of a superconductor. Since materials with high spin polarization (P) are essential for all spintronics devices, high P materials, especially half metals with $P = 100\%$, are highly sort after and extensively searched. Chien's group has reported the P values of many highly spin-polarized materials including CrO_2 , the first true half-metal a measured P of more than 99% [*Phys. Rev. Lett.* **86**, 5585 (2001).] as well as several others with exceptionally high spin polarization including $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ and $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ [*Phys. Rev. B* **66**, 12410 (2002)], Co_2MnSi and NiMnSb [*Phys. Rev. B* **68**, 104430 (2003)], and $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$ [*Phys. Rev. Lett.*, **94**, 056602 (2005)].

- 281. Y. Ji, G. J. Strijkers, F. Y. Yang, C. L. Chien, J. M. Byers, A. Anguelouch, G. Xiao, and A. Gupta, "Determination of the Spin Polarization of Half-Metallic CrO_2 by point Contact Andreev Reflection," *Phys. Rev. Lett.* **86**, 5585 (2001).
- 301. Y. Ji, C. L. Chien, Y. Tomioka and Y. Tokura, "Measurement of Spin Polarization of Single Crystals of $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ and $\text{La}_{0.6}\text{Sr}_{0.4}\text{MnO}_3$ " *Phys. Rev. B* **66**, 12410 (2002).
- 305. Lance Ritchie, Gang Xiao, Y. Ji, T. Chen, C. L. Chien, M. Zhang, J. Chen, Z. Liu, G. Wu, and X. X. Zhang, "Magnetic, structural, and transport properties of Heusler alloys Co_2MnSi and NiMnSb ," *Phys. Rev. B* **68**, 104430 (2003).
- 318. J. M. D. Coey and C. L. Chien, "Half-Metallic Ferromagnetic Oxides," in *Spin-Polarized Materials for Spintronics* in *MRS Bulletin* **28** (no.10), 720 (October 2003).
- 339. L. Wang, K. Umemoto, R. M. Wentzcovitch, T. Y. Chen, C. L. Chien, J. G. Checkelsky, J. C. Eckert, E. D. Dahlberg, and C. Leighton, " $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$: a tunable source of highly spin polarized electrons," *Phys. Rev. Lett.*, **94**, 056602 (2005).
- 384. T. Y. Chen, S. X. Huang, and C. L. Chien, "Pronounced effects of additional resistance in Andreev reflection spectroscopy," *Phys. Rev. B* **81**, 214444 (2010).
- 400. T. Y. Chen, Z. Tesanovic, and C. L. Chien, "Unified formalism of Andreev reflection at a ferromagnet/superconductor interface," *Phys. Rev. Lett.* **109**, 146602 (2012).

Magneto-Transport Properties of Single-Crystal Bi Thin Films: Bi is a semimetal with unusual Fermi surfaces and electrons and holes of low effective mass and carrier density. We have accomplished in high quality Bi thin films enormous carrier mean path necessary for capturing extremely large magnetoresistance (400,000%) [*Science* **284**, 1335 (1999), *Phys. Rev. Lett.* **82**, 3328 (1999)], Shubnikov-de Haas oscillations [*Phys. Rev. B* **61**, 6631 (2000).], spin Hall effect, and quantum transport.

- 257. F. Y. Yang, Kai Liu, C. L. Chien, and P. C. Searson, "Large Magnetoresistance and Finite-Size Effects in Electrodeposited Single-Crystal Bi Thin Films," *Phys. Rev. Lett.* **82**, 3328 (1999).
- 261. F. Y. Yang, Kai Liu, Kimin Hong, D. H. Reich, P. C. Searson, and C. L. Chien, " Large Magnetoresistance of Electrodeposited Single-Crystal Bismuth Thin Films," *Science* **284**, 1335 (1999).
- 266. F. Y. Yang, Kai Liu, Kimin Hong, D. H. Reich, P. C. Searson, C. L. Chien, Y. Leprince-Wang, Kui Yu-Zhang, and Ke Han, "Shubnikov-de Haas Oscillations in Electrodeposited Single-Crystal Bismuth Films," *Phys. Rev. B* **61**, 6631 (2000).

Spin-Transfer Torque Effects: Spin transfer torque (STT) is the inverse effect of the GMR effect, where an electrical current alters the magnetic configuration without using a magnetic field. Due to the high current density required, STT switching can only be observed in nanostructures of nanopillars and point contacts with a small cross section. Using the point contact technique, we have observed STT switching in continuous trilayers [*Appl. Phys. Lett.* **84**, 380 (2004).], and have discovered new STT effects. We have observed STT effect in a single exchange-biased ferromagnetic layer [*Phys. Rev. Lett.*, **90**, 106601(2003), *Phys. Rev. Lett.*, **93**, 026601 (2004)], which is the inverse effect of domain wall resistance (DMR). We have also observed that granular solids exhibit no STT effect at zero field but a huge effect of 400% under either a large external magnetic field or a large current density, which is essential for generating the all-important spin-polarized current [*Phys. Rev. Lett.* **96**, 207203 (2006)].

312. Y. Ji, C. L. Chien, and M. D. Stiles, “Current Induced Spin Wave Excitations in a Single Ferromagnetic Layer,” *Phys. Rev. Lett.*, **90**, 106601(2003).
323. T. Y. Chen, Y. Ji, and C. L. Chien, “Reversible Switching in Continuous Films by Point Contact Spin Injection,” *Appl. Phys. Lett.* **84**, 380 (2004).
324. T. Y. Chen, Y. Ji, C. L. Chien, and M. D. Stiles, “Current-driven switching in a single exchange-biased ferromagnetic layer,” *Phys. Rev. Lett.*, **93**, 026601 (2004).
346. S. Urazhdin, C. L. Chien, K. Y. Guslienko, and L. Novozhilova, “Effects of current on the magnetic states of permalloy nanodiscs,” *Phys., Rev. B* **73**, 054416 (2006).
351. T. Y. Chen, S. X. Huang, C. L. Chien and M. D. Stiles, “Enhanced magnetoresistance induced by spin transfer torque in granular films with a magnetic field,” *Phys. Rev. Lett.* **96**, 207203 (2006).

Patterned Nanomagnets and Devices: While poles are synonymous to magnets as in the case of a macroscopic bar magnet, the magnetic configurations of a nanomagnet of sub-micron size are altogether different depending intricately on the geometrical shape and material. For example, a circular nanomagnet does not have a dipole configuration, but instead forms a vortex state of two chiralities with no poles, without a net magnetization nor stray magnetic field. However, a vortex core, lying at the disc center with spins pointing perpendicular to the disc, dominates the dynamics of circular nanomagnets [*Physics Today* **60**, 40 (2007)]. Chien’s group also pioneered magnetic nanorings that exhibit unique magnetic configurations. A few years ago with the nanosphere lithography, they have fabricated arrays of nanorings with the smallest diameter (100 nm), narrowest ring width (20 nm), largest number (10^9), and highest areal density (45 rings/ μm^2), which are still records to date [*Adv. Mater.* **16**, 2155 (2004)]. They demonstrated the new configurations of “onion”, “vortex”, and “twisted” states and switching schemes of magnetic nanorings [*Phys. Rev. Lett.*, **96**, 027203 (2006)]. They have also fabricated the first nanoring magnetic tunnel junctions (MTJs) and demonstrated that in nanoring MTJs, unlike their counterparts in disc MTJs, magnetic field switching and spin torque switching can yield different states with potential for multilevel storage [*Phys. Rev. B* **77**, 224432 (2008)].

330. F. Q. Zhu, D. L. Fan, X. C. Zhu, J. G. Zhu, R. C. Cammarata, C. L. Chien, “Ultrahigh density arrays of ferromagnetic nanorings on a macroscopic area,” *Adv. Mater.* **16**, 2155 (2004).
342. F. Q. Zhu, G. W. Chern, O. Tchernyshyov, X. C. Zhu, J. G. Zhu, and C. L. Chien, “Magnetic Bistability and Controllable Reversal of Asymmetric Ferromagnetic Nanorings,” *Phys. Rev. Lett.*, **96**, 027203 (2006).
360. F. Q. Zhu, Z. Shang, D. Monet, and C. L. Chien, “Large enhancement of coercivity of magnetic Co/Pt nanodots with perpendicular anisotropy,” *J. Appl. Phys.* **101**, 09J101 (2007).

363. C. L. Chien, F. Q. Zhu, and J. G. Zhu, "Patterned Nanomagnets," *Physics Today* **60**, 40 (2007); *Japanese translation in Parity* **23** (no.2) 10 (2008).
371. H. X. Wei, F. Q. Zhu, X. F. Han, Z. C. Wen, and C. L. Chien, "Current-induced multiple spin structures in 100 nm ring magnetic tunnel junctions," *Phys. Rev. B* **77**, 224432 (2008).

Development of Electric Tweezers and Cell Specific Drug Delivery: Optical tweezers and magnetic tweezers are well known techniques to only hold nanoparticles in suspension using laser beam and magnetic field gradients respectively. Since no net force is exerted, neither technique can manipulate small entities in suspension. We recently developed electric tweezers using AC and DC electric field to manipulate nanowires to execute translational and rotational motion with high precision of better than 150 nm. [*Appl. Phys. Lett.* **85**, 4175 (2004), *Phys. Rev. Lett.*, **94**, 247208 (2005), *Appl. Phys. Lett.* **89**, 223115 (2006), *Appl. Phys. Lett.* **92**, 093115 (2008)]. Electric tweezers is a new technique for a wide range of biomedical, MEMS, and fluid mechanics applications. In 2010, we have accomplished for the first time cell-specific drug delivery using electric tweezers to manipulate a single nanowire functionalized with a drug [*Nature Nanotechnology* **5**, 545 (2010)]

329. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Manipulation of Nanowires in Suspension by AC Electric Fields," *Appl. Phys. Lett.* **85**, 4175 (2004).
341. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Controllable High-Speed Rotation of Nanowires," *Phys. Rev. Lett.*, **94**, 247208 (2005).
356. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Efficiency of assembling of nanowires in suspension by AC electric fields," *Appl. Phys. Lett.* **89**, 223115 (2006).
364. D. L. Fan, R. C. Cammarata, and C. L. Chien, "Precision transport and assembling of nanowires in suspension by electric field," *Appl. Phys. Lett.* **92**, 093115 (2008).
382. D. L. Fan, Z. Z. Yin, R. Cheong, F. Q. Zhu, R. C. Cammarata, C. L. Chien, and A. Levchenko, "Sub-cellular resolution delivery of a cytokine via precisely manipulated nanowires," *Nature Nanotechnology* **5**, 545 (2010). Featured story, "Nanowires have cells in their sights," *Nature Nanotechnology* **5**, 481 (2010).
391. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Electric Tweezers," (invited) *Nanotoday* **6**, 339 (2011).

Materials with Perpendicular Magnetic Anisotropy Hybrids with Superconductors: While most ferromagnetic materials have in-plane anisotropy, a few materials, among them Co/Pt multilayers, exhibit perpendicular magnetic anisotropy, suitable for the studies of Bloch domain walls, the interplay in ferromagnet-superconductor hybrids, and with relevance to perpendicular magnetic recording. We have discovered antisymmetric instead of symmetric MR in materials with PMA due to the fact the domain walls aligns perpendicular to *both* magnetization and current, a situation exists only in materials with PMA [*Phys. Rev. Lett.*, **94**, 017203 (2005)]. We have also observed asymmetric domain nucleation where the reversal begins for one field direction only and characterized by an acute asymmetry of domain wall mobility for forward and backward domain motion [*Phys. Rev. Lett.*, **98**, 117204 (2007)] Recently, we show that the superconducting transition can be driven by the domain wall arrangement in the ferromagnet in ferromagnet/superconductor hybrids [*Phys. Rev. Lett.* **101**, 017004 (2008)].

333. X. M. Cheng, S. Urazhdin, O. Tchernyshyov, C.L. Chien, V.I. Nikitenko, A.J. Shapiro and R.D. Shull, "Antisymmetric magnetoresistance in magnetic multilayers with perpendicular anisotropy," *Phys. Rev. Lett.*, **94**, 017203 (2005).

358. Y. L. Iudin, Y. P. Kabanov, V. I. Nikitenko, X. M. Cheng, D. Clarke, O. A. Tretiakov, O. Tchernyshyov, A. J. Shapiro, R. D. Shull, and C. L. Chien, "Asymmetric domain nucleation and unusual magnetization reversal in ultrathin Co films with perpendicular anisotropy," *Phys. Rev. Lett.*, **98**, 117204 (2007).
372. L. Y. Zhu, T. Y. Chen, and C. L. Chien, "Altering the superconducting transition temperature by domain-wall arrangement in hybrid ferromagnet-superconductor structures," *Phys. Rev. Lett.* **101**, 017004 (2008).
385. L. Y. Zhu, M. Z. Cieplak, and C. L. Chien, "Tunable phase diagram and vortex pinning in ferromagnet-superconductor bilayer," *Phys. Rev. B (Rapid Commun.)* **82**, 060503 (2010).
390. M. Z. Cieplak, L. Y. Zhu, Z. Adamus, M. Konczykowski, and C. L. Chien, "Enhancement of vortex pinning in superconductor/ferromagnet bilayer via angled demagnetization," *Phys. Rev. B (Rapid Commun.)* **84**, 020514(R) (2011).

New Fe Superconductors: A new family of Fe superconductors were discovered in the spring of 2008, two decades after the cuprates. Most theoretical papers early on had predicted, and some experiments have claimed, *d*-wave pairing with nodal gaps, similarly to those of the well-known cuprate superconductors. Chien's group used point contact Andreev reflection spectroscopy to show that the gap of the new Fe superconductors have the *s*-wave symmetry with a BCS-like temperature dependence and $2\Delta/k_B T_C = 3.68$, [*Nature*, **453**, 1224 (2008)]. This conclusion has since been corroborated by many other experiments, including ARPES, penetration depth, NMR relaxation time, Josephson junction, measurements. More recently, they use epitaxial thin film of $\text{FeSe}_{0.5}\text{Te}_{0.5}$ to control tetrahedral coordination and shows its intimate connection with superconductivity [*Phys. Rev. Lett.*, **104**, 217002, (2010)]

369. T. Y. Chen, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, "A BCS-like gap in the superconducting $\text{SmFeAsO}_{0.85}\text{F}_{0.15}$," *Nature*, **453**, 1224 (2008).
378. T. Y. Chen, S. X. Huang, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, "Determination of Superconducting Gap of $\text{SmFeAsF}_x\text{O}_{1-x}$ Superconductors by Andreev Reflection Spectroscopy," *Physica C* **469**, 521 (2009).
383. S. X. Huang, C. L. Chien, V. Thampy, and C. Broholm, "Control of tetrahedral coordination and superconductivity in $\text{FeSe}_{0.5}\text{Te}_{0.5}$ thin films," *Phys. Rev. Lett.*, **104**, 217002, (2010).

Spin Caloritronics: In spintronics, both electronic charge and spin are manipulated. On the heel of spintronics, we now have spin caloritronics where one exploits the interaction between heat transport and the charge or spin degree of freedom. Spin Seebeck effect and spin-dependent spin transport are two very recent examples.

394. S. Y. Huang, W. G. Wang, S. F. Lee, J. R. Kwo, and C. L. Chien, "Intrinsic spin-dependent thermal transport," *Phys. Rev. Lett.* **107**, 216604 (2011).
399. S. Y. Huang, X. Fan, D. Qu, Y. P. Chen, W. G. Wang, J. Wu, T. Y. Chen, J. Q. Xiao, and C. L. Chien, "Transport Magnetic Proximity Effects in Platinum," *Phys. Rev. Lett.* **109**, 107204 (2012)

Voltage-Controlled Spintronic Devices: Spintronic devices have evolved from first-generation (1G) field devices, driven by magnetic field to second-generation (2G) current devices driven by the spin transfer torque (STT) effect. Unfortunately, the critical switching current density in the 2G current devices is too high at $10^6 - 10^7 \text{ A/cm}^2$ to be useful. Very recently, voltage-controlled spintronic devices have been achieved where low voltages (less than 1.5 V) can alter the magnetic properties and thereby controlling spintronic properties with current density in the range of 10^4 A/cm^2 , two to three orders of magnitude lower.

395. W. G. Wang, M. Li, S. Hageman, and C. L. Chien, "Electric field assisted switching in magnetic tunnel junctions," *Nature Mater.* **11**, 64 (2012).

Publications

1. C. L. Chien and J. E. Greedan, "A Study of the Spontaneous Magnetization of EuLiH_3 Using the Mössbauer Effect," *Phys. Lett.* **36A**, 197 (1971).
2. C. L. Chien and F. deS. Barros, "Hyperfine Interaction of ^{151}Eu in Eu_2TiO_4 ," *Phys. Lett.* **38A**, 427 (1972).
3. C. L. Chien, S. DeBenedetti and F. deS. Barros, "Ferrimagnetic Properties of $\text{Eu}_3\text{Ti}_2\text{O}_7$," *Phys. Lett.* **44A**, 178 (1973).
4. C. L. Chien and J. C. Walker, "Study of Temperature Spikes in Solids Using the Mössbauer Effect Following Coulomb Excitations," *Proceedings of the 5th Int. Conf. on Mössbauer Spectroscopy*, (Bratislava, Czech. 1973).
5. C. L. Chien, S. DeBenedetti and F. deS. Barros, "Crystal Field Calculations of the 5d Splittings of Eu^{2+} ," *Intl. J. Magnetism* **5**, 361 (1974).
6. C. L. Chien, S. DeBenedetti and F. deS. Barros, "Magnetic Properties of EuTiO_3 , Eu_2TiO_4 , and $\text{Eu}_3\text{Ti}_2\text{O}_7$," *Phys. Rev.* **B10**, 3913 (1974).
7. E. Loh, C. L. Chien and J. C. Walker, "Sublattice Magnetization of Dy Near the Néel Point," *Phys. Lett.* **49A**, 357 (1974).
8. C. L. Chien, J. C. Walker and E. Loh, "Critical Behavior of the Sublattice Magnetization of Dy Near the Néel Point," *AIP Conf. Proc.* **24**, 282 (1975).
9. C. L. Chien, J. C. Walker and R. Hasegawa, "Observation of rf-Induced Sideband Effects in an Amorphous Magnetic Material," *AIP Conf. Proc.* **24**, 127 (1975).
10. R. J. Semper, C. L. Chien and J. C. Walker, "Observation of the Temperature Dependence of Magnetic Hyperfine Fields in Very Thin Fe Films," *Proc. Int. Conf. on Mössbauer Spectroscopy*, Cracow, Poland, p. 35.
11. C. L. Chien and J. C. Walker, "Origin of rf Sidebands in Mössbauer Spectra," *Proc. Int. Conf. on Mössbauer Spectroscopy*, Cracow, Poland, p. 47.
12. C. L. Chien and R. Hasegawa, "Mössbauer Studies of the Amorphous Alloys Fe-Pd-Si," *Proc. Int. Conf. On Mössbauer Spectroscopy*, Cracow, Poland, p. 343.
13. C. L. Chien and J. C. Walker, "Mössbauer Sidebands from a Single Parent Line," *Phys. Rev.* **B13**, 1876 (1976).
14. R. Hasegawa and C. L. Chien, "Mössbauer and Its rf Sideband Effects in Iron-rich Glassy Alloys," *Solid State Comm.* **18**, 913 (1976).

15. R. J. Semper, C. L. Chien and J. C. Walker, "Temperature Studies of the Hyperfine Magnetic Field in Thin Iron Films," AIP Conf. Proc. **29**, 538 (1976).
16. C. L. Chien and R. Hasegawa, "Magnetic Properties of Amorphous $\text{Fe}_{40}\text{Ni}_{40}\text{P}_{14}\text{B}_6$," AIP Conf. Proc. **29**, 214 (1976).
17. C. L. Chien and R. Hasegawa, "Easy Axis of Amorphous Ferromagnet $\text{Fe}_{40}\text{Ni}_{40}\text{P}_{14}\text{B}_6$," J. Appl. Phys. **47**, 2234 (1976).
18. C. L. Chien and R. Hasegawa, "Spontaneous Magnetization of Amorphous Ferromagnets," AIP Conf. Proc. **31**, 366 (1976).
19. C. L. Chien and R. Hasegawa, "Magnetic Properties of a Ferromagnetic Metallic Glass $\text{Fe}_{80}\text{P}_{16}\text{B}_1\text{C}_3$," IEEE Trans. **MAG-12**, 951 (1976).
20. J. E. Greedan, C. L. Chien and R. G. Johnston, "A Systematic Study of Magnetic Order in Divalent Eu Perovskites," J. Solid State Chem. **19**, 155 (1976).
21. C. L. Chien and R. Hasegawa, "Mössbauer Study of Amorphous $\text{Fe}_{75}\text{P}_{15}\text{C}_{10}$," J. de Physique **C6**, 759 (1976).
22. J. C. Walker, C. L. Chien and R. J. Semper, "Temperature and Thickness Dependence of the Magnetic Hyperfine Field in Ultrathin Iron Films," Thin Film Conf., York, England (1976).
23. C. L. Chien and R. Hasegawa, "Mössbauer Study of a Glassy Ferromagnet," in *Amorphous Magnetism II*, (edited by R.A. Levy and R. Hasegawa, New York: Plenum, 1977), p. 289.
24. C. L. Chien and R. Hasegawa, " $T^{3/2}$ Dependence of Hyperfine Field and Spin-Wave Excitations in Ferromagnetic Metallic Glass," Phys. Rev. **B16**, 2115 (1977).
25. C. L. Chien and R. Hasegawa, "Mössbauer Study of a Glassy Ferromagnet: $\text{Fe}_{40}\text{Ni}_{40}\text{P}_{14}\text{B}_6$," Phys. Rev. **B16**, 3024 (1977).
26. C. L. Chien, D. Musser, F. E. Luborsky, J. J. Becker and J. L. Walter, "Magnetic Hyperfine Interaction and Curie Temperatures of Amorphous $(\text{Fe}_x\text{Ni}_{1-x})_{80}\text{P}_{14}\text{B}_6$," Solid State Comm. **24**, 231 (1977).
27. S. Duncan, R. J. Semper, C. L. Chien and J. C. Walker, "Anomalous Magnetic Hyperfine Fields in Ultrathin Fe Films," ICMS, **I**, 109 (1977).
28. C. L. Chien, "Electric Field Gradient in Amorphous Magnetic Solid," J. Hyper. Int. **4**, 869 (1978).

29. C. L. Chien and R. Hasegawa, "Mössbauer Study of Glassy Alloys $(\text{Fe-Mo})_{80}\text{B}_{20}$," J. Appl. Phys. **49**, 1721 (1978).
30. C. L. Chien, "Mössbauer Study of a Binary Amorphous Ferromagnet: $\text{Fe}_{80}\text{B}_{20}$," Phys. Rev. **B18**, 1003 (1978).
31. C. L. Chien and R. Hasegawa, " $T^{3/2}$ Dependence of Hyperfine Field in Amorphous Ferromagnets," J. Hyper. Int. **4**, 866 (1978).
32. C. L. Chien and A. W. Sleight, "Mössbauer Effect Studies of Europium Pyrochlores," Phys. Rev. **B18**, 2031 (1978).
33. C. L. Chien, D. Musser, F. E. Luborsky and J. L. Walter, "Hyperfine Field Distributions in Amorphous $(\text{Fe}_x\text{Ni}_{1-x})_{80}\text{P}_{14}\text{B}_6$," J. Phys. F8, 2407 (1978).
34. R. J. Birgeneau, J. A. Tarvin, G. Shirane, E. M. Gyorgy, R. C. Sherwood, H. S. Chen and C. L. Chien, "Spin-Wave Excitations and Low-Temperature Magnetization in the Amorphous Metallic Ferromagnetic $(\text{Fe-Ni})_{75}\text{P}_{16}\text{B}_6\text{Al}_3$," Phys. Rev. **B18**, 2192 (1978).
35. C. L. Chien, "Hyperfine Interactions and Magnetic Ordering Temperature of Amorphous $\text{Fe}_x\text{Pd}_{80-x}\text{Si}_{20}$ with Low Fe Concentrations," Phys. Lett. **38A**, 2192 (1978).
36. C. L. Chien, D. Musser, F. E. Luborsky and J. L. Walter, "The Influence of the Metalloid Elements on the Magnetic Properties of Amorphous $\text{Fe}_{40}\text{Ni}_{40}\text{P}_y\text{B}_{20-y}$," Solid State Comm. **28**, 645 (1978).
37. C. L. Chien, "Mössbauer Study of An Amorphous Magnetic Solid Containing Cr," Phys. Rev. **B19**, 81 (1979).
38. C. L. Chien, J. C. Walker and R. Shnidman, "Observation of Very Short-lived Radiation Effects in Rare Earth Solids Following Coulomb Excitation," Phys. Rev. **B19**, 1363 (1979).
39. C. L. Chien and H. S. Chen, "Correlation of Isomer Shift and Hyperfine Field in Amorphous $(\text{Fe}_{0.2}\text{Co}_{0.8})_{80}\text{P}_{17}\text{Al}_3$," J. de Physique (C2) 118 (1979).
40. C. L. Chien, D. Musser, F. E. Luborsky and J. L. Walter, "Mössbauer Studies of Amorphous $(\text{Fe}_x\text{Ni}_{1-x})_{80}\text{P}_{17}\text{B}_3$," J. de Physique (C2), 129 (1979).
41. A. H. Owens, C. L. Chien and J. C. Walker, "Depth Profiling of the Magnetic Hyperfine Field in Ultrathin Films of Fe Using Mössbauer Spectroscopy," J. de Physique (C2) 74 (1979).
42. D. Musser, C. L. Chien, F. E. Luborsky and J. L. Walter, "The Influence of Carbon on the Hyperfine Interaction and Curie Temperature of Amorphous $\text{Fe}_{84}\text{B}_{16-x}\text{C}_x$," J. Appl. Phys. **50**, 1571 (1979).

43. C. L. Chien and H. S. Chen, "Effect of Mo on the Magnetic Properties of Amorphous $(\text{Fe}_x\text{Mo}_{1-x})_{75}\text{P}_{16}\text{B}_6\text{Al}_3$," J. Appl. Phys. **50**, 1574 (1979).
44. C. L. Chien, D. Musser, E. M. Gyorgy, R. C. Sherwood, H. S. Chen, F. E. Luborsky and J. L. Walter, "Magnetic Properties of Amorphous $\text{Fe}_x\text{B}_{100-x}$ ($72 \leq x \leq 86$) and Crystalline Fe_3B ," Phys. Rev. **B20**, 283 (1979).
45. D. Musser, C. L. Chien and H. S. Chen, "Mössbauer Study of a Binary Amorphous Ferromagnet: ," J. Appl. Phys. **50**, 7659 (1979).
46. C. L. Chien, J. H. Hsu, J. P. Stokes, A. N. Bloch and H. S. Chen, "Magnetic Ordering Temperature, Hyperfine Field Distribution and Electrical Resistivity of Amorphous $(\text{Fe}_x\text{Mn}_{1-x})_{75}\text{P}_{16}\text{B}_6\text{Al}_3$," J. Appl. Phys. **50**, 7647 (1979).
47. *Hall Effect and Its Applications*, edited by C. L. Chien and C. R. Westgate, (Plenum, New York, 1980).
48. C. L. Chien, J. H. Hsu, P. J. Viccaro, B. D. Dunlap, G. K. Shenoy and H. S. Chen, "Mössbauer Studies of Magnetic Ordering in Amorphous $(\text{Fe}_x\text{Mn}_{1-x})_{75}\text{P}_{16}\text{B}_6\text{Al}_3$ under External Magnetic Field," J. Appl. Phys. **52**, 1750 (1981).
49. C. L. Chien, "Mössbauer Spectroscopy Studies of Amorphous Metallic Solids," in *Nuclear and Electron Resonance Spectroscopies Applied to Materials Science*, edited by E.N. Kaufmann and G. Shenoy (Elsevier North-Holland, 1981), p.157.
50. C. L. Chien, "Comments on the Analysis of Hyperfine Field Distributions in Amorphous Magnetic Solids Using a Spectrum-subtraction Method," Phys. Rev. **B23**, 4788 (1981).
51. C. L. Chien and K. M. Unruh, "Magnetic Properties of Amorphous $\text{Fe}_x\text{B}_{100-x}$ ($0 \leq x \leq 90$)," Phys. Rev. **B24**, 1556 (1981).
52. C. L. Chien, K. M. Unruh, A. Levy, S. H. Liou, J. P. Stokes, R. J. Gambino and K. Fukamichi, "Magnetic, Mössbauer and Resistivity Studies of Amorphous $\text{Fe}_{74}\text{Zr}_{26}$ and $\text{Fe}_{81}\text{Hf}_{19}$ Alloys," J. Appl. Phys. **53**, 2307 (1982).
53. T. S. Plaskett, S. A. Shivashankar, B. L. Gilbert, B. L. Olson, C. L. Chien and D. A. Herman, "Synthesis of Mn-Zn Ferrites From $\text{Na}_2\text{O}-\text{B}_2\text{O}_3$ Flux Under $\text{CO}-\text{CO}_2$ Ambients," J. App. Phys. **52**, 2428 (1982).
54. C. L. Chien and K. M. Unruh, "Magnetic Hyperfine Interactions in Amorphous $\text{Fe}_x\text{B}_{100-x}$," Phys. Rev. **B25**, 5790 (1982).
55. C. L. Chien and K. M. Unruh, "Mössbauer Spectroscopy Studies of Amorphous $\text{Fe}_x\text{B}_{100-x}$ ($0 \leq x \leq 90$)," Nuclear Inst. & Meth. **199**, 193 (1982).

56. C. L. Chien, K. M. Unruh and S. H. Liou, "Amorphous $\text{Fe}_x\text{Nb}_{100-x}$ with Wide Composition Range," *J. Appl. Phys.* **53**, 7756 (1982).
57. K. M. Unruh and C. L. Chien, "Magnetic Properties of Amorphous Fe-Nb and Fe-Zr," *J. Mag. Mag. Mat.* 31-34, 1587 (1983).
58. C. L. Chien and K. M. Unruh, "Magnetic Properties and Hyperfine Interactions in Concentrated Fe-Ag Alloys," *Phys. Rev.* **B28**, 1214 (1983).
59. C. L. Chien and K. M. Unruh, "Comparison of Amorphous and Crystalline FeB," *Phys. Rev.* **B29**, 207 (1984).
60. C. L. Chien and S. H. Liou, "Temperature Dependence of Resistance of Amorphous Metal-Metal Solids with Wide Composition Ranges," *J. Non-crystalline Solids*, **61 & 62**, 1119 (1984).
61. K. M. Unruh and C. L. Chien, "Composition Dependence of the Effective Hyperfine Field in Amorphous Fe-early Transition Metal Alloys," *J. Non-crystalline Solids*, **61 & 62**, 1409 (1984).
62. S. H. Liou and C. L. Chien, "Mössbauer Study of Sputtered Fe-Ti Alloys with Wide Composition Range," *J. Appl. Phys.* **55**, 1820 (1984).
63. L. C. McCormick, N. S. Wheeler, C. R. Molock and C. L. Chien, "Corrosion Properties of Amorphous Iron-Zirconium Films in 1N Sulfuric Acid," *J. Electrochem. Soc.* **131**, 530 (1984).
64. K. M. Unruh and C. L. Chien, "Magnetic Properties and Hyperfine Interactions in Amorphous Fe-Zr Alloys," *Phys. Rev.* **B30**, 4968 (1984).
65. S. H. Liou, G. Xiao, J. N. Taylor and C. L. Chien, "Magnetic Properties and Hyperfine Interactions of Amorphous Fe-Hf Alloys," *J. Appl. Phys.* **57**, 3356 (1985).
66. C. L. Chien, S. H. Liou, B. K. Ha and K. M. Unruh, "Rapidly Quenched $\text{Fe}_x\text{Ta}_{100-x}$ Alloys," *J. Appl. Phys.* **57**, 3539 (1985).
67. C. L. Chien and S. H. Liou, "Crystalline and Amorphous FeTi and Fe_2Ti ," *Phys. Rev.* **B31**, 8238 (1985).
68. C. L. Chien and S. H. Liou, "Rapidly Quenched Crystalline and Amorphous Fe-Ti Alloys," in *Rapidly Quenched Metals*, edited by S. Steeb and H. Warlimont (Elsevier, 1985), p. 1243.
69. C. L. Chien, G. Xiao and K. M. Unruh, "Hyperfine Interactions and Magnetic Properties of Amorphous Fe-Sb Alloys," *Phys. Rev.* **B32**, 5582 (1985).

70. L. Zhang, G. T. Rado, S. H. Liou, and C. L. Chien, "Magnetic Surface Anisotropy of Amorphous Iron-Boron Ultrathin Films," *J. Mag. Mag. Mat.* **54-57**, 765 (1986).
71. G. Xiao and C. L. Chien, "Ferromagnetic and Spin Glass Orderings in Amorphous Fe-Sb Alloys," *J. Mag. Mag. Mat.* **54-57**, 241 (1986).
72. U. Gonser, S. M. Fries, C. L. Chien and H. G. Wagner, "Hydrogen Induced Changes on the Magnetic Properties of Amorphous Fe-Zr Sputtered Films," *J. Mag. Mag. Mat.* **54-57**, 287 (1986).
73. C. L. Chien, S. H. Ge, S. H. Liou and G. Xiao, "Structural and Magnetic Behavior of Vapor Quenched Fe-Mo Alloys," *J. Mag. Mag. Mat.* **54-57**, 291 (1986).
74. C. L. Chien, S. H. Liou, D. Kufalt, W. Yu, T. Egami, and T. R. McGuire, "Magnetic Properties of $\text{Fe}_x\text{Cu}_{100-x}$ Solid Solution," *Phys. Rev.* **B33**, 3247 (1986).
75. C. L. Chien, G. Xiao and S. H. Liou, "Isomer Shift Systematics of Amorphous Fe-Early Transition Metal and Fe-Metalloid Systems". Presented at ICME, Leuvan, Hyperfine Interactions, **27**, 373 (1986).
76. S. M. Fries, C. L. Chien, H. G. Wagner and U. Gonser, "Mixed Hyperfine Interaction in Amorphous Fe-Zr Sputtered Films in External Magnetic Fields--A ^{57}Fe Mössbauer Study ," *Hyperfine Interactions*, **27**, 405 (1986).
77. G. Xiao and C. L. Chien, "Mössbauer Study of Amorphous Fe-Sb Alloys with Large Composition Range," *Hyperfine Interactions*, **27**, 377 (1986).
78. C. L. Chien, S. H. Liou and Gang Xiao, "Granular Fe Metal Films," *J. Mag. Mag. Mat.* **54-57**, 759 (1986).
79. L. D. McCormick, P. M. Fabis and C. L. Chien, "Transmission Electron Microscopy of Rapidly Quenched Iron-Aluminum Sputter Deposited Films," *J. Non-Cryst. Solids*, **81**, 155 (1986).
80. Gang Xiao, S. H. Liou, A. Levy, J. N. Taylor and C. L. Chien, "Magnetic Relaxation in Granular Fe-(SiO_2) Films," *Phys. Rev.* **B34**, 7573 (1986).
81. Gang Xiao and C. L. Chien, "Metal-Insulator Transition, Effects of Localization and Correlation in Amorphous $\text{Fe}_x\text{Sb}_{100-x}$ Alloys," *Phys. Rev.* **B34**, 8430 (1986).
82. S. H. Liou and C. L. Chien, "Composition Range of Binary Amorphous Alloys," *Phys. Rev.* **B35**, 2443 (1987).
83. S. H. Liou, S. H. Ge, J. N. Taylor and C. L. Chien, "Enhanced Magnetism in Amorphous Fe-Based Alloys," *J. Appl. Phys.* **61**, 3243 (1987).

84. M. Abe, S. H. Liou, C. L. Chien, N. C. Koon, B. N. Das and E. Callen, "Mössbauer Study of Spin Reorientation in $Y_{1.8}Er_{0.2}Fe_{14}B$, J. Appl. Phys. **61**, 3568 (1987).
85. L. H. Bennett, M. Rubinstein, Gang Xiao and C. L. Chien, "Magnetism and the Observation of NMR Lines in Hexagonal Al_4Mn Icosahedral Al-Mn Alloys," J. Appl. Phys. **61**, 4364 (1987).
86. Gang Xiao and C. L. Chien, "Magnetic Properties of [100] Textured Cu-Ni Superlattices," J. Appl. Phys. **61**, 4061 (1987).
87. C. L. Chien, Gang Xiao, S. H. Liou, J. N. Taylor and A. Levy, "Magnetic Granular Fe-(SiO₂) Solids," J. Appl. Phys. **61**, 3311 (1987).
88. Gang Xiao, C. L. Chien and M. Natan, "Magnetization and Its Temperature Dependence in Compositionally Modulated Amorphous Fe₇₀B₃₀-Ag Films," J. Appl. Phys. **61**, 4314 (1987).
89. K. Bridger, J. Watts, M. Tadros, Gang Xiao, S. H. Liou and C. L. Chien, "Magnetic Characteristics of Ultrafine Fe Particles Reduced From Uniform Iron Oxide Particles," J. Appl. Phys. **61**, 3323 (1987).
90. Gang Xiao and C. L. Chien, "Temperature Dependence of Spontaneous Magnetization of Ultrafine Fe Particles in Fe-SiO₂ Granular Solids," J. Appl. Phys. **61**, 3308 (1987).
91. Gang Xiao and C. L. Chien, "Polymorphism of Amorphous Pure Iron," J. Appl. Phys. **61**, 3246 (1987).
92. C. L. Chien, S. H. Liou, Gang Xiao and M. A. Gatzke, "Magnetic Percolation in New Crystalline fcc Fe-Cu Alloys," in *Science and Technology of Rapidly Quenched Alloys*, eds. M. Tenhover, L. E. Tanner and W. L. Johnson, p.395 (1987).
93. S. H. Liou and C. L. Chien, "Atomic Size Effects on the Composition Range of Binary Amorphous Alloys," in *Science and Technology of Rapidly Quenched Alloys*, eds. M. Tenhover, L. E. Tanner and W. L. Johnson, p.145 (1987).
94. C. L. Chien, S. H. Liou and M. Natan, "Modulated Amorphous Alloy Films," in *Interfaces, Superlattices and Thin Films*, eds. J. D. Dow, I. K. Schuller, p.387 (1987).
95. S. H. Liou, Gang Xiao and C. L. Chien, "Multilayer Fe/Cu Films," in *Interfaces, Superlattices and Thin Films*, eds. J. D. Dow, I. K. Schuller, p.697 (1987).
96. Gang Xiao and C. L. Chien, "Nonuniqueness of the State of Amorphous Pure Iron," Phys. Rev. **B35**, (Rapid Communications), 8763 (1987).

97. Gang Xiao, F. H. Streitz, A. Gavrin, Y. W. Du and C. L. Chien, "Effect of Transition Metal Element on the Superconductivity of Y-Ba-Cu-O," *Phys. Rev.* **B35**, (Rapid Communications), 8782 (1987).
98. C. L. Chien, Gang Xiao, F. H. Streitz, A. Gavrin and M. Z. Cieplak, "Effect of Noble Metal Buffer Layers on Superconducting YBa₂Cu₃O₇ Thin Films," *Appl. Phys. Lett.* **51**, 2155 (1987).
99. Gang Xiao, F. H. Streitz, A. Gavrin and C. L. Chien, "Magnetic Characteristics of Superconducting RBa₂Cu₃O_{6+y} (R = Nd, Sm, Eu, Gd, Dy, Ho, Er, Tm and Yb)," *Solid State Commun.* **63**, 817 (1987).
100. C. L. Chien, "Magnetic Properties of Sputtered Amorphous Solids and Modulated Solids," in *Magnetic Properties of Amorphous Metals*, eds. A. Hernandez, V. Madurga, M. C. Sanchez-Trujillo and M. Vazquez, p.104 (Elsevier, 1987).
101. S. M. Fries, C. L. Chien, J. Crummenauer, H. G. Wagner and U. Gonser, "The Influence of Hydrogenation on the Magnetic Properties and Hyperfine Interactions of Amorphous Fe-Zr Alloys," *J. Less-Common Metals*, **130**, 17 (1987).
102. Gang Xiao, F. H. Streitz, A. Gavrin, M. Z. Cieplak, J. Childress, Ming Lu, A. Zwicker and C. L. Chien, "Flux Pinning and Critical Current Density in YBa₃Cu₃O_{6+y} and EuBa₂Cu₃O_{6+y} Superconductors," *Phys. Rev.* **B36**, (Rapid Communications), 2382 (1987).
103. Gang Xiao and C. L. Chien, "Giant Magnetic Coercivity and Percolation Effects in Granular Fe-(SiO₂) Solids," *Appl. Phys. Lett.* **51**, 1280 (1987).
104. H. Tang, Z. Q. Qiu, Y. W. Du, G. Xiao, C. L. Chien and J. C. Walker, "Magnetic Ordering in GdBa₂(Cu_{0.94}Fe_{0.06})₃O₇ Below the Superconducting Transition Temperature," *Phys. Rev.* **B36**, (Rapid Communications), 4018 (1987).
105. C. L. Chien, S. H. Liou and Gang Xiao, "Superlattice and Multilayer Systems with Crystalline and Amorphous Constituent Layers," in *Metallic Multilayers and Epitaxy*, edited by M. Hong, S. Wolf and D. C. Gubser, p.245 (Metallurgical Society, 1988).
106. S. H. Liou and C. L. Chien, "Particle Size Dependence of the Magnetic Properties of Ultrafine Granular Films," *J. Appl. Phys.* **63**, 4240 (1988).
107. K. Bridger, J. Watts and C. L. Chien, "The Dependence of Coercivity of Ultrafine Fe Particles on Packing Fraction and Microstructure," *J. Appl. Phys.* **63**, 3233 (1988).
108. Gang Xiao and C. L. Chien, "Enhanced Magnetic Coercivity in Magnetic Granular Solids," *J. Appl. Phys.* **63**, 4252 (1988).

109. C. L. Chien, Gang Xiao, F. H. Streitz and A. Gavrin, "Magnetic Study and Critical Current Density of High T_c Y- and Rare-Earth-Ba-Cu-O Superconductors," in *Rev. Solid State Science* 1, 329 (1987) and also in *Progress in High Temperature Superconductivity*, Vol.3, eds. S. M. Bose and S. D. Tyagi, p.183 (World Scientific, Singapore 1988).
110. Gang Xiao, M. Z. Cieplak, A. Gavrin, F. H. Streitz, A. Bakhshai, and C. L. Chien, "Superconductivity and Structure of $YBa_2(Cu_{0.9}A_{0.1})_3O_7$ (A = Ti, V, Cr, Mn, Fe, Co, Ni, Cu and Zn)," in *Rev. Solid State Science* 1, 323 (1987) and also in *Progress in High Temperature Superconductivity*, Vol.3, eds. S. M. Bose and S. D. Tyagi, p.177 (World Scientific, Singapore 1988).
111. Gang Xiao, F. H. Streitz, A. Gavrin, C. L. Chien, A. Bakhshai, "Superconductivity and Magnetism in Transition Element Substituted $YBa_2Cu_3O_7$ Compounds," *J. Appl. Phys.* **63**, 4196 (1988).
112. S. H. Liou and C. L. Chien, "Granular Metal Films as Recording Media," *Appl. Phys. Lett.* **52**, 512 (1988).
113. Gang Xiao, F. H. Streitz, M. Z. Cieplak, A. Bakhshai, A. Gavrin, and C. L. Chien, "Electrical Transport and Superconductivity in Au- $YBa_2Cu_3O_7$ Percolation System," *Phys. Rev.* **B38**, 776 (1988).
114. C. F. Majkrzak, Doon Gibbs, P. Boni, Alan I. Goldman, J. Kwo, M. Hong, T. C. Hsieh, R. M. Fleming, D. E. McWhan, Y. Yafet, J.W. Cable, J. Bohr, H. Grim and C. L. Chien, "Magnetic Rare Earth Superlattices," Invited paper at 3M Conference in Chicago, *J. Appl. Phys.* **63**, 3447 (1988).
115. C. L. Chien, Gang Xiao, M. Z. Cieplak, A. Bakhshai, A. Gavrin, F. H. Streitz and J. Childress, "Fabrication of High T_c Superconducting Films with Diffusion Barrier," in *High T_c Superconductors*, eds M. B. Brodsky, R. C. Dynes, H. L. Tuller and K. Kitazawa, p.311 (1988).
116. Gang Xiao, M. Z. Cieplak, A. Bakhshai, F. H. Streitz, M. Lu, A. Zwicker, A Gavrin and C. L. Chien, "Superconducting Properties of Orthorhombic $YBa_2(Cu-Zn)_3O_7$ and Tetragonal $YBa_2(Cu-Ga)_3O_7$, in *High T_c Superconductors*, eds. M. B. Brodsky, R. C. Dynes, H. L. Tuller and K. Kitazawa, p.399 (1988).
117. Gang Xiao, M. Z. Cieplak, A. Gavrin, F. H. Streitz, A. Bakhshai, and C. L. Chien, "High Temperature Superconductivity in Tetragonal Perovskite Structure: Is Oxygen Vacancy Order Important?," *Phys. Rev. Lett.* **60**, 1446 (1988).
118. F. H. Streitz, M. Z. Cieplak, Gang Xiao, A. Gavrin, A. Bakhshai, and C. L. Chien, "Superconducting Au- $YBa_2Cu_3O_7$ Composites," *Appl. Phys. Lett.* **52**, 927 (1988).

119. Gang Xiao, M. Z. Cieplak, D. Musser, A. Gavrin, F. H. Streitz, C. L. Chien, J. J. Rhyne and J. A. Gotaas, "Significance of Plane versus Chain Sites in High T_c Oxide Superconductor," *Nature*, **332**, 238 (1988).
120. S. M. Fries, J. Crummenauer, H-G. Wagner, U. Gonser and C. L. Chien, "Short Range Order in Amorphous Fe-Zr Sputtered Alloys Deduced by Mixed Hyperfine Interaction," *Z. Physikalische Chemie Neue Folge*, **157**, 127 (1988).
121. C. L. Chien, Gang Xiao, Marta Z. Cieplak, D. Musser, J. J. Rhyne and J. Gotaas, "Superconductivity in Orthorhombic and Tetragonal $YBa_2(Cu_{1-x}A_x)_3O_y$ System (A = Zn, Ga, Al and Co)" in *Superconductivity and Applications*, eds. H.S. Kwo and D.T. Shaw (1988), p.110.
122. J. Childress, S. H. Liou and C. L. Chien, "Ferromagnetism in Metastable 304 Stainless Steel with bcc Structure," *J. Appl. Phys.* **64**, 6059 (1988).
123. C. S. Kim, J. Childress and C. L. Chien, "Magnetic Properties of Spinel Phase $Fe_xCu_{1-x}RbSe_4$ " *J. Appl. Phys.* **64**, 5886 (1988).
124. C. L. Chien, Gang Xiao and S. H. Liou, "Magnetic Properties of Nanocrystals of Fe," *J. de Physique*, (C8), 1821 (1988).
125. Gang Xiao, M. Z. Cieplak and C. L. Chien, "Emergence of Superconductivity in Bi-Sr-Cu-O System," *Phys. Rev.* **B38**, 11824 (1988).
126. J. Kwo, M. Hong, D. B. McWhan, Y. Yafet, R. M. Fleming, F. J. DiSalvo, J. W. Waszczak, C. F. Majkrzak, D. Gibbs, A. I. Goldman, P. Boni, C. L. Chien, J. W. Cable, J. Bohr and H. Grim, "Magnetic Superlattices," Invited paper at the International Conference of Magnetism in Paris, France, July.1988, *J. de Physique*, (C8), 1651 (1988).
127. J. Childress, S. H. Liou and C. L. Chien, "Magnetic Properties of Metastable 304 Stainless Steel with bcc Structure," *J. de Physique* (C8), 113 (1988).
128. F. H. Streitz and C. L. Chien, "Coercivity in Granular Fe- Al_2O_3 ," in *Multicomponent Ultrafine Microstructures*, eds. L.E. McCandlish, D.E. Polk, R.W. Siegel and B.H. Kear, p.185 (1989).
129. J. Bohr, D. Gibbs, J. D. Axe, D. E. Moncton, K. L. D'Amico, C. F. Majkrzak, J. Kwo, M. Hong, C. L. Chien and J. Jensen, "Diffraction Studies of Rare Earth Metals and Superlattices," *Physica* **B159**, 93 (1989).
130. M. Z. Cieplak, Gang Xiao and C. L. Chien, "Superconducting and Normal State Properties of $La_{1.85}Sr_{0.15}(Cu_{1-x}Ga_x)O_4$," *Phys. Rev.* **B39**, 4222 (1989).

131. A. Gavrin and C. L. Chien, "Fabrication and Properties of Granular Fe-Ni Alloys," in *Multicomponent Ultrafine Microstructures*, eds. L. E. McCandlish, D. E. Polk, R. W. Siegel and B. H. Kear, P.143 (1989).
132. Gang Xiao, A. Bakhshai, Marta Z. Cieplak, Z. Tesanovic and C. L. Chien, "Correlation Between Superconductivity and Normal State Properties in the $\text{La}_{1.85}\text{Sr}_{0.15}(\text{Cu}_{1-x}\text{Zn}_x)\text{O}_4$ System," *Phys. Rev.* **B39**, 315 (1989).
133. J. Childress, A. Levy, and C. L. Chien, "Study of the Lattice Dynamics of Iron Nanocrystals by Mössbauer Spectroscopy," in *Multicomponent Ultrafine Microstructures*, eds. L. E. McCandlish, D. E. Polk, R. E. Siegel and B. H. Kear, P.161, (1989).
134. S. H. Liou, C. H. Chen, H. S. Chen, A. R. Kortan and C. L. Chien, "On the Coercivity of Granular Fe-SiO₂ Films," in *Multicomponent Ultrafine Microstructures*, eds. L. E. McCandlish, D. E. Polk, R. W. Siegel and B. H. Kear, P.191, (1989).
135. Gang Xiao, M. Z. Cieplak, and C. L. Chien, "A Systematic Study of $(\text{La}_{1-x}\text{Gd}_x)_{1.85}\text{Sr}_{0.15}\text{CuO}_4$ ($0 \leq x \leq 1$): Structure, Superconductivity, Resistivity and Magnetic Properties," *Phys. Rev.* **B40**, 4538 (1989).
136. Y. J. Uemura, G. M. Luke, B. J. Sternlieb, J. H. Brewer, J. F. Carolan, W. N. Hardy, R. Kadono, J. R. Kempton, R. F. Kiefl, S. R. Kreitzman, P. Mulhern, T. M. Riseman, D. L. Williams, B. X. Yang, S. Uchida, H. Takagi, J. Gopalakrishnan, A. W. Sleight, M. A. Subramanian, C. L. Chien, M. Z. Cieplak, Gang Xiao, V. Y. Lee, B. W. Statt, C. E. Stronach, W. J. Kossler, and X. H. Yu, "Universal Correlation Between T_c and n_s/m^* (carrier density over effective mass) in High T_c Cuprate Superconductors," *Phys. Rev. Lett.* **62**, 2317 (1989).
137. C. L. Chien, Gang Xiao and M. Z. Cieplak, "Experimental Study of High Temperature Superconductors Through Substitution" in *Oxygen Disorder Effects in High T_c Superconductor*, edited by J. L Moran-Lopez and I. K. Schuller, (Plenum, New York, 1990) p.189.
138. C. L. Chien, "Granular Magnetic Solids," in *Recent Advances in Magnetism and Magnetic Materials*, edited by H. L. Huang and P.C. Kuo (World Scientific, Singapore 1990) P.296
139. C. L. Chien, "Artificially Structured Materials," Invited paper at the International Conference on the Applications of the Mössbauer Effect, Budapest, Hungary, *Hyperfine Interactions*, **53**, 3 (1990).
140. A. Gavrin and C. L. Chien, "Fabrication and Magnetic Properties of Granular Alloys," *J. Appl. Phys.* **67**, 938 (1990).

141. M. Lu and C. L. Chien, "Structural and Magnetic Properties of Fe-W Alloys," *J. Appl. Phys.* **67**, 5787 (1990).
142. J. Q. Xiao, A. Gavrin, Gang Xiao, W. A. Bryden, C. L. Chien and A. S. Edelstein, "Structural Studies and Magnetic Properties of Fe/Ag Superlattices," *J. Appl. Phys.* **67**, 5388 (1990).
143. J. R. Childress, C. L. Chien, and M. Nathan, "Granular Fe in a Metallic Matrix," *Appl. Phys. Lett.* **56**, 95 (1990).
144. Gang Xiao, M. Z. Cieplak and C. L. Chien, "Static Vacancies in Antiferromagnetic La_2CuO_4 and Superconducting $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ " *Phys. Rev.* **B42**, 240 (1990).
145. A. Gavrin, J. R. Childress, C. L. Chien, B. Martinez and M. B. Salamon. "Dimensional Crossover of the Spin-Glass Transition in Thin CuMn Multilayers". *Phys. Rev. Lett.* **64**, 2438 (1990).
146. H. Tang, Gang Xiao, A. Singh, Z. Tesanovic, C. L. Chien, and J. C. Walker, "Magnetic Dynamics of La_2CuO_4 Studied by Mössbauer Spectroscopy," *J. Appl. Phys.* **67**, 4518 (1990)
147. R. J. Hicken, G. T. Rado, Gang Xiao and C. L. Chien, "Observation of Thickness Dependence of Magnetic Surface Anisotropy in Ultrathin Amorphous Films," *Phys. Rev. Lett.* **64**, 1820 (1990).
148. A. Singh, Z. Tesanovic, H. Tang, G. Xiao, C. L. Chien and J. C. Walker, "Magnetic Dynamics in Copper-Oxide Based Antiferromagnets---the Role of Interlayer Coupling," *Phys. Rev. Lett.* **64**, 2571 (1990).
149. G. M. Chow, R. L. Holtz, C. L. Chien and A. S. Edelstein, "Fabrication of Granular Materials by High-Pressure Sputtering," in *Physical Phenomena in Granular Materials*, edited by G. D. Cody, T. H. Geballe and Ping Sheng, p.623 (1990).
150. R. E. Camley, J. Kwo, M. Hong and C. L. Chien, "Magnetic Properties of Gd/Dy Superlattices: Experiment and Theory," *Phys. Rev. Lett.* **64**, 2703 (1990).
151. C. L. Chien, "Granular Magnetism," in *Physical Phenomena in Granular Materials*, edited by G. D. Cody, T. H. Geballe and Ping Sheng, p.411, Invited paper at the Materials Research Society Meeting, San Francisco (1990)
152. M. Z. Cieplak, Gang Xiao, C. L. Chien, J. K. Stalick and J. J. Rhyne, "Unexpected Effects of Gold on the Structure, Superconductivity and Normal-State of $\text{YBa}_2\text{Cu}_3\text{O}_7$." *Appl. Phys. Lett.* **57**, 934 (1990).

153. T. E. Schlesinger, A. Gavrin, R. C. Cammarata and C. L. Chien, "Percolation Effects in the Mechanical Properties of Granular Ni-Al₂O₃ Thin Films," in *Physical Phenomena in Granular Materials*, edited by G. D. Cody, T. H. Geballe and Ping Sheng, p.441 (1990).
154. G. Xiao, M. Z. Cieplak, J. Q. Xiao and C. L. Chien, "Magnetic Pair-Breaking Effects: Moment Formation and Critical Doping Level in Superconducting La_{1.85}Sr_{0.15}Cu_{1-x}A_xO₄ Systems (A=Fe, Ni, Co, Zn, Ga and Al)" *Phys. Rev.* **B42** 8752 (1990).
155. M. Z. Cieplak, G. Xiao, C. L. Chien, A. Bakhshai, D. Artymowicz, W. Bryden, J. K. Stalick and J. J. Rhyne, "Incorporation of Gold into Structure and T_c Enhancement," *Phys. Rev.* **B42**, 6200 (1990).
156. C. F. Majkrzak, J. Kwo, M. Hong, Y. Yafet, Doon Gibbs, C. L. Chien and J. Bohr, "Magnetic Rare Earth Superlattices," *Advances in Physics*, **40**, 99 (1991).
157. C. L. Chien, "Granular Solids," in *Science and Technology of Nanostructured Magnetic Materials*, edited by G. C. Hadjipanayis and G. A. Prinz, NATO Advanced Study Institute in Science and Technology, Series B: Physics Vol. 259, p.477, (1991).
158. C. L. Chien, "Granular Magnetic Solids". Invited paper at the Conference on Magnetism and Magnetic Materials, *J. Appl. Phys.* **69**, 5267 (1991).
159. R. J. Hicken, G. T. Rado and C. L. Chien, "Effect of Spacer Material on the Magnetic Surface Anisotropy in Ultrathin Fe₇₀B₃₀ Multilayer Films," *J. Appl. Phys.* **69**, 5301 (1991).
160. G. Xiao, J. Q. Xiao, M. Z. Cieplak, and C. L. Chien, "Asymmetrical Effects of Copper-Site Holes versus Oxygen-Site Holes in La-Sr-Cu-O," *Phys. Rev.* **B43**, 1245 (1991).
161. J. R. Childress and C. L. Chien, "Reentrant Magnetic Behavior in fcc Co-Cu Alloys," *Phys. Rev.* **B43**, 8089 (1991).
162. G. M. Chow, C. L. Chien, and A. S. Edelstein, "Formation Threshold and Structural Evolution of Mo Nanocrystals with Sputtering Pressure," *J. Mater. Res.* **6**, 8 (1991).
163. J. R. Childress, C. L. Chien, M. Y. Zhou and Ping Sheng "Lattice Softening in Iron Nanocrystals," *Phys. Rev.* **B44**, 11689 (1991).
164. S. Guha, M. Z. Cieplak, Gang Xiao, J. Q. Xiao, C. L. Chien, H. Kojima and P. Lindenfeld, "The Metal-Insulator-Transition in La_{1.85}Sr_{0.15}CuO₄ with Various Substitutions for Cu," *Superconductor Science and Tech*, **4**, S67 (1991).
165. J. R. Childress and C. L. Chien, "Granular Co in a Metallic Matrix," *J. Appl. Phys* **70**, 5885 (1991).

166. J. H. Hsu, B. G. Alten, J. R. Childress, A. Gavrin and C. L. Chien, "Structural and Magnetic Studies of Metastable Gd-Cr Alloys Over the Entire Composition Range," *J. Appl. Phys* **70**, 6308 (1991).
167. T. E. Schlesinger, R. C. Cammarata, A. Gavrin, C. L. Chien, M. F. Ferber, and C. Hayzelden, "Enhanced Mechanical and Magnetic Properties of Granular Metal Thin Films," *J. Appl. Phys.* **70**, 3275 (1991).
168. J. Q. Xiao and C. L. Chien, "Structural Studies and Magnetic Properties of Fe/W Superlattices," *J. Appl. Phys* **70**, 6415 (1991).
169. J. R. Childress, C. L. Chien, and A. F. Jankowski, "Magnetization, Curie Temperature and Magnetic Anisotropy of Strained [111]Ni/Au Superlattices," *Phys. Rev.* **B45**, 2855 (1992).
170. M. Z. Cieplak, S. Guha, H. Kojima, P. Lindenfeld, Gang Xiao, J. Q. Xiao, and C. L. Chien, "Superconductivity and Metal-insulator Transition in $\text{La}_{1.85}\text{Sr}_{0.15}\text{CuO}_4$," *Physica C* **185**, 1233 (1992).
171. C. L. Chien and M. Lu, "Three states of $\text{Al}_{65}\text{Cu}_{20}\text{Fe}_{15}$: Amorphous, Crystalline, and Quasicrystalline," *Phys. Rev.* **B45**, 12793 (1992)
172. M. Lu and C. L. Chien, " $\text{Al}_{65}\text{Cu}_{20}\text{Fe}_{15}$ in Amorphous, Crystalline and Quasicrystalline States," *Hyperfine Int.* **71**, 1525 (1992).
173. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Giant Magnetoresistance in Non-Multilayer Magnetic Systems," *Phys. Rev. Lett.* **68**, 3749 (1992).
174. J. R. Childress, C. L. Chien, J. J. Rhyne and R. W. Erwin, "Small-Angle Neutron Scattering of Nanometer-Size Magnetic Particles," *J. Mag. Mag. Mat.* **104-107**, 1585 (1992).
175. A. Gavrin, J. H. Hsu, B. G. Alten, J. R. Childress and C. L. Chien, "Competing Magnetic Interactions in Metastable Gd-Cr Alloys," *J. Mag. Mag. Mat.* **104-107**, 1351 (1992).
176. J. Hsu and C. L. Chien, "Structural and Mössbauer Studies of $\text{Fe}_{1-x}\text{Al}_x$ Alloys Over the Entire Composition Range," *Hyperfine Int.* **69**, 451 (1992).
177. Marta Z. Cieplak, A. Sienkiewicz, F. Mila, S. Guha, G. Xiao, J. Q. Xiao and C. L. Chien, "Spin Dynamics in $\text{La}_{1.85}\text{Sr}_{0.15}\text{CuO}_4$ System Probed by ESR," *Phys. Rev.* **B48**, 4019 (1993).
178. Marta Z. Cieplak, S. Guha, H. Kojima, P. Lindenfeld, G. Xiao, J. Q. Xiao, and C. L. Chien, "Metal-Insulator Transition in $\text{La}_{1.85}\text{Sr}_{0.15}\text{CuO}_4$ with Various Substitutions for Cu," *Phys. Rev.* **B46**, 5536 (1992).

179. C. L. Chien, "Nanostructure-Induced Properties of Granular Metallic Solids," *Nanostructured Materials*, **1**, 179 (1992).
180. T. Ambrose, A. Gavrin, and C. L. Chien, "Formation and Magnetic Properties of Nanocomposite Fe-Al₂O₃ Using High-Energy Ball Milling," *J. Mag. Mag. Mater.* **116**, L311 (1992).
181. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Giant Magnetoresistance in Granular Co-Ag System," *Phys. Rev.* **B46**, 9266 (1992).
182. C. L. Chien, "Nanostructure-Induced Properties of Granular Solids," (invited paper) in *Ferrites : Proceedings of the Sixth International Conference on Ferrites (ICF6), Tokyo and Kyoto, Japan*, edited by Yamaguchi and M. Abe, (Japan Society of Power and Powder Metallurgy), p.938 (1992).
183. C. L. Chien, "Magnetic Granular Solids," (invited paper) in *Ferrites : Proceedings of the Sixth International Conference on Ferrites (ICF6), Tokyo and Kyoto, Japan*, edited by Yamaguchi and M. Abe, (Japan Society of Power and Powder Metallurgy), p.1071 (1992).
184. J. S. Jiang, J. Q. Xiao and C. L. Chien, "Giant Magnetoresistance in Granular Magnetic Systems," in *Ferrites : Proceedings of the Sixth International Conference on Ferrites (ICF6), Tokyo and Kyoto, Japan*, edited by Yamaguchi and M. Abe, (Japan Society of Power and Powder Metallurgy), p.944 (1992).
185. P. Xiong, G. Xiao, J. Q. Wang, J. Q. Xiao, J. S. Jiang, and C. L. Chien, "Extraordinary Hall Effect and Giant Magnetoresistance in Granular Co-Ag System," *Phys. Rev. Lett.* **69**, 3220 (1992).
186. T. Ambrose, O. L. Thameen, A. Gavrin, and C. L. Chien, "Formation of Granular Materials Using a High Energy Ball Mill," in *Ferrites : Proceedings of the Sixth International Conference on Ferrites (ICF6), Tokyo and Kyoto, Japan*, edited by Yamaguchi and M. Abe, (Japan Society of Power and Powder Metallurgy), p.955 (1992).
187. J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Magnetic Properties and Giant Magnetoresistance of Granular Permalloy in Silver," *Appl. Phys. Lett.* **61**, 2362 (1992).
188. C. L. Chien, John Q. Xiao and J. Samuel Jiang, "Giant Negative Magneto-resistance in Granular Magnetic Solids," (invited paper of Magnetism Conference in Houston, Texas) *J. Appl. Phys.* **73**, 5309 (1993).
189. J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Giant Magnetoresistance in Granular Magnetic Systems, in *Magnetism and Structure in Systems of Reduced Dimension*, NATO ASI Series B, edited by R. F. C. Farrow, B. Dieny, M. Donath, A. Fert and D. B. Hermsmeier, NATO Advanced Study Institute in Science and Technology, Series B, Vol. 309, p.381-388 (Plenum Press, NY 1993).

190. K. M. Unruh, C. L. Chien and P. Sheng, "Physical Properties of Granular Metal Solids," in *On Clusters and Clustering, From Atoms to Fractals*, edited by P. Reynolds (Elsevier, 1993), p.303.
191. A. Gavrin and C. L. Chien, "Magnetic Ordering in Granular Ni-Al₂O₃," *J. Appl. Phys.* **73**, 6949 (1993).
192. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Structure of Co_xAg_{100-x} and Its Relation to GMR," (invited paper of MRS annual meeting in Boston, MA 1992), *Mat. Res. Soc. Proc.* No. 286 "Nanophase and Nanocomposite Materials," edited by S. Komarneni, J. C. Parker and G. J. Thomas, p.197-207, (1993).
193. John Q. Xiao, J. Samuel Jiang, and C. L. Chien, "Giant Magnetoresistive Properties in Granular Transition Metals," (invited paper of INTERMAG Conference in Stockholm, Sweden, 1993), *IEEE Trans. Mag-29*, 2688 (1993).
194. L. Piraux, M. Cassart, J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Magneto-thermal Transport Properties of Granular Co-Ag," *Phys. Rev. (Rapid Commun.)* **B48**, 638 (1993).
195. L. Piraux, M. Cassart, V. Bayot, J. Samuel Jiang, John Q. Xiao, and C. L. Chien, "Giant Magneto-thermal Conductivity and Giant Magneto-thermopower in Granular Co-Ag Solids," (invited paper of INTERMAG Conference in Stockholm, Sweden, 1993), *IEEE Trans. Mag-29*, 2700 (1993).
196. T. M. Whitney, J. S. Jiang, P. C. Searson, and C. L. Chien, "Fabrication and Magnetic Properties of Arrays of Metallic Nanowires," *Science*, **261**, 1316 (1993).
197. T. Ambrose, A. Gavrin and C. L. Chien, "Magnetic Properties of Metastable fcc Fe-Cu Alloys Prepared by High Energy Ball Milling," *J. Mag. Mag. Mater.*, **124**, L15, (1993).
198. C. L. Chien, John Q. Xiao, and J. S. Jiang, "Giant Negative Magnetoresistance and Other Magneto-Transport Properties in Granular Magnetic Systems," *Advanced Materials '93, IIB (Information Storage Materials)*, eds. M. Abe, H. Yokoyama, K. Kawakami, S. Takayama, J. K. Howard, and M. Naoe, (Elsevier, 1994), p.1071.
199. John Q. Xiao and C. L. Chien, "RF-Reactive Sputtered Iron Nitrides Using Ammonia Gas : Structure and Magnetic Properties," *Appl. Phys. Lett.* **64**, 384 (1994).
200. C. L. Chien, "Giant Magneto-Transport Properties in Granular Magnetic Systems" in *Nanophase Materials : Synthesis - Properties - Applications*, edited by G. C. Hadjipanayis and R. W. Siegel, NATO Advanced Study Institute in Science and Technology, Series E, Vol. 260, p.555 (Kluwer Academic Publishers) (1994).
201. D. L. Leslie-Pelecky, F. VanWijland, C. N. Hoff, J. A. Cowen. A. Gavrin, and C. L. Chien, "Comparison of the Electron-Spin-Resonance Linewidth in Multilayered CuMn

- Spin Glasses with Insulating versus Conducting Interlayers," J. Appl. Phys. **75**, 6489 (1994).
202. L. Piraux, M. Cassart, E. Grivei, M. Kinany-Alaoui, V. Bayot, J. Samuel Jiang, John. Q. Xiao, and C. L. Chien, "Thermal and Thermoelectric Properties of Granular Co-Ag Solid," J. Magn. Magn. Mat. **136**, 221 (1994).
 203. T. Ambrose and C. L. Chien, "Magnetic Properties of Exchanged Coupled NiFe/CoO/NiFe Trilayers," Appl. Phys. Lett. **65**, 1967 (1994).
 204. John Q. Xiao, K. Liu, C. L. Chien, L. F. Schelp and J. E. Schmidt, "Effects of Ar Ion implantation and Annealing on Structural and Magnetic Properties of Co/Pd Multilayers," J. Appl. Phys. **76**, 6081(1994).
 205. J. H. Kim, J. Q. Xiao, C. L. Chien, Z. Tesanovic, and L. Xing, "A Model for Giant Magnetoresistance in Magnetic Granular Solids," Solid State Commun. **89**, 157 (1994).
 206. J. S. Jiang, D. Davidovic, D. H. Reich and C. L. Chien, "Oscillatory Superconducting Transition Temperature in Nb/Gd Multilayers," Phys. Rev. Lett. **74**, 314 (1995).
 207. A. Gavrin, M. H. Kelley, John Q. Xiao, and C. L. Chien, "Domain Structures in Magnetoresistive Granular Metals," Appl. Phys. Lett. **66**, 1683 (1995).
 208. C. L. Chien, "Giant Magneto-Transport Phenomena in Granular Magnetic Systems," invited presentation at the 5th NEC Symposium on Fundamental Approaches to New Materials Phases -- Spin-dependent Phenomena in Multilayer Systems. (Karuzawa, Japan, Oct. 1994), Materials Science and Engineering **B31**, 127 (1995).
 209. C. L. Chien, "Magnetism and Giant Magneto-Transport Properties in Granular Solids," *Annual Review of Materials Science*, **25**, 129 (1995).
 210. K. Liu, K. Nagodawithana, P. C. Searson, and C. L. Chien, "Perpendicular Giant Magnetoresistance of Multilayered Co/Cu Nanowires," Phys. Rev. (Rapid Commun.) **B51**, 7381 (1995).
 211. P. C. Searson, R. C. Cammarata, and C. L. Chien, "Electrochemical Processing of Nanostructured Materials," *Defect Structure, Morphology and Properties of Deposits*, eds. H. Merchant, The Minerals, Metals and Materials Society, (1995), p.345.
 212. C. L. Chien, "Magnetic Properties of Vapor-Quenched Transition Metal Alloys," in *The Magnetism of Amorphous Metals and Alloys*, edited by J. A. Fernandez-Baca and W. Y. Ching. (World Scientific, 1995). pp 175 -220.
 213. R. L. Sommer and C. L. Chien, "The Role of Magnetic Anisotropy in the Magneto-Impedance Effect in Amorphous Alloys," Appl. Phys. Lett. **66**, 857 (1995).

214. K. Nagodawithana, K. Liu, P. C. Searson, and C. L. Chien, "Processing and Properties of Electrodeposited Cu-Co Multilayered Nanowires," Symposium on Nanostructured Materials in Electrochemistry, eds. P. C. Searson and G. J. Meyer, Electrochemical Society Proceedings **95-8**, 237 (1995).
215. R. L. Sommer and C. L. Chien, "Longitudinal and Transverse Magneto-Impedance in Amorphous $\text{Fe}_{73.5}\text{Cu}_1\text{Nb}_3\text{Si}_{13.5}\text{B}_9$ Films," Appl. Phys. Lett. **67**, 3346 (1995).
216. Fa-Shen Li, Ji-Jun Sun, and C. L. Chien, " ^{57}Fe Mössbauer Study of Metastable 304 Stainless Steel Film With bcc Structure," J. Phys. (Condensed Matter), **7**, 1921 (1995).
217. J. Q. Xiao and C. L. Chien, "Proximity Effects of Superconductor/Magnetic Semiconductor NbN/GdN Multilayers," Phys. Rev. Lett. **76**, 1727 (1996).
218. R. L. Sommer and C. L. Chien, "Longitudinal, Transverse, and Perpendicular Magneto-impedance in Nearly Zero Magnetostrictive Amorphous Alloys,," Phys. Rev. (Rapid Communications), **B53**, R5982 (1996).
219. T. Ambrose and C. L. Chien, "Finite-Size Effects and Uncompensated Magnetization in Thin Antiferromagnetic CoO Layers," Phys. Rev. Lett. **76**, 1743 (1996).
220. T. Ambrose and C. L. Chien, "Finite-Size Scaling in Thin Antiferromagnetic CoO Layer," J. Appl. Phys. **79**, 5920 (1996).
221. R. L. Sommer and C. L. Chien, "Giant Magneto-Impedance Effects in Metglas 2705 M," J. Appl. Phys. **79**, 5139 (1996).
222. R. L. Sommer and C. L. Chien, "Annealing and Geometrical Effects in the Magneto-Impedance of Amorphous $\text{Co}_{70.4}\text{Fe}_{4.6}\text{Si}_{15}\text{B}_{10}$ Alloys," J. Appl. Phys. **79**, 6117 (1996).
223. A. Gavrin, M. H. Kelley, John Q. Xiao and C. L. Chien, "Magnetic Domain Percolation in Co-Ag," J. Appl. Phys. **79**, 5306 (1996).
224. K. H. Ahn, X. W. Wu, K. Liu, and C. L. Chien, "Magnetic Properties and Colossal Magnetoresistance of $\text{La}(\text{Ca})\text{MnO}_3$ Materials Doped with Fe," Phys. Rev. **B54**, 15299 (1996).
225. J. Samuel Jiang and C. L. Chien, "Magnetization and Finite-Size Effects in Gd/W Multilayers," J. Appl. Phys. **79**, 5615 (1996).
226. K. Liu, X. W. Wu, K. H. Ahn, T. Sulchek, C. L. Chien, and J. Q. Xiao, "Charge Ordering and Magnetoresistance in $\text{Nd}_{1-x}\text{Ca}_x\text{MnO}_3$ due to Reduced Double Exchange," Phys. Rev. **B54**, 3007 (1996).
227. J. S. Jiang, D. Davidovic, D. H. Reich and C. L. Chien, "Superconducting Transition in Nb/Gd/Nb Trilayers," Phys. Rev. **B54**, 6119 (1996).

228. John Q. Xiao, C. L. Chien, and A. Gavrin, "Observation of Perpendicular Anisotropy in Granular Magnetic Solid," *J. Appl. Phys.* **79**, 5309 (1996).
229. K. M. Unruh and C. L. Chien, "Magnetic and Transport Properties of Nanostructured Granular Metal Films, in *Nanostructured Materials : Synthesis, Properties and Uses*, Edited by A. S. Edelstein and R. C. Cammarata, (Institute of Physics Publishing, Bristol, UK, 1996).
230. N. J. Gökemeijer, T. Ambrose, C. L. Chien, N. Wang, and K. K. Fung, "Long-Range Exchange Coupling Between a Ferromagnet and an Antiferromagnet Across a Non-Magnetic Spacer Layer," *J. Appl. Phys.* **81**, 4999 (1997).
231. C. L. Chien, J. S. Jiang, John Q. Xiao, D. Davidovic, and Daniel H. Reich, "Proximity and Coupling Effects in Superconductor/Ferromagnet Multilayers," (invited paper of Magnetism Conference in Atlanta, GA) *J. Appl. Phys.* **81**, 5358 (1997).
232. K. H. Ahn, X. W. Wu, K. Liu, and C. L. Chien, "Effects of Fe Doping in the Colossal Magnetoresistive $\text{La}_{1-x}\text{Ca}_x\text{MnO}_3$," *J. Appl. Phys.* **81**, 5505 (1997).
233. T. Ambrose, Klaus Leifer, K. J. Hemker, and C. L. Chien, "Studies of Deposition Order Anomaly of Exchange Coupling in Bilayers and Trilayers of NiFe and CoO," *J. Appl. Phys.* **81**, 5007 (1997).
234. T. Ambrose, R. L. Sommer, and C. L. Chien, "Angular Dependence of Exchange Coupling in Ferromagnet/Antiferromagnet Bilayers," *Phys. Rev. B* **56**, 83 (1997).
235. N. J. Gokemeijer, T. Ambrose, and C. L. Chien, "Long-Range Exchange Bias Across a Spacer Layer," *Phys. Rev. Lett.* **79**, 4270 (1997).
236. John Q. Xiao and C. L. Chien, "Antiferromagnetic Exchange Through an Amorphous Metallic Layer," *J. Chinese Electron Microscopy Society*, **16**(4) 409 (1997).
237. K. Liu, X. W. Wu, K. H. Ahn, C. L. Chien and C. L. Chien, "Origin of Colossal Magnetoresistance in $\text{Nd}_{1-x}\text{Ca}_x\text{MnO}$," *J. Chinese Electron Microscopy Society*, **16**(4) 425 (1997).
238. T. Ambrose, R. L. Sommer, and C. L. Chien, "New Features of Exchange Coupling in FM/AF Bilayers," *J. Mag. Mag. Mater.* **117-181**, 1235 (1998).
239. X. W. Wu, T. Ambrose, and C. L. Chien, "Exchange Bias and Spin-Valve Structures Using Amorphous Ferromagnetic $\text{Co}_{63}\text{Mo}_2\text{B}_{33}$ Layers," *Appl. Phys. Lett.* **72**, 2176 (1998).

240. Y. D. Zhang, J. I. Budnick, W. A. Hines, C. L. Chien, and J. Q. Xiao, "Effect of Magnetic Field on the Superparamagnetic Relaxation in Granular Co-Ag Samples," *Appl. Phys. Lett.* **72**, 2053 (1998).
241. K. Liu and C. L. Chien, "Magnetic and Transport Properties of Novel Nanostructured Networks," *IEEE Trans. Mag.* **34**, 1021 (1998).
242. R. L. Sommer, J. Q. Xiao and C. L. Chien, "Magnetic and Magneto-Transport Properties of Co-Deposited Gd-Nb Films," *IEEE Trans. Mag.* **34**, 1135 (1998).
243. T. Ambrose and C. L. Chien, "Dependence of Exchange Field and Coercivity in NiFe/CoO Bilayers on Cooling Field," *J. Appl. Phys.*, **83**, 7222 (1998).
244. K. Liu, C. L. Chien, P. C. Searson and Kui Yu-Zhang, "Giant Positive Magnetoresistance in Arrays of Semi-metallic Bismuth Nanowires," *IEEE Trans. Mag.* **34**, 1093 (1998).
245. T. Ambrose and C. L. Chien, "Dependence of Exchange Biasing on the Thickness of Antiferromagnetic Layer," *J. Appl. Phys.*, **83**, 6822 (1998).
246. K. Liu, C. L. Chien, P. C. Searson, and Kui Yu-Zhang, "Structural and Magneto-Transport Properties of Electrodeposited Bismuth Nanowires," *Appl. Phys. Lett.* **73**, 1436 (1998).
247. A. Gündel, R. L. Sommer, J. S. Jiang, and C. L. Chien, "Magneto-Impedance and Transverse Susceptibility by Moke in Amorphous FeCuNbSiN Films," *J. Appl. Phys.* (1998).
248. X. W. Wu and C. L. Chien, "Exchange Coupling in Ferromagnet/Antiferromagnet Bilayers with Comparable T_C and T_N ," *Phys. Rev. Lett.* **81**, 2795 (1998).
249. S. M. Zhou, Kai Liu, and C. L. Chien, "Exchange Coupling and Macroscopic Domain Structure in a Wedged Permalloy/FeMn Bilayer," *Phys. Rev. B* **58** (Rapid Communications) 14717 (1998).
250. Kai Liu, C. L. Chien, and P. C. Searson, "Finite-Size Effects in Bismuth Nanowires," *Phys. Rev. B* **58** (Rapid Communications), 14681 (1998).
251. J. W. Cai, Kai Liu, and C. L. Chien, "Exchange Coupling in the Paramagnetic State," *Phys. Rev. B* **60**, 72 (1999).
252. Shufeng Zhang, D. V. Dimitrov, G. C. Hadjipanayis, J. W. Cai, and C. L. Chien, "Coercivity Induced by Random-Field at Ferromagnetic and Antiferromagnetic Interfaces," *J. Mag. Mag. Mater.* **198-199**, 468 (1999).
253. T. Ambrose, Kai Liu, and C. L. Chien, "Doubly Exchange-Biased NiCoO/NiFe/Cu/NiFe/NiCoO Spin Valves," *J. Appl. Phys.* **85**, 6124 (1999).

254. H. Sang, Y. W. Du, and C. L. Chien, "Exchange Coupling in Fe₅₀Mn₅₀/Ni₈₁Fe₁₉ Bilayers: Dependence on Antiferromagnetic Layer Thickness," J. Appl. Phys. **85**, 4931 (1999).
255. Kimin Hong, F. Y. Yang, Kai Liu, D. H. Reich, P. C. Searson, C. L. Chien, F. F. Balakirev, and G. S. Boebinger, "Giant Positive magnetoresistance of Bi Nanowire Arrays in High Magnetic Fields," J. Appl. Phys. **85**, 6184 (1999).
256. N. J. Gökemeijer and C. L. Chien, "Memory Effects of Exchange Coupling in CoO/Ni₈₁Fe₁₉ Bilayers," J. Appl. Phys. **85**, 5516 (1999).
257. F. Y. Yang, Kai Liu, C. L. Chien, and P. C. Searson, "Large Magnetoresistance and Finite-Size Effects in Electrodeposited Single-Crystal Bi Thin Films," Phys. Rev. Lett. **82**, 3328 (1999).
258. L. Sun, P. C. Searson, and C. L. Chien, "Electrochemical Deposition of Nickel Nanowire Arrays in Single Crystal Mica Films," Appl. Phys. Lett. **74**, 2803 (1999).
259. H. S. Wang, Qi Li, Kai Liu, and C. L. Chien, "Low-Field Magnetoresistance Anisotropy in Ultrathin Pr_{0.67}Sr_{0.33}MnO₃ Films Grown on Different Substrates," Appl. Phys. Lett. **74**, 2212 (1999).
260. C. L. Chien and D. H. Reich, "Proximity Effects in Superconducting/Magnetic Multilayers," J. Mag. Mag. Mat. **200**, 83-94 (1999).
261. F. Y. Yang, Kai Liu, Kimin Hong, D. H. Reich, P. C. Searson, and C. L. Chien, "Large Magnetoresistance of Electrodeposited Single-Crystal Bismuth Thin Films," *Science* **284**, 1335 (1999).
262. R. L. Sommer, A. Gündel, and C. L. Chien, "Magneto-Impedance Effects in Multilayered Permalloy Materials," J. Appl. Phys. **86**, 1057 (1999).
263. N. J. Gökemeijer, J. W. Cai, and C. L. Chien, "Memory Effects of Exchange Coupling in Ferromagnet/Antiferromagnet Bilayers," Phys. Rev. B **60**, 3033 (1999).
264. V. I. Nikitenko, V. S. Gornakov, A. J. Shapiro, R. D. Shull, Kai Liu, S. M. Zhou, and C. L. Chien, "Asymmetry in the Elementary Events of Magnetization Reversal in Ferromagnetic/Antiferromagnetic Bilayers," Phys. Rev. Lett. **84**, 765 (2000).
265. L. Sun, C. L. Chien and P. C. Searson, "Fabrication of Nanoporous Single Crystal Mica Templates for Electrochemical Deposition of Nanowire Arrays," J. Materials Science, **35**, 1097-1103 (2000).
266. F. Y. Yang, Kai Liu, Kimin Hong, D. H. Reich, P. C. Searson, C. L. Chien, Y. Leprince-Wang, Kui Yu-Zhang, and Ke Han, "Shubnikov-de Haas Oscillations in Electrodeposited Single-Crystal Bismuth Films," Phys. Rev. B **61**, 6631 (2000).

267. L. Sun, P. C. Searson and C. L. Chien, "Finite-Size Effects in Nickel Nanowire Arrays," *Phys. Rev. B* **61** (Rapid Commun). R6463 (2000).
268. Chang He Shang, T. P. Weihs, R. C. Cammarata, Yi Ji, and C. L. Chien, "Anisotropy in Magnetic and Mechanical Properties in Textured Hiperco FeCoV Alloys", *J. Appl. Phys.* **87**, 6508 (2000).
269. Kai Liu, S. M. Zhou, C. L. Chien, V. I. Nikitenko, V. S. Gornakov, A. J. Shapiro, and R. D. Shull, "Anisotropy-Dependent Macroscopic Domain Structure in Wedged-Permalloy/Uniform-FeMn Bilayers," *J. Appl. Phys.* **87**, 5052 (2000).
270. C. L. Chien, F. Y. Yang, Kai Liu, D. H. Reich, and P. C. Searson, "Very Large Magnetoresistance in Electrodeposited Single-Crystal Bi Thin Films," Invited paper 3M Conference. *J. Appl. Phys.* **87**, 4659 (2000).
271. S. M. Zhou, Kai Liu, and C. L. Chien, "Dependence of Exchange Coupling in Permalloy/Cr₈₂Al₁₈ Bilayers", *J. Appl. Phys.* **87**, 6659 (2000).
272. C. H. Shang, R. C. Cammarata, T. P. Weihs, and C. L. Chien, "Microstructures and Hall-Petch Behavior of Fe-Co-Based Hiperco Alloys," *J. Mater. Res.* **15**, 835 (2000).
273. F. Y. Yang, C. L. Chien, E. F. Ferrari, X. W. Li, A. Gupta, and Gang Xiao, "Uniaxial Anisotropy and Switching Behavior of Epitaxial CrO₂ Films," *Appl. Phys. Lett.*, **77**, 286 (2000).
274. F. Y. Yang and C. L. Chien, "Spiraling Spin Structure in an Exchange-Coupled Antiferromagnetic Layer," *Phys. Rev. Lett.*, **85**, 2597 (2000).
275. P. M. Vereecken, L. Sun, P. C. Searson, M. Tanase, D. H. Reich, and C. L. Chien, "Magnetotransport Properties of Bismuth Films on *p*-GaAs," *J. Appl. Phys.* **88**, 6529 (2000).
276. G. J. Strijkers, S. M. Zhou, F. Y. Yang, and C. L. Chien, "Magnetic Characterization and Modeling of FeMn/Co/Ru/Co Artificial Antiferromagnets," *Phys. Rev. B* **62**, 13896 (2000).
277. C. L. Chien, "Standing Out from the Giants and Colossi", *Physics World* **13**(11), 24 (2000).
278. D. H. Reich, D. M. Silevitch, C. L. Chien, D. Davidovic, and S. B. Field, "Disorder and Correlations in Extended Superconducting Nanostructure," Invited paper, 22nd Rare Earth Research Conference, *Journal of Alloys and Compounds*, **303-304**, 245 (2000).

279. G. J. Strijkers, Y. Ji, F. Y. Yang, C. L. Chien, and J. M. Byers, "Andreev Reflections at Metal/Superconductor Point-Contacts: Measurement and Analysis," *Phys. Rev. B* **63**, 104510 (2001).
280. N. J. Gokemeijer, R. L. Penn, D. R. Veblen, and C. L. Chien, "Exchange Coupling in Epitaxial CoO/NiFe Bilayers with Compensated and uncompensated Interfacial Spin Structures," *Phys. Rev. B* **63**, 174422 (2001).
281. Y. Ji, G. J. Strijkers, F. Y. Yang, C. L. Chien, J. M. Byers, A. Anguelouch, G. Xiao, and A. Gupta, "Determination of the Spin Polarization of Half-Metallic CrO₂ by point Contact Andreev Reflection," *Phys. Rev. Lett.* **86**, 5585 (2001).
282. S. M. Zhou and C. L. Chien, "Dependence of Exchange Coupling on Magnetization in Co-Ni/FeMn Bilayer," *Phys. Rev. B* **63**, 104406 (2001).
283. F. Y. Yang, C. L. Chien, X. W. Li, A. Gupta, and G. Xiao, "Critical Behavior of Epitaxial Half-Metallic Ferromagnetic CrO₂ Films," *Phys. Rev. B* **63**, 92403 (2001).
284. J. H. He, H. W. Sheng, P. J. Schilling, C. L. Chien, and E. Ma, "Amorphous Structures in the Immiscible Ag-Ni System," *Phys. Rev. Lett.* **86**, 2826 (2001).
285. G. J. Strijkers, F. Y. Yang, D. H. Reich, C. L. Chien, P. C. Searson, Y. M. Strelniker, and D. J. Bergman, "Magnetoresistance Anisotropy of a Bi Antidot Array," *IEEE Trans. Mag.* **37**, 2067 (2001).
286. F. Y. Yang, G. J. Strijkers, K. Hong, D. H. Reich, P. C. Searson, and C. L. Chien, "Large Magnetoresistance and Finite Size Effect in Electrodeposited Bismuth Lines," *J. Appl. Phys.* **89**, 7206 (2001).
287. D. M. Silevitch, D. H. Reich, C. L. Chien, S. B. Field, and H. Shtrikman, "Imaging and Magnetotransport in Superconductor/magnet Dot Arrays," *J. Appl. Phys.* **89**, 7478 (2001).
288. L. Sun, Y. Ding, C. L. Chien, and P. C. Searson, "Exchange Coupling in Nanostructured CoO/NiFe Networks," *Phys. Rev. B* **64**, 184430 (2001).
289. L. Sun, C. L. Chien, and P. C. Searson, "Magnetic Anisotropy in Prismatic Ni Nanowires," *Appl. Phys. Lett.* **79**, 4429 (2001).
290. Y. Ji, G. J. Strijkers, F. Y. Yang, and C. L. Chien, "A Comparison of Two Models for Spin Polarization Measurements by Andreev Reflection," *Phys. Rev. B* **64**, 2245 (2001).
291. A. Anguelouch, A. Gupta, Gang Xiao, D. W. Abraham, Y. Ji, S. T. Ingvarsson, and C. L. Chien, "Near-Complete spin polarization in Atomically-Smooth chromium dioxide epitaxial films prepared using a CVD liquid precursor," *Phys. Rev. B* **64**, 180408(R) (2001).

292. A. D. C. Viegas, A. M. H. de Andrade, R. L. Sommer, J. S. Jiang, and C. L. Chien, "Magneto-impedance in $\text{Fe}_{73.5}\text{Cu}_1\text{Nb}_3\text{Si}_{13.5}\text{B}_9$ amorphous films at microwave frequencies," *J. Mag. Mag. Mater.* **226**, 707 (2001).
293. I. Shao, P.M. Vereecken, P.C. Searson, C.L. Chien, and R.C. Cammarata, "Electrochemical Deposition of Nanocomposite Soft Magnetic Materials," Proceedings 6th International Symposium on Magnetic Materials, Processes and Devices, Editors S. Krongelb, L.T. Romankiw, J.-W. Chang, W. Schwarzacher, and C.H. Ahn, Proceedings Volume PV 2000-29, The Electrochemical Society, Pennington, New Jersey.(2001) p.420.
294. I. Shao, P.M. Vereecken, R. C. Cammarata, P.C. Searson, and C.L. Chien, "Electrochemical Deposition of FeCo Alloys and FeCo/TiO₂ Nanocomposites," *Mater. Res. Symo. Proc.* **674**, U53 (2001).
295. C. L. Chien, L. Sun, M. Tanase, L. A. Bauer, A. Hulgren, D. M. Silevitch, G. J. Meyer, P. C. Searson, and D. H. Reich, "Electrodeposited Magnetic Nanowires: Arrays, Field-Induced Assembly, and Surface Functionalization," Invited paper, International Workshop on Magnetic Wires, San Sebastian, Spain, June 20-23, 2001, *J. Magn. Magn. Mater.* **249**, 146-155 (2002).
296. A. Anguelouch, A. Gupta, Gang Xiao, D.W. Abraham, Y. Ji, G. X. Miao, S. Ingvarsson, and C. L. Chien, "Properties of Epitaxial Chromium Dioxide Films Grown by Chemical Vapor Deposition Using a Liquid Precursor", *J. Appl. Phys.* **91**, 7140 (2002).
297. I. Shao, P. M. Vereecken, C. L. Chien, R. C. Cammarata, and P. C. Searson, "Magnetic and Mechanical Properties of Ni/Al₂O₃ Nanocomposite Films," *J. Mater. Res.*, **17**, 1412 (2002).
298. F. Y. Yang, C. H. Shang, C. L. Chien, T. Ambrose, J. J. Krebs, and G. A. Prinz, V. I. Nikitenko, V. S. Gornakov, A. J. Shapiro, and R. D. Shull, "Multi-step Magnetic Switching in Single-Crystal (001) Co₂MnGe Films," *Phys. Rev. B.* **65**, 174410 (2002).
299. C. L. Chien, V. S. Gornakov, V. I. Nikitenko, A. J. Shapiro, and R. D. Shull, "Antiferromagnetic Spin Structure and Domains in Exchange-Coupled Multilayers," Invited paper at 2002 Intermag Conference in Amsterdam, The Netherlands, April 28 – May 2, 2002. *IEEE Trans. Mag.* **38**, 2736 (2002).
300. I. Shao, P. M. Vereecken, C. L. Chien, P. C. Searson, and R. C. Cammarata, "Synthesis and Characterization of Particle Reinforced Ni/Al₂O₃ Nanocomposites," *J. Mater. Res.* **17**(6) 1412 (2002).
301. Y. Ji, C. L. Chien, Y. Tomioka and Y. Tokura, "Measurement of Spin Polarization of Single Crystals of La_{0.7}Sr_{0.3}MnO₃ and La_{0.6}Sr_{0.4}MnO₃" *Phys. Rev. B* **66**, 12410 (2002).

302. C. H. Shang, R. C. Cammarata, D. Van Heerden, C. L. Chien, and T. P. Weihs, "Bulk Processing of High Performance Nanocrystalline Intermetallics," *J. Mater. Res.* **18**, 2017 (2003).
303. K. Yu-Zhang, D. Imhoff, Y. Leprince-Wang, E. Roy, S. Zhou, and C. L. Chien, "Multi-scale Analysis of Nanostructured Granular CoO-Ag Solid," *Acta Materialia* , **51**, 1157 (2003).
304. I. Shao, P. M. Vereecken, C. L. Chien, R. C. Cammarata, and P. C. Searson, "Electrochemical Deposition of FeCo and FeCoV Alloys," *J. Electrochemical Society* **150**. C184 (2003).
305. Lance Ritchie, Gang Xiao, Y. Ji, T. Chen, C. L. Chien, M. Zhang, J. Chen, Z. Liu, G. Wu, and X. X. Zhang, "Magnetic, structural, and transport properties of Heusler alloys Co_2MnSi and NiMnSb ," *Phys. Rev. B* **68**, 104430 (2003).
306. C. L. Chien, "Magnetic Characterization of Materials," in "*Magnetic Interactions and Spin Transport*", Eds Almadena Chtchelkanova, Stuart Wolf, and Yves Idzerda, (Kluwer Academic/Plenum Publishers, New York 2003) pp.313-339.
307. X. M. Cheng, S. H. Lee, D. Zhang, A. Duckham, X. K. Zhang, T. P. Weihs², R. C. Cammarata, J. Q. Xiao, and C. L. Chien, "Magnetic Core Loss of Ultrahigh Strength Nanocrystalline FeCo Alloys," *J. Appl. Phys.*, **93**, 7121 (2003).
308. V. I. Nikitenko, V. S. Garnakov, Yu. P. Kabanov, A. J. Shapiro, R. D. Shull, C. L. Chien, and S. D. Bader, "Magneto-Optical Indicator Film Study of the Hybrid Exchange Spring Formation and Evolution Processes," Invited Paper at Moscow International Symposium on Magnetism (MISM 2002), *J. Mag. Mag. Mater.* **258-259**, 19 (2003).
309. M. Chen, P. C. Searson, and C. L. Chien, "Micromagnetic Behavior of Electrodeposited Ni/Cu Multilayered Nanowires," *J. Appl. Phys.*, **93**, 8253 (2003).
310. X. M. Cheng and C. L. Chien, "Magnetic Properties of Epitaxial Mn-doped ZnO Thin Films," *J. Appl. Phys.*, **93**, 7876 (2003).
311. L. Sun, S. M. Zhou, P. C. Searson, and C. L. Chien, "Longitudinal and Perpendicular Exchange Bias in $\text{FeMn}/(\text{FeNi}/\text{FeMn})_n$ Multilayers," *J. Appl. Phys.*, **93**, 6841 (2003).
312. Y. Ji, C. L. Chien, and M. D. Stiles, "Current Induced Spin Wave Excitations in a Single Ferromagnetic Layer," *Phys. Rev. Lett.*, **90**, 106601(2003).
313. F. Y. Yang and C. L. Chien, "Oscillatory Exchange Bias due to an Antiferromagnet with Incommensurate Spin Density wave.," *Phys. Rev. Lett.* **90**, 147201 (2003).
314. M. Chen, L. Sun, J. E. Bonevich, D. H. Reich, C. L. Chien, and P. C. Searson "Tuning the response of Magnetic Suspensions," *Appl. Phys. Lett.* **82**, 3310 (2003).

315. A. Duckham, D. Z. Zhang, D. Liang, V. Luzin, R. C. Cammarata, R. L. Leheny, C. L. Chien, and T. P. Weihs, "Temperature Dependent Mechanical Properties of Ultra-Fine Grained FeCo-2V," *Acta. Mat.*, **51**, 4083 (2003).
316. M. Tanase, D. M. Silevitich, C. L. Chien, and D. H. Reich, "Magnetotransport Properties of Bent Ferromagnetic Nanowires," *J. Appl. Phys.*, **93**, 7616 (2003).
317. F. Y. Yang and C. L. Chien, "Exchange Coupling between Cr and Ferromagnetic Thin Films," *J. Appl. Phys.*, **93**, 6829 (2003).
318. J. M. D. Coey and C. L. Chien, "Half-Metallic Ferromagnetic Oxides," in *Spin-Polarized Materials for Spintronics* in *MRS Bulletin* **28** (no.10), 720 (October 2003).
319. C. L. Chien, V. S. Gornakov, V. I. Nikitenko, A. J. Shapiro, and R. D. Shull, "Hybrid Domain Walls and Antiferromagnetic Domains in Exchange-Coupled Ferromagnet/Antiferromagnet Bilayers," *Phys. Rev. B* **68**, 014418 (2003).
320. S. M. Zhou, L. Sun, P. C. Searson, and C. L. Chien, "Perpendicular exchange bias and magnetic anisotropy in CoO/permalloy multilayers," *Phys. Rev. B* **69**, 024408 (2004).
321. J. Mallet, T. Eagleton, K. Yu-Zhang, C. L. Chien, and P. C. Searson, "Fabrication and Magnetic Properties of fcc $\text{Co}_x\text{Pt}_{1-x}$ Nanowires," *Appl. Phys. Lett.*, **84**, 3900-3902 (2004).
322. F. Q. Zhu, D. Fan, R. C. Cammarata, and C. L. Chien. "Magnetic and magneto-transport properties of electrodeposited magnetic nano-network on laser modified Au surface," *J. Appl. Phys.* **95**, 6989 (2004).
323. T. Y. Chen, Y. Ji, and C. L. Chien, "Switching by Point Contact Spin Injection in a Continuous Film," *Appl. Phys. Lett.* **84**, 380 (2004).
324. T. Y. Chen, Y. Ji, C. L. Chien, and M. D. Stiles, "Current-driven switching in a single exchange-biased ferromagnetic layer," *Phys. Rev. Lett.*, **93**, 026601 (2004).
325. M. Z. Cieplak, Z. Adamus, M. Konczkowski, X. M. Cheng, A. Byczuk, A. Abal'oshev, H. Samg, and C. L. Chien, "Superconducting pinning by magnetic domains in a ferromagnet-superconductor bilayer," *Acta Physica polonica*, A106, 693-698 (2004).
326. J. B. Vella, A. B. Mann, H. Kung, C. L. Chien, T. P. Weihs, and R. C. Cammarata, "Mechanical Properties of Nanostructured Amorphous Metal Multilayer Thin Films," *J. Mater. Res.*, **19**, 1840 (2004).
327. A. Anguelouch, D. H. Reich, C. L. Chien and M. Tondra, "Detection of ferromagnetic nanowires using GMR sensors," *IEEE Trans. Mag.* **40**, 2997 (2004).

328. L. Sun, C. L. Chien, and P. C. Searson, "Fabrication of Nanoporous Nickel by Electrochemical Dealloying," *Chemistry of Materials* **16**, 3125 (2004).
329. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Manipulation of Nanowires in Suspension by AC Electric Fields," *Appl. Phys. Lett.* **85**, 4175 (2004).
330. F. Q. Zhu, D. L. Fan, X. C. Zhu, J. G. Zhu, R. C. Cammarata, C. L. Chien, "Ultrahigh density arrays of ferromagnetic nanorings on a macroscopic area," *Adv. Mater.* **16**, 2155 (2004).
331. Marta Z. Cieplak, X. M. Cheng, C. L. Chien, and H. Sang, "Origin of Pinning enhancement in ferromagnet-superconductor bilayer," *J. Appl. Phys.* **97**, 026105 (2005).
332. T. S. Eagleton, J. Mallet, X. Cheng, J. Wang, C. L. Chien, and P. C. Searson, "Electrodeposition of $\text{Co}_x\text{Pt}_{1-x}$ thin films," *J. Electrochem. Soc.* **152**, C27 (2005).
333. X. M. Cheng, S. Urazhdin, O. Tchernyshyov, C.L. Chien, V.I. Nikitenko, A.J. Shapiro and R.D. Shull, "Antisymmetric magnetoresistance in magnetic multilayers with perpendicular anisotropy," *Phys. Rev. Lett.*, **94**, 017203 (2005).
334. L. Sun, Y. Hao, C. L. Chien. And P. C. Searson, "Tuning the properties of magnetic nanowires," *IBM J. Res. and Develop.*, **49**, 79 (2005).
335. L. Sun, P. C. Searson, and C. L. Chien, "Asymmetry of magnetic hysteresis in exchange-biased multilayers with out-of-plane applied field," *Phys. Rev. B (Rap. Comm.)* **71**, 012417 (2005).
336. F. Q. Zhu and C. L. Chien, "Determination of multiple easy axes in magnetic multipayers by remanence measurement using a vector magnetometer," *J. Appl. Phys.* **97**, 10J110 (2005).
337. T. Y. Chen, Y. Ji, C. L. Chien and M. D. Stiles, "Current-induced hysteretic switching in a single exchange-biased ferromagnetic layer," *J. Appl. Phys.* **97**, 10C709 (2005).
338. Q. Zhu, F. Y. Yang, C. L. Chien, L. Ritchie, G. Xiao, and G. H. Wu, "Ferromagnetic Shape Memory Alloys $\text{Ni}_{51.9}\text{Mn}_{23.2}\text{Ga}_{24.9}$ with Martensitic Transition Near Room Temperature," *J. Mag. Mag. Mater.* **288**, 79 (2005).
339. L. Wang, K. Umemoto, R. M. Wentzcovitch, T. Y. Chen, C. L. Chien, J. G. Checkelsky, J. C. Eckert, E. D. Dahlberg, and C. Leighton, " $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$: a tunable source of highly spin polarized electrons," *Phys. Rev. Lett.*, **94**, 056602 (2005).
340. S. Urazhdin and C. L. Chien, "Effects of antiferromagnetic spin rotation on the anisotropy of ferromagnetic/antiferromagnetic bilayers," *Phys. Rev. B* **71**, 220410 (Rapid Commun.) (2005).

341. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Controllable High-Speed Rotation of Nanowires," *Phys. Rev. Lett.*, **94**, 247208 (2005).
342. F. Q. Zhu, G. W. Chern, O. Tchernyshyov, X. C. Zhu, J. G. Zhu, and C. L. Chien, "Magnetic Bistability and Controllable Reversal of Asymmetric Ferromagnetic Nanorings," *Phys. Rev. Lett.*, **96**, 027203 (2006).
343. H. Sang, C. L. Chien and F. Y. Yang, "Periodicity dependence of exchange bias in $[\text{Co}/\text{Pt}]_n/\text{Co}/\text{CoO}$ multilayers with perpendicular anisotropy," *J. Appl. Phys.* **99**, 013906 (2006).
344. M. Chen, C. L. Chien, and P. C. Searson, "Potential modulated multilayer deposition of multisegment Cu/Ni nanowires with tunable magnetic properties," *Chem. Mater.*, **18**, 1595 (2006).
345. L. Wang, T. Y. Chen, C. L. Chien, J. G. Checkelsky, J. C. Eckert, E. D. Dahlberg, K. Umamoto, R. M. Wentzcovitch, and C. Leighton, "Composition controlled spin polarization in $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$: electronic, magnetic, and thermodynamic properties," *Phys. Rev. B* **73**, 144402 (2006).
346. S. Urazhdin, C. L. Chien, K. Y. Guslienko, and L. Novozhilova, "Effects of current on the magnetic states of permalloy nanodiscs," *Phys. Rev. B* **73**, 054416 (2006).
347. W. L. Lee, F. Q. Zhu, and C. L. Chien, "Determination of domain wall resistance in a cobalt thin film by means of thickness modulation," *Appl. Phys. Lett.* **88**, 122503 (2006).
348. L. Y. Zhu, X. M. Cheng, and C. L. Chien, "Magnetic properties of one-dimensional quasiperiodic Co/Pt multilayers," *J. Appl. Phys.* **99**, 08C902 (2006).
349. X. M. Cheng, V. I. Nikitenko, A. J. Shapiro, R. D. Shull, and C. L. Chien, "Unusual magnetization reversal in $[\text{Co}/\text{Pt}]_4$ multilayers with perpendicular anisotropy," *J. Appl. Phys.* **99**, 08C905 (2006).
350. J. M. Valentine and C. L. Chien, "Determination of spin polarization of Gd and Dy by point-contact Andreev reflection," *J. Appl. Phys.* **99**, 08P902 (2006).
351. T. Y. Chen, S. X. Huang, C. L. Chien and M. D. Stiles, "Enhanced magnetoresistance induced by spin transfer torque in granular films with a magnetic field," *Phys. Rev. Lett.* **96**, 207203 (2006).
352. V. S. Gornakov, V. I. Nikitenko, A. J. Shapiro, R. D. Shull, F. Y. Yang, and C. L. Chien, "Switching of domains and domain walls in $\text{Fe}_{50}\text{Mn}_{50}/\text{Ni}_{81}\text{Fe}_{19}$," *The Physics of Metals and Metallography*, **101**, S51 (2006).
353. L. Wang, T. Y. Chen, C. L. Chien, and C. Leighton, "Sulfur stoichiometry effects in spin polarized CoS_2 single crystals," *Appl. Phys. Lett.* **88**, 232509 (2006).

354. V. S. Gornakov, Yu. P. Kabanov, O. A. Tikhomirov, V. I. Nikitenko, S. V. Urazhdin, F. Y. Yang, C. L. Chien, A. J. Shapiro, and R. D. Shull, "Experimental study of the microscopic mechanisms of magnetization reversal in FeNi/FeMn exchange-biased ferromagnet/antiferromagnet polycrystalline bilayers using the magneto-optical indicator film technique," *Phys. Rev. B* **73**, 184428 (2006).
355. Z. Adamus, M. Z. Cieplak, A. Abal'oshev, M. Berkowski, M. Konczykowski, X. M. Cheng, L. Y. Zhu, and C. L. Chien, "Vortex pinning in ferromagnet/superconductor bilayers – the dependence on the ferromagnetic layer and temperature," *Acta Physica Polonica A* **109**, 451-456 (2006).
356. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Efficiency of assembling of nanowires in suspension by AC electric fields," *Appl. Phys. Lett.* **89**, 223115 (2006).
357. Y. W. Hao, F. Q. Zhu, C. L. Chien, and P. C. Searson, "Fabrication and magnetic properties of ordered macroporous nickel structures," *J. Electrochemical Society*, **154**, D65-D69 (2007).
358. Y. L. Iunin, Y. P. Kabanov, V. I. Nikitenko, X. M. Cheng, D. Clarke, O. A. Tretiakov, O. Tchernyshyov, A. J. Shapiro, R. D. Shull, and C. L. Chien, "Asymmetric domain nucleation and unusual magnetization reversal in ultrathin Co films with perpendicular anisotropy," *Phys. Rev. Lett.*, **98**, 117204 (2007).
359. Z. Adamus, M. Z. Cieplak, A. Abal'oshev, M. Konczykowski, X. M. Cheng, L. Y. Zhu, and C. L. Chien, "Flux penetration in a ferromagnetic/superconducting bilayer," *Acta Physica Polonica A* **111**, 95-98 (2007).
360. F. Q. Zhu, Z. Shang, D. Monet, and C. L. Chien, "Large enhancement of coercivity of magnetic Co/Pt nanodots with perpendicular anisotropy," *J. Appl. Phys.* **101**, 09J101 (2007).
361. C. Leighton, M. Manno, A. Cady, J. W. Freeland, L. Wang, K. Umemoto, R. M. Wentzcovitch, T. Y. Chen, C. L. Chien, P. L. Kuhns, M. J. R. Hoch, A. P. Reyes, W. G. Moulton, E. D. Dahlberg, J. Checkelsky, and J. Eckert, "Composition controlled spin polarization in $\text{Co}_{1-x}\text{Fe}_x\text{S}_2$ alloys," *J. Phys. Condens. Matter* **19**, 315219 (2007).
362. T. Y. Chen, C. L. Chien and C. Petrovic, "Enhanced Curie temperature and spin polarization in Mn_4FeGe_3 ," *Appl. Phys. Lett.* **91**, 142505 (2007).
363. C. L. Chien, F. Q. Zhu, and J. G. Zhu, "Patterned Nanomagnets," *Physics Today* **60** (no. 6) 40 (2007); Japanese translation in *Parity* **23** (no.2) 10 (2008).
364. D. L. Fan, R. C. Cammarata, and C. L. Chien, "Precision transport and assembling of nanowires in suspension by electric field," *Appl. Phys. Lett.* **92**, 093115 (2008).

365. Z. Liu, G. Q. Xia, F. Q. Zhu, S. Kim, N. Markovic, C. L. Chien, and P. C. Searson, "Exploiting finite size effects in a novel core/shell microstructure," *J. Appl. Phys.* **103**, 064313 (2008).
366. Y. L. Iunin, Y. P. Kabanov, V. I. Nikitenko, X. M. Cheng, A. J. Shapiro, C. L. Chien, and R. D. Shull, "On the nature of asymmetry of nucleation centers in ultrathin Co films and Co/Pt multilayers," *Functional Materials* **15**, 51 (2008).
367. S. H. Lee, F. Q. Zhu, C. L. Chien, and N. Markovic, "Effect of geometry on magnetic domain structure in Ni wires with perpendicular anisotropy: A magnetic force microscopy study," *Phys. Rev. B* **77**, 132408 (2008).
368. X. J. Zou, G. Xiao, S. X. Huang, T. Y. Chen, and C. L. Chien, "Magnetotransport properties of polycrystalline and epitaxial CrO₂ nanowires," *J. Appl. Phys.*, **103**, 07D710 (2008).
369. T. Y. Chen, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, "A BCS-like gap in the superconducting SmFeAsO_{0.85}F_{0.15}," *Nature*, **453**, 1224 (2008).
370. S. X. Huang, T. Y. Chen, and C. L. Chien, "Spin polarization of amorphous CoFeB determined by point-contact Andreev reflection," *Appl. Phys. Lett.* **92**, 242509 (2008).
371. H. X. Wei, F. Q. Zhu, X. F. Han, Z. C. Wen, and C. L. Chien, "Current-induced multiple spin structures in 100 nm ring magnetic tunnel junctions," *Phys. Rev. B.* **77**, 224432 (2008).
372. L. Y. Zhu, T. Y. Chen, and C. L. Chien, "Altering the superconducting transition temperature by domain-wall arrangement in hybrid ferromagnet-superconductor structures," *Phys. Rev. Lett.* **101**, 017004 (2008).
373. Y. L. Iunin, Y. P. Kabanov, V. I. Nikitenko, X. M. Cheng, C. L. Chien, A. J. Shapiro, and R. D. Shull, "Magnetic field dependence of asymmetry in the magnetization reversal of ultrathin Co films and Co/Pt multilayers with perpendicular anisotropy," *J. Mag. Mag. Mater.* **322**, 2044 (2008).
374. D. L. Fan, R. C. Cammarata, and C. L. Chien, "Controlled manipulation of nanoentities in suspension," in *Biomagnetism and Magnetic Biosystems Based on Molecular Recognition Processes*, p. 44-51, eds J. A. C. Bland and A. Ionescu, AIP Conf. Proc. 1025 (2008).

375. B. O'Brien, M. Plaza, L. Y. Zhu, L. Perez, C. L. Chien, and P. C. Searson, "Magnetotransport properties of electrodeposited bismuth films," *J. Phys. Chem. C* **112**, 12018 (2008).
376. Z. Liu, D. Elbert, C. L. Chien, and P. C. Searson, "FIB/TEM Characterization of the composition and structure of core/shell Cu-Ni nanowires," *Nano Lett.* **8**, 2166 (2008).
377. Z. Liu, L. Guo, C. L. Chien, and P. C. Searson, "Formation of core/shell microstructure in Cu-Ni thin films," *J. Electrochem. Soc.* **155**, D569 (2008).
378. T. Y. Chen, S. X. Huang, Z. Tesanovic, R. H. Liu, X. H. Chen, and C. L. Chien, "Determination of Superconducting Gap of $\text{SmFeAsF}_x\text{O}_{1-x}$ Superconductors by Andreev Reflection Spectroscopy," *Physica C* **469**, 521 (2009).
379. T. Y. Chen, C. L. Chien, M. Manno, L. Wang, and C. Leighton, "Ballistic heat transport in nanocontact," *Phys. Rev. B (Rapid Commun.)* **81**, 020301(R)(2010).
380. A. K. Rumaiz, J. C. Woicik, W. G. Wang, J. Jordan Sweet, G. H. Jaffari, C. Ni, and C. L. Chien, "Effects of annealing on the local structure of Fe and Co in CoFeB/MgO/CoFeB tunnel junctions: an extended x-ray-absorption fine structure study," *Appl. Phys. Lett.* **96**, 112502 (2010).
381. Y. P. Kabanov, Y. L. Iunin, V. I. Nikitenko, A. J. Shapiro, R. D. Shull, L. Y. Zhu, and C. L. Chien, "In-plane field effects on the dynamics of domain walls in ultrathin Co films with perpendicular anisotropy," *IEEE Trans. Mag.* **46**, 2220 (2010).
382. D. L. Fan, Z. Z. Yin, R. Cheong, F. Q. Zhu, R. C. Cammarata, C. L. Chien, and A. Levchenko, "Sub-cellular resolution delivery of a cytokine via precisely manipulated nanowires," *Nature Nanotechnology* **5**, 545 (2010).
Featured story, "Nanowires have cells in their sights," *Nature Nanotechnology* **5**, 481 (2010).
383. S. X. Huang, C. L. Chien, V. Thampy, and C. Broholm, "Control of tetrahedral coordination and superconductivity in $\text{FeSe}_{0.5}\text{Te}_{0.5}$ thin films," *Phys. Rev. Lett.*, **104**, 217002, (2010).
384. T. Y. Chen, S. X. Huang, and C. L. Chien, "Pronounced effects of additional resistance in Andreev reflection spectroscopy," *Phys. Rev. B* **81**, 214444 (2010).

385. L. Y. Zhu, M. Z. Cieplak, and C. L. Chien, "Tunable phase diagram and vortex pinning in ferromagnet-superconductor bilayer," *Phys. Rev. B (Rapid Commun.)* **82**, 060503(R) (2010).
386. L. Guo, D. Hung, W. G. Wang, W. F. Shen, L. Y. Zhu, C. L. Chien, and P. C. Searson, "Tunnel barrier photoelectrodes for solar water splitting," *Appl. Phys. Lett.* **97**, 063111 (2010).
387. I. S. Abal'osheva, A. V. Abal'oshev, M. Z. Cieplak, L. Y. Zhu, and C. L. Chien, "Inhomogeneous magnetic field penetration in superconducting Niobium films," *Acta Physica Polonica*, **118**, 396 (2010)
388. Y. Syryany, L. Y. Zhu, M. Z. Cieplak, and C. L. Chien, "Enhancement of flux pinning in the superconductor-ferromagnet bilayer Nb(Co/Pd)," *Acta Physica Polonica*, **118**, 399 (2010)
389. I. Zaytseva, M. Z. Cieplak, A. Abal'oshev, P. Dluzewski, G. Grabecki, W. Plesiewicz, L. Y. Zhu, and C. L. Chien, "Magnetoresistance of Si/Nb/Si Trilayers," *Acta Physica Polonica*, **118**, 406 (2010)
390. M. Z. Cieplak, L. Y. Zhu, Z. Adamus, M. Konczykowski, and C. L. Chien, "Enhancement of vortex pinning in superconductor/ferromagnet bilayer via angled demagnetization," *Phys. Rev. B (Rapid Commun.)* **84**, 020514(R) (2011).
391. D. L. Fan, F. Q. Zhu, R. C. Cammarata, and C. L. Chien, "Electric Tweezers," (invited) *Nanotoday* **6**, 339 (2011)
392. W. G. Wang, S. Hageman, M. Li, S. X. Huang, X. M. Kou, X. Fan, J. Q. Xiao, and C. L. Chien, "Thermal annealing study of magnetoresistance and perpendicular anisotropy in magnetic tunnel junctions based on MgO and CoFeB," *Appl. Phys. Lett.* **99**, 102502 (2011).
393. S. Y. Huang, W. G. Wang, S. F. Lee, J. Kwo, and C. L. Chien, "Intrinsic spin-dependent thermal transport," *Phys. Rev. Lett.* **107**, 216604 (2011).
394. Abdul K. Rumaiz, C. Jaye, J. C. Woicik, Weigang Wang, D. A. Fischer, J. Jordan-Sweet, and C. L. Chien, "Boron migration due to annealing in CoFeB/MgO/CoFeB interfaces: A combined hard x-ray photoelectron spectroscopy and x-ray absorption studies," *Appl. Phys. Lett.* **99**, 222502 (2011)
395. W. G. Wang, M. Li, S. Hageman, and C. L. Chien, "Electric field assisted switching in magnetic tunnel junctions," *Nature Mater.* **11**, 64 (2012).

396. D. L. Fan, F. Q. Zhu, X. B. Xu, R. C. Cammarata, and C. L. Chien, "Electronic properties of nanoentities revealed by mechanical motion," *Proceedings of the National Academy of Sciences* **109**, 9309 (2012).
397. M. Gooch, B. Lorenz, S. X. Huang, C. L. Chien, and C. W. Chu, "Pressure effects on strained $\text{FeSe}_{0.5}\text{Te}_{0.5}$ thin films," *J. Appl. Phys.* **111**, 112610 (2012).
398. S. X. Huang and C. L. Chien, "Extended Skyrmion phase in epitaxial FeGe(111) thin films," *Phys. Rev. Lett.* **108**, 267201 (2012).
399. S. Y. Huang, X. Fan, D. Qu, Y. P. Chen, W. G. Wang, J. Wu, T. Y. Chen, J. Q. Xiao, and C. L. Chien, "Transport Magnetic Proximity Effects in Platinum," *Phys. Rev. Lett.* **109**, 107204 (2012)
400. T. Y. Chen, Z. Tesanovic, and C. L. Chien, "Unified formalism of Andreev reflection at a ferromagnet/superconductor interface," *Phys. Rev. Lett.* **109**, 146602 (2012).
401. W. G. Wang and C. L. Chien, "Voltage induced switching in magnetic tunnel junctions with perpendicular magnetic anisotropy," *J. Phys. D: Appl. Phys.* (2013)

Invited Talks, Colloquia, and Seminars (1987 -):

55. **"Superlattice and Multilayer Systems with Crystalline and Amorphous Constituent Layers,"** Joint Annual Meeting of Metallurgical Society and American Society for Metal, Symposium on Metallic Multilayer and Epitaxy, Denver, CO, (Feb. 24-25, 1987).
56. **"Vapor-Quench Amorphous Solids and Modulated Solids,"** International Symposium on Magnetic Properties of Amorphous Metals, Benalmadena, Spain (May 25-29, 1987).
57. **"High Temperature Superconducting Ceramic Materials,"** ASM - International, Baltimore Chapter (September 21, 1987).
58. **"Superlattices and Modulated Solids,"** Colloquium, Department of Physics, University of Nebraska (October 8, 1987).
59. **"Flux Pinning, Critical Current Density, and Magnetic Properties of High T_c Ceramic Superconductors,"** TMS Fall Meeting, Cincinnati, Ohio (October 11-14, 1987).
60. **"High T_c Superconductors,"** Colloquium, Department of Physics, Towson State University (November 17, 1987).
61. **"Superlattices and Modulated Solids,"** IBM T.J. Watson Research Center, Yorktown Heights, New York (January 25, 1988).
62. **"High T_c Superconductivity in Orthorhombic and Tetragonal Perovskite Structures Induced By 3d Element Substitution,"** American Physical Society March Meeting, New Orleans, LA (March 21-25, 1988).
63. **"Magnetic Granular Solids,"** Magnetism Technology Center, Carnegie-Mellon University, Pittsburgh, Pennsylvania (April 7, 1988).
64. **"Significance of Plane vs. Chain Sites in High T_c Superconducting $YBa_2Cu_3O_7$,"** Conference on Superconductivity and Applications, Buffalo, New York (April 18-20, 1988).
65. **"Substitution Studies of $YBa_2Cu_3O_7$ and Properties of Bi and Tl-based Superconductors,"** AT&T Bell Labs, Murray Hill, New Jersey (April 21, 1988).
66. **"Substitutional Studies of High T_c Superconductors,"** Los Alamos National Laboratory, Los Alamos, New Mexico (June 24, 1988).
67. **"Magnetic Granular Solids,"** 3M Research Center, Maplewood, Minnesota (September 1, 1988).
68. **"Granular Magnetic Solids,"** Colloquium, Department of Physics, Kansas State University, Manhattan, Kansas (September 22, 1988).

69. **"High T_c Superconductors,"** Colloquium, Martin Marietta Research Lab, Baltimore, Maryland (October 19, 1988).
70. **"Substitution Studies of High T_c Superconductors,"** Department of Physics, University of Virginia, Charlottesville, Virginia (October 20, 1988).
71. **"The Role of Cu in High T_c Superconductors,"** Colloquium, Department of Physics, Columbia University, New York, New York (April 10, 1989)
72. **"Cation and Copper Substitution Studies of High T_c Cuprate Superconductors,"** International Conference on Oxygen Disorder Effects in High T_c Superconductors, Trieste, Italy (April 18-21, 1989).
73. **"Magnetic Granular Solids,"** 5th Annual Symposium on Magnetism and Magnetic Materials, Taipei, Taiwan (April 19 - 20, 1989)
74. **"Artificially Structured Solids,"** Colloquium, Department of Physics, Seoul National University, Seoul, Korea (April 24, 1989)
75. **"Superlattices and Modulated Solids,"** Colloquium, Technion, Haifa, Israel (May 21, 1989).
76. **"Probing the High T_c Superconductors Through Substitution,"** Colloquium, Institut für Festkörperphysik, Technische Hochschule, Darmstadt, Germany (May 26, 1989).
77. **"Superlattices, Multilayers Made by Sputtering and MBE,"** Colloquium, Naval Research Lab, Washington DC (August 4, 1989).
78. **"Artificially Structured Solids,"** International Conference on the Applications of the Mössbauer Effect, Budapest, Hungary (September 4 - 8, 1989).
79. **"Superlattices and Multilayers,"** Colloquium, Royal Institute of Technology, Stockholm, Sweden (September 14, 1989)
80. **"Superlattices and Multilayers,"** Seminar, Department of Physics, University of Delaware, Newark, Delaware (September 26, 1989)
81. **"Magnetic Granular Solids,"** Materials Research Society Spring Meeting, San Francisco, CA (April 16-20, 1990)
82. **"Metal-Insulator Multilayers,"** IBM Yorktown Research Center, Yorktown Heights, NY (May 18, 1990).
83. **"Granular Solids,"** NATO Advanced Study Institute on the Science and Technology of Nanostructured Magnetic Materials, Crete, Greece (June 25-July 6, 1990).
84. **"Superlattices and Multilayers,"** National Institute of Standards and Technology, Gaithersburg, MD (August 22, 1990)

85. **"Finite-Size Effects Observed in Metal-Insulator Multilayers,"** Department of Physics, University of Maryland, College Park, MD (October 8, 1990).
86. **"Metal-Insulator Multilayers,"** Symposium on Properties of Multilayered Alloys," Electrochemical Society Meeting, Seattle, WA (October 14-19,1990)
87. **"Granular Magnetic Solids,"** Conference On Magnetism and Magnetic Materials, San Diego, CA (October 29-November 1,1990).
88. **"Nanostructure-Induced Properties in Granular Metallic Solids,"** 5th Israel Materials Engineering Conference, Haifa, Israel (December 19-20, 1990).
89. **"Finite-Size Effects and Dimensional Crossover in Magnetic Thin Layers,"** Colloquium, Department of Physics & Astronomy, The Johns Hopkins University, Baltimore, MD (December 6, 1990).
90. **"Finite-Size Scaling and Dimensional Crossover in Spin Glass Layers,"** American Physical Society March Meeting, Cincinnati, Ohio (March 18-22, 1991).
91. **"Finite-Size Effects and Dimensional Crossover in Magnetic Thin Layers,"** Colloquium, Naval Research Lab, Washington DC (April 18, 1991).
92. **"Interlayer Coupling, Finite-Size Effects and Dimensional Crossover in Magnetic Multilayers,"** Workshop on Surfaces, Thin Films and Multilayers, Rio de Janeiro, Brazil, (July 15-16, 1991).
93. **"What Degrades High T_c Cuprate Superconductors ?,"** 1991 International Workshop on High T_c Superconductivity, Chi-Toh, Taiwan (July 28-31, 1991).
94. **"Magnetic and Other Nanostructure-Induced Properties of Granular Solids,"** International Symposium on the Physics and Chemistry of Finite Systems: from Clusters to Crystals, Richmond, Virginia (October 8-12, 1991).
95. **"Finite-Size Effects in Magnetic Multilayers,"** Seminar, Lawrence Livermore National Laboratory, Livermore, CA (November 29, 1991).
96. **"Interlayer Coupling, Finite-Size Effects and Dimensional Crossover in Magnetic Multilayers,"** Symposium on the Trends in Condensed Matter Physics, Taipei, Taiwan (November 1-2, 1991).
97. **"Finite-Size Effects in Magnetic Systems,"** Colloquium, Department of Physics, Brown University, Providence, RI (April 20, 1992).
98. **"Giant Magnetoresistance in Granular Magnetic Systems,"** 1992 NATO Advanced Research Workshop on "Magnetism and Structure in Systems with Reduced Dimensions," Cargese, Corsica, France (June 15 - 19, 1992).

99. **"Nanostructure-Induced Enhanced Properties of Granular Solids,"** The 6th International Conference on Ferrites, Tokyo, Japan (September 29 - October 2, 1992).
100. **"Magnetic Granular Solids,"** Conference on New Development in Magnetic Material Composite, Kyoto, Japan (October 4 - 7, 1992).
101. **"Giant Magnetoresistance,"** Seminar, Department of Physics, Michigan State University, East Lansing, MI (October 19, 1992).
102. **"Giant Negative Magnetoresistance,"** Colloquium, Department of Physics and Astronomy, The Johns Hopkins University, Baltimore, MD (October 22, 1992).
103. **"Giant Negative Magnetoresistance,"** Colloquium, Department of Physics, University of Delaware, Newark, DE (November 4, 1992).
104. **"Giant Magnetoresistance in Granular Magnetic Systems,"** 1992 Materials Research Society Fall Meeting, Boston, MA (November 30 - December 4, 1992).
105. **"Giant Negative Magnetoresistance in Granular Magnetic Systems,"** Conference on Magnetism and Magnetic Materials, Houston, TX (December 1 - 4, 1992).
106. **"Giant Magneto-Transport Properties in Artificially Structured Solids,"** Colloquium, Applied Physics Laboratory, Laurel, MD (January 29, 1993).
107. **"Giant Magnetoresistance in Granular Magnetic Solids,"** Colloquium, Ford Research Laboratory, Dearborn, Michigan (March 9, 1993).
108. **"Giant Magneto-Transport Properties in Granular Magnetic Solids,"** American Physical Society March Meeting, Seattle, WA (March 22-26, 1993).
109. **"Artificially Structured Solid,"** Colloquium, Department of Physics, Villanova University, Philadelphia, PA. (April 1, 1993).
110. **"Nanostructure-Induced Properties of Granular Solids,"** Colloquium, Virginia Institute for Material Systems and the Center for Intelligent Material Systems and Structures, Virginia Tech, Blacksburg, Virginia (April 6, 1993).
111. **"Giant Magneto-Transport Properties in Granular Magnetic Solids,"** XVI Encontro Nacional de Fisica da Materia Condensada, Caxambu, Brazil (May 18 - 22, 1993).
112. **"Granular Magnetic Solids,"** NATO Advanced Study Institute on Nanophase Materials, Corfu, Greece (June 20 - July 2, 1993).
113. **"Giant Magneto-Transport Properties in Granular Magnetic Solids,"** 3rd IUMRS International Conference on Advanced Materials, Sunshine City, Ikebukuro, Tokyo, Japan (August 31 - September 4, 1993).

114. **"Giant Magneto-Transport Properties in Granular Magnetic Solids,"** Seminar, Department of Physics, Carnegie-Mellon University, Pittsburgh, PA. (March 3, 1994).
115. **"Magnetic and Transport Properties of Nanostructured Materials with zero-dimensional and One-dimensional Entities,"** Acta Metallurgica Conference on Novel Magnetic Structures and Properties, Santa Fe, NM (June 24-25, 1994).
116. **"Artificially Structured Solids,"** Colloquium, Department of Mechanical Engineering, Johns Hopkins University, Baltimore, MD (September 15, 1994).
117. **"Giant Magneto-Transport Properties in Granular Magnetic Systems,"** The 5th NEC Symposium on Fundamental Approaches to New Material Phases - Spin-dependent Phenomena in Multilayer Systems, Karuizawa, Japan (October 16-20, 1994).
118. **"Giant Magneto-Transport Properties in Granular Solids, Nanowires, and Amorphous Alloys,"** International Workshop on Spin Polarized Electron Transport, Miami, FL. (February 19 - 23, 1995).
119. **"Oscillatory Superconducting Transition Temperature in Gd/Nb Multilayers,"** International Workshop on Magnetism in Multilayered and Reduced Dimensional Systems, Argonne National Lab, Argonne, IL. (June 19 - 23, 1995).
120. **"Nanostructured Solids with 2D, 1D and 0D Entities,"** The Hong Kong University of Science and Technology Physics Summer School on Nanostructured and Granular Materials, Hong Kong (July 3- 14, 1995).
121. **"Giant Magneto-Transport Properties in Granular Solid, Nanowires, and Amorphous Alloys,"** The 3rd International Symposium on Physics of Magnetic Materials (ISPM 95), Seoul Korea (August 21-25, 1995).
122. **"Magnetic Nanostructures,"** The 8th Chinese International Summer School of Physics-Beijing International Workshop on Modern Magnetism," Beijing, China (August 28 - September 7, 1995).
123. **"Giant Magnetoresistance in Magnetic Nanostructures,"** Colloquium, Department of Physics, Washington University, St. Louis, MO (October 18, 1995).
124. **"Fabrication, Magnetic Properties, and Giant Magnetoresistance in Arrays of Nanowire,"** International Symposium on the Science and Technology of Atomically Engineered Materials, Richmond, VA (October 30 - November 4, 1995).
125. **"Magnetic Nanostructures with 2D, 1D, and 0D Entities,"** Colloquium, Department of Physics, University of Connecticut, Storrs, CT (March 7, 1996)
126. **"Arrays of Nanowires,"** Fourth International Conference on Nanometer-Scale Science and Technology, Beijing, China (September 8-12, 1996).

127. **"Magnetic Nanostructures with 2D, 1D, and 0D Entities (I),"** Lectures for Honorary Professorship, Department of Physics, Nanjing University, Nanjing, China, (September 16, 1996).
128. **"Magnetic Nanostructures with 2D, 1D, and 0D Entities (II),"** Lectures for Honorary Professorship, Department of Physics, Nanjing University, Nanjing, China, (September 19, 1996).
129. **"Superconducting Nanostructures"** Lectures for Honorary Professorship, Department of Physics, Nanjing University, Nanjing, China, (September 23, 1996).
130. **"Magnetic and Superconducting Nanostructures,"** Department of Physics, Suzhou University, Suzhou, China, (September 27, 1996).
131. **"Magnetic Nanostructures (I),"** Lectures for Honorary Professorship, Department of Physics, Lanzhou University, Lanzhou, China, (October 2, 1996).
132. **"Magnetic Nanostructures (II),"** Lectures for Honorary Professorship, Department of Physics, Lanzhou University, Lanzhou, China, (October 3, 1996).
133. **"Superconductor/Ferromagnet Multilayers,"** Conference on Magnetism and Magnetic Materials, Atlanta, GA (November 12-15, 1996).
134. **"Superconducting Proximity Effects in Magnetic Materials,"** Department of Physics, University of Maryland, College Park, Maryland (April 24, 1997).
135. **"Magnetic Nanostructures with 2D and 1D Entities,"** American Vacuum Society 44th National Symposium and Topical Conferences, San Jose, California (October 20 - 24, 1997).
136. **"FM/AF Exchange Biasing and Arrays of Nanowires,"** Hewlett-Packard Research Lab, Palo Alto, California (October 25, 1997)
137. **"Recent Results in FM/AF Exchange Biasing and Arrays of Nanowires"** IBM Almaden Research Center, San Jose, California (October 27, 1997).
138. **"Magnetic Nanostructured Materials,"** AT&T Bell Labs Colloquium, Murray Hill, New Jersey, (December 9, 1997).
139. **"The Intriguing Physics of Exchange Coupling,"** Nanjing University Colloquium, Nanjing, China (October 13, 1998).
140. **"Magnetic Nanostructures,"** Fudan University Colloquium, Shanghai, China (October 15, 1998).
141. **"Magnetoresistive Sensors, the Role of Exchange Bias,"** Army Research Lab, Adelphi, MD (October 28, 1998).

142. **“Magnetic Nanostructures,”** Department of Physics, Penn State University, University Park, PA (November 2, 1998).
143. **“Magnetic Nanostructures,”** Department of Physics, Brown University, Providence RI (December 1, 1998).
144. **“Exchange Coupling in Magnetic Multilayers,”** American Physical Society Centennial March Meeting, Atlanta, GA (March 20-26, 1999).
145. **“Bi Nanowires and Single Crystal Bi Thin Films,” First GT Workshop on Exotic Multilayered Systems,”** Georgia Tech. Atlanta, GA (March 27, 1999).
146. **“Magnetic Nanostructures,”** Department de Physique, Universite de Marne La Vallee, France, (April 13, 1999).
147. **“New Features of Exchange Coupling in FM/AF Bilayers and Very Large MR in Single Crystal Bi Thin Films”**, Thomson-CSF, Orsay, France (April 14, 1999).
148. **“Large Magnetoresistance and Field-Sensing Characteristics of Single Crystal Bismuth Films,”** The 5th International Conference on Advanced Materials (IUMRS-ICAM'99), Beijing, China (June 13 - 18, 1999).
149. **“Magneto-Transport Properties of Bi Nanowires and Single Crystal Bi Thin Films,”** 5th International Conference on Electrical Transport and Optical Properties of Inhomogeneous Media (ETOPIM5), Hong Kong, China (June 21 - 25, 1999).
150. **“Intriguing Exchange Coupling in FM/AF Bilayers”** NIST, Gaithersburg, Maryland (August 11, 1999)
151. **“Nanostructures with Large Magneto-Transport Properties”** Workshop on "Magnetoelectronic Materials and Devices SUNY-Buffalo, Buffalo, New York (September 17 –18, 1999).
152. **“Large Magneto-Transport Properties in Bi Nanowires and Thin Films”**, Colloquium, Argonne National Lab, Argonne, IL (September 22, 1999).
153. **“Large Magnetoresistance in Magnetic Heterostructures, Nanowires and Single-Crystal Films of Bismuth”** Colloquium, Department of Physics, University of Minnesota, Minneapolis, MN (October 20, 1999).
154. **“Magneto-Transport Properties of Bi Nanowires and Single Crystal Bi Thin Films”** International Symposium on Cluster and Nanostructure Interfaces, Richmond, VA (October 25 –29, 1999).
155. **“Large Magnetoresistance in Magnetic Heterostructures, Nanowires and Single-Crystal Films of Bismuth”** Colloquium, Department of Physics, Florida State University, Tallahassee, Florida (November 4, 1999).

156. **“Very Large Magnetoresistance in Electrodeposited Single Crystal Bismuth Films”** 44th Annual Conference on Magnetism and Magnetic Materials, San Jose, California (November 15 – 18, 1999).
157. **“Overview of Magnetic Materials of Importance”** New Technology R & D Center, Philip Morris, Richmond, VA (November 23, 1999).
158. **“Magneto-Transport Properties of Electrodeposited Single-Crystal Bi Films”** International Workshop on Latest developments in Low-density and Low-dimensional electronic Systems (LD)³, University of Florida, Gainesville, Florida (March 4 – 7, 2000).
159. **“Exchange Bias in FM/AF Bilayers”** Spallation Neutron Source Workshop on Magnetism, Argonne national Lab, Argonne, Illinois (April 27 – 28, 2000).
160. **“Exchange Bias in FM/AF Bilayers”** Synchrotron Radiation Research Center, Hsinchu, Taiwan, (May 31, 2000).
161. **“Large Magnetoresistance Effects in Magnetic Heterostructures, Nanowires and Single-Crystal Thin Films of Bismuth”** Institute of Physics, Academia Sinica, Taipei, Taiwan (June 1, 2000).
162. **Half-Metallic Ferromagnetic CrO₂** Department of Physics, National Taiwan University, Taipei, Taiwan (June 2, 2000)
163. **“Magnetic Nanostructures”** Second Conference on Nanostructured Materials, Academia Sinica, Taipei, Taiwan (June 3, 2000).
164. **“Large Magneto-Transport Properties of Electrodeposited Single Crystal Bismuth Films”** International Conference on Magnetism (ICM2000), Recife, Brazil (August 6 – 11, 2000).
165. **“Spin-Dependent Transport and Magnetoelectronic Devices,”** Colloquium, Physics Department, Virginia Commonwealth University, Richmond, VA (Oct. 6, 2000).
166. **“Heterostructures and Spintronics,”** Colloquium, Applied Physics Laboratory, JHU, Laurel, MD (February 2, 2001).
167. **“Antiferromagnetic Spin Structure and Domains in Exchange-Coupled Multilayers,”** American Physical Society Centennial March Meeting, Seattle, WA (March 12-16, 2001).
168. **“Antiferromagnetic Spin Structure in Exchange-Coupled Multilayers and Determination of Spin Polarization in Half-Metallic Ferromagnets,”** Einhoven Institute of Technology, Einhoven, The Netherlands, (June 19, 2001).
169. **“Magnetic Nanowire Arrays and Manipulation of Isolated Magnetic Nanowires,”** International Workshop on Magnetic Wires, Sebastian, Spain (June 20 –23, 2001).

170. **“Highly Spin-Polarized Materials”**, International Conference on Novel Aspects of Spin-Polarized Transport and Dynamics (Spintronics 2001), Washington DC (August 9 – 11, 2001).
171. **“Magnetization Reversal in Bilayers with Exchange Anisotropy”**, First Seeheim Conference on Magnetism, Seeheim, Germany (September 9-13, 2001).
172. **“The Central Roles of Antiferromagnetic Spin Structure and Domains in Exchange-Biased Multilayers,”** Michigan State University MRSEC workshop, East Lansing, MI (September 22, 2001).
173. **“Measurement of Spin Polarization using Point Contact,”** III Escola Brasileira de Magnetismo, Porto Alegre, Brazil (October 17-25, 2001)
174. **“Highly Spin-Polarized Materials”**, 48th International Symposium of the American Vacuum Society, IUUSTA 15th International Vacuum Congress, 11th International Congress on Solid Surfaces, San Francisco, CA (October 29 – November 2, 2001).
175. **“Bismuth Nanowires, Single-Crystal Thin Films, and Antidot Arrays,”** Colloquium, Department of Chemical Engineering and Materials Science, University of Minnesota, Minneapolis MN (Nov. 6, 2001).
176. **“Dynamic Spin Structure and Antiferromagnetic Domains in Exchange-Coupled Multilayers”**, Intermag Conference, Amsterdam, The Netherlands (April 28 – May 2, 2002)
177. **“Determination of Spin Polarization in Half-Metallic CrO₂,”** Gordon Research Conference on Magnetic Nanostructures, Barga, Italy (May 12 – 17, 2002).
178. **“Highly Spin Polarized Materials,”** Nanjing University Centennial Lecture, Nanjing, China (May 21, 2002).
179. **“Semi-Metallic and Half-Metallic Thin Films,”** Taiwan-Japan Joint Symposium on Fundamentals and Applications of Nano-Magnetic Thin Films and Particles, Tokyo, Japan (September 17-20, 2002).
180. **“Half-Metallic Ferromagnets,”** Materials Research Lecture Series, California Institute of Technology (October 9, 2002).
181. **“Measurement of Spin Polarization by Andreev Reflection,”** Materials Research Society Fall Meeting, Boston, MA (December 2-6, 2002).
182. **“Spin-Torque Effects in a Single Ferromagnetic Layer,”** FORC workshop, University of California at Davis, (April 25-27, 2003).
183. **“Spin-Transfer Torque in Magnetic Nanostructures,”** Invited talk, Annual National Physical Society Conference of Taiwan, Hsin-Chu, Taiwan (February 9-11, 2004).

184. **“Half-Metals and Nanorings,”** Plenary talk, Annual National Physical Society Conference of Taiwan, Hsin-Chu, Taiwan (February 9-11, 2004).
185. **“Bismuth Nanowires, Single-Crystal Films, and Antidot Arrays,”** Physics Department, Tunghai University, Taichung, Taiwan (February 12, 2004).
186. **“Bismuth Nanowires, Single-Crystal Films, and Antidot Arrays,”** Physics Department, National Central University, Chungli, Taiwan (February 13, 2004).
187. **Half-Metals, Spin Torque, and Nanorings,”** David Adler Award talk, APS March Meeting, Montreal, Canada (March 22- 26, 2004).
188. **“Spin-Transfer Torque in Magnetic Nanostructures,”** Invited talk, Indo-US Workshop 2004, Puri, India (April 5-8, 2004).
189. **“Spin-Transfer Torque in Magnetic Nanostructures,”** Colloquium, Physics Department, University of North Carolina, Chapel Hill, NC(April 12, 2004).
190. **“Spin-Transfer Torque in Magnetic Nanostructures,”** Seminar, Faculté des Science, Université de Reims, Reims, France (July12, 2004).
191. **“Intriguing exchange bias – the role of antiferromagnetic spin structure,”** Ultrabias Summer School, Anglet, France (Sept. 12-16, 2004).
192. **“Spin transfer torque in magnetic nanostructure,”** Ultrabias Summer School, Anglet, France (Sept. 12-16, 2004).
193. **“Spin Torque and Nanorings,”** Workshop on Nanomagnetism using X-ray Techniques, Lake Geneva, WI (August 29 - September 3, 2004).
194. **“Spin Torque and Nanorings,”** Keynote Speaker, 5th Annual Nanoscience and Nanotechnology Forum, Vanderbilt University, Nashville, TN (October 6, 2004).
195. **“Spin Torque and Nanorings,”** Colloquium, Department of Physics and Astronomy, Johns Hopkins University, Baltimore, MD (October 26, 2004).
196. **“Spin Torque and Nanorings,”** Seminar, San Jose Research Center, San Jose, CA, (February 15, 2005).
197. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Komag Auditorium, San Jose, CA, (February 15, 2005).
198. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Center for Magnetic Recording Research, University of California at San Diego, CA (March 1, 2005).
199. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, Department of Physics, Colorado State University, Fort Collins, CO (March 28, 2005).

200. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, Seagate Research Center, Pittsburgh, PA (March 31, 2005).
201. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, Department of Computer and Electrical Engineering, Carnegie-Mellon University, Pittsburgh, PA (April 1, 2005).
202. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, Department of Computer and Electrical Engineering, University of Minnesota, Minneapolis, MN (April 19, 2005).
203. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, NIST, Boulder, CO (April 20, 2005).
204. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Colloquium, Department of Computer and Electrical Engineering, Georgetown University, Washington DC (April 27, 2005).
205. **“Manipulation of nanowires, patterning and rotation,”** US-Spain Workshop, Segovia, Spain (Sept. 19-22, 2005).
206. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Department of Physics, University of York, York, UK (September 26, 2005).
207. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Department of Physics, University of Glasgow, Glasgow, UK (September 27, 2005).
208. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Department of Physics, University of Exeter, Exeter, UK (September 29, 2005).
209. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Department of Materials Science and Engineering, Stanford University, Palo Alto, CA (November 4, 2005).
210. **“Magnetic Nanostructures, Intricate Science and Technology,”** IEEE Distinguished Lecture, Department of Physics, Taiwan University, Taipei, Taiwan, Chien (November 12, 2005).
211. **“Spin Torque and Nanorings,”** Department of Physics, Fudan University, Shanghai, China (November 15, 2005).
212. **“Spin Torque and Nanorings,”** Department of Physics, Nanjing University, Nanjing, Chien (November 16, 2005).
213. **“Spin Torque and Nanorings,”** IEEE Distinguished Lecture, Korean Magnetism Society Meeting, Yongpyong, Korea (December 9, 2005).

214. **“Manipulation of Nanoentities by AC Electric Field,”** Annual Hopkins Biology Symposium on “Mining the Biology-Physics Interface” (January 25, 2006).
215. **“Magnetic Nanorings and Manipulation of Nanowires,”** American Physical Society March Meeting, Baltimore, MD (March 13-17, 2006).
216. **“Magnetic Nanoring,”** 5th International Workshop on Surfaces, Interfaces, and Thin Film Physics, Shanghai, China, (May 27-30, 2006).
217. **“Manipulation of Nanorings and of Nanowires,”** Zhongguancun Forum in Institute Of Physics, Chinese Academy of Sciences, Beijing, China (June 2, 2006).
218. **“Spin Transfer Torque Effect in Magnetic Nanostructures,”** Invited lecturer Ultrasmooth Network Summer School, Durham Castle, UK (July 9 – 14, 2006).
219. **“Spin Transfer Torque Effect in Magnetic Nanostructures,”** Department of Physics, University of Cambridge, Cambridge UK (July 17, 2006).
220. **“Manipulation of Nanoentities in Suspension,”** 2006 Ta-You Wu Science Camp, Taiwan (July 31 – August 5, 2006).
221. **“Spin Electronics,”** 2006 Ta-You Wu Science Camp, Taiwan (July 31 – August 5, 2006).
222. **“Spin Torque and Nanorings,”** Colloquium, Department of Physics, UC Riverside, (Oct. 13, 2006).
223. **“Manipulation of Nanoentities in Suspension,”** Colloquium, Department of Physics, National Tsing Hwa University, Hsinchu, Taiwan (January 2, 2007).
224. **“Nanomagnets: Poles or No Poles”** Colloquium, Department of Physics, Penn State University, State College, PA (September 6, 2007).
225. **“Patterned Nanomagnets,”** School of Nanofabrication, Rio de Janeiro, Brazil (September 17 –20, 2007).
226. **“Controlled Manipulation of Nanoentities in Suspension,”** European Science Foundation/European Molecular Biology organization Symposium on Biomagnetism and magnetic biosystems based on molecular recognition processes,” Sant Feliu de Guixols, Spain (September 22-27, 2007)
227. **“Nanomagnets: Poles or No Poles”** Department of Physics, Universitat Autònoma de Barcelona, Barcelona, Spain (Sept.27, 2007)
228. **“Controlled Manipulation of Nanoentities in Suspension,”** Colloquium, Department of Mechanical Engineering, Johns Hopkins University, (October 3, 2007).

229. **“Patterned Nanomagnets,”** Colloquium, Department of Physics, University of Hong Kong, and Hong Kong Physical Society, Hong Kong (October 15, 2007).
230. **“Nanomagnets: Poles or No Poles,”** Colloquium, Department of Physics, University of Science and Technology of China, Hefei, China (October 23, 2007).
231. **“Controlled Manipulation of Nanoentities in Suspension,”** MRSEC/NSEC seminar, Columbia University, New York, (December 5, 2007).
232. **“Nanomagnets: poles or no poles,”** Colloquium, Argonne National Laboratory, Argonne, IL (December 7, 2007).
233. **“Nanomagnets: poles or no poles,”** Colloquium, Department of Materials Science and Engineering, University of Texas at Arlington, Arlington, TX (April 18, 2008)
234. **“Nanomagnets: poles or no poles,”** Nanoscience Symposium, Brown University, Providence RI (May 5-7, 2008).
235. **“Iron Superconductors,”** Department of Physics and Astronomy, Johns Hopkins University, (May 15, 2008).
236. **“Iron Superconductors,”** Department of Physics and Astronomy, National Tsing Hua University, Hsinchu, Taiwan (June 3, 2008).
237. **“Iron Superconductors,”** Institute of Physics, Academia Sinica, Taipei, Taiwan (June 4, 2008).
238. **“Nanomagnets: poles or no poles,”** Department of Electrophysics, National Chiao Tung University, Hsinchu, Taiwan (June 5, 2008).
239. **“Iron Superconductors,”** Department of Physics, National Taiwan University, Taipei, Taiwan (June 6, 2008).
240. **“Ballistic transport through nanocontacts,”** 7th International Workshop on Surface, Interface, and Thin Film Physics Shanghai, China (June 17-19, 2008).
241. **“Mind the Gap of Iron Superconductor,”** International Workshop on Strongly Correlated Systems, Hefei, China (June 20 – 22, 2008).
242. **“Mind the Gap of Iron Superconductor,”** Taiwan International Conference on Superconductivity (TIC08) HuiSun Forrest Station, Taiwan (July 7-10, 2008).
243. **“Nanomagnets: poles or no poles,”** Department of Physics, Nanjing University, Nanjing, Chien (September 10, 2008).
244. **“Mind the Gap of Iron Superconductor,”** Department of Physics, Nanjing University, Nanjing, Chien (September 12, 2008).

245. **“Mind the Gap of Iron Superconductor,”** National High Magnetic Field Lab, Tallahassee, Florida (October 3, 2008).
246. **“Mind the Gap of Iron Superconductor,”** Colloquium, Department of Physics, West Virginia University, Morgantown, WV (October 9, 2008).
247. **“Mind the Gap of Iron Superconductor,”** Department of Physics, UC Berkeley, Berkeley, CA (October 20, 2008).
248. **“Gap and Pseudogap of Fe-pnictide Superconductors,”** ICAM Workshop on Fe-pnictide and related superconductors, College Park, MD (Nov. 16-17, 2008).
249. **“Mind the Gap of Iron Superconductor,”** Keynote speaker, Howard University Nanotechnology Symposium, Washington DC (Nov. 20-21, 2008).
250. **“Superconducting gap of Fe superconductors,”** Materials Research Society Fall meeting, Boston, MA (Dec. 1-5, 2008).
251. **“Andreev reflection spectroscopy of iron superconductors,”** American Physical Society March Meeting, Pittsburgh, PA (March 16-20, 2009).
252. **“Nanomagnets: poles or no poles,”** Department of Physics, Fudan University, Shanghai, Chien (June 19, 2009).
253. **“Controlled manipulation of nanoentities in suspension by electric tweezers,”** in 2009 Workshop of “Investigation and manipulation of quantum discipline of correlated electron systems” and Summer School of “Advanced Functional Materials” University of Science and Technology of China, Hefei, China (June 26 – 29, 2009)
254. **“Nanomagnets: poles or no poles,”** Keynote speaker at International Conference on Materials for Advanced Technologies 2009 (ICAME-2009) and International Union of Materials Research Society-International Conference in Asia 2009 (IUMRS-ICA 2009), Singapore (June 28 – July 3, 2009)
255. **“Gap and Pseudogap of Fe-pnictide Superconductors,”** OCPA06, Lanzhou, China (August 3-7, 2009).
256. **“Mind the Gap of Iron Superconductor,”** Colloquium, University of Delaware, Newark, DE, (Dec. 2, 2009).
257. **“Ballistic heat transport,”** Ninth International Workshop on Surface, Interface and Thin Film Physics, Shanghai, China, June 16-19, 2010.
258. **“Ballistic heat transport,”** International Workshop on Strongly Correlated Electron Systems 2010 (IWSCES-2010), Taiping Lake, Anhui, China, June 24-28 (2010)
259. **“Ballistic transport of spin and heat,”** Keynote, 2010 International Symposium on Spintronics and Devices, Beijing, China, October 21-22 (2010).

260. **“Nanomagnets: poles or no poles,”** Colloquium, Institute of Physics, Academia Sinica March 8, (2011).
261. **“Nanomagnets: poles or no poles,”** Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)/Center of Condensed Matter Science (CCMS)/National Taiwan University(NTU) Joint Colloquium, March 15, (2011).
262. **“Ballistic transport of spin and heat in nanocontacts”** Intermag 2011. Taipei, Taiwan, April 25-29, (2011).
263. **“Ballistic transport in nanocontacts”** Department of Physics, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong May 23, (2011).
264. **“Spintronics and Spin Caloritronics in Magnetic Nanostructures,”** Plenary Presentation, Chinese Physical Society Annual Meeting, Hangzhou, China, September 16 (2011).
265. **“Spintronics, Spin Hall, and Spin Caloritronics,”** Colloquium, Department of Physics, Arizona State University, Tempe, Arizona (January 26, 2012).
266. **“Intrinsic Spin-Dependent Thermal Transport,”** American Physical Society March Meeting, Boston MA (February 27 – March 2, 2012).
267. **“Intrinsic Spin-Dependent Thermal Transport,”** 3rd International Conference on Superconductivity and Magnetism – ICSM2012 April 29 – May 4, 2012 Istanbul, Turkey.
268. **“Spin Seebeck effect in the midst of Anomalous Nernst effect,”** Spin Caloritronics 4, Sendai, Japan, (June 2-5, 2012).
269. **“Spin Seebeck effect,”** Institute of Physics, Chinese Academy of Sciences, Beijing, China (June 7, 2012).
270. **“Spin Seebeck Effect,”** Department of Physics, Fudan University, Shanghai. China (June 21, 2012).
271. **“Electric Tweezers,”** Department of Physics, Yunan University, Kunming. China (June 28, 2012).
272. **“Electric Tweezers,”** Department of Physics, Fudan University, Shanghai. China (July 3, 2012).
273. **“Entanglement of Spin Seebeck Effect and Anomalous Nernst Effect,”** International Conference on Magnetism, Busan, Korea (July 8-13, 2012).

274. **“Entanglement of Spin Seebeck Effect and Anomalous Nernst Effect,”** 21th International Colloquium on Magnetic Films and Surfaces, Shanghai China (September 24-28, 2012).
275. **“Spintronics, Spin Caloritronics, and Skyrmion”** International Conference of Asian Union of Magnetism Societies,” Nara Japan (October 2-5, 2012).