

CURRICULUM VITAE

XINYU LIU

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PROFESSIONAL APPOINTMENTS

- University of Notre Dame* **Research Assistant Professor of Physics** 2004-present
Conducting, among others, research on spin-based processes in semiconductors and their nanostructures funded by NSF, DOE, ONR, and DARPA. Providing leadership in research projects and supervising MS and Ph.D. graduate students.
- University of Notre Dame* **Postdoctoral Research Associate** 2002-2004
Played a major part in one of the national top priority research projects – the SPINS program funded by DARPA. Conducted physical studies of spin-based processes in magnetic semiconductors.
- University of Notre Dame* **Graduate Research Assistant** 2000-2002
Developed ferromagnetic semiconductor materials and carried out magnetic, electronic, optical, and magnetic resonance studies on these materials.
- University of Notre Dame* **Teaching Assistant** 1996-2000
The principal duties were to serve as assistant to a faculty instructor, as homework or exam grader, tutorial leader or laboratory instructor, and as occasional lecturer in undergraduate or graduate courses. Achieved Department Teaching Assistant Award in 2000.
- U. of Sci. & Tech. of China* **Software Programmer (part-time)** 1994-1996
Developed and programmed computer management information systems in various companies as part-time software programmer.

EDUCATION

- University of Notre Dame* Ph.D. Condensed Matter Physics 01/2003
Dissertation: Thin Semiconductor Alloy Films: Fabrication and Physical Properties
Directed by Professor Jacek K. Furdyna
- U. of Sci. & Tech. of China* M.S. Physics 07/1996
Thesis: Zhejiang Three Lions Cement Co., Ltd Network Management Information System
Directed by Professor Pingsong Hong
- U. of Sci. & Tech. of China* B. Eng. Applied Physics 07/1993

RECENT/CURRENT RESEARCH

Research Activities and Interests:

- Spin phenomena in semiconductor nanostructures for spintronic applications;
- Developing, fabricating, and characterizing nanostructures based on magnetic semiconductors, and hybrid systems such as semiconductor/superconductor and semiconductor/ferromagnet;
- Studies of low-dimensional semiconductor structures (quantum wells, quantum wire, quantum dots, coupled quantum dots, etc.) grown by MBE;
- Semiconductor optoelectronic devices and materials, including semiconductor lasers, photodetectors, solar cells, and their integration for various applications.
- Materials science researches using ferromagnetic resonance, electronic and spin transport, neutron scattering, magneto-optical imaging, ultrafast pump-probe spectroscopy, E-beam lithograph, AFM, SEM, TEM, channeling Rutherford backscattering (c-RBS), and channeling particle induced x-ray emission (c-PIXE).

Synergistic Activities:

Collaborating extensively with over 30 other research institutions – including Universities, National and Government Laboratories, and Research Institutes in the US and abroad – both by providing research specimens and by sharing important research findings with collaborators in those institutions. Feedback from these outside collaborations not only improves the quality of the materials fabricated at Notre Dame, but also extends the research in the directions of new device design.

Program Committee Member for Electronic Materials Conference 2008-2010

RESEARCH HIGHLIGHTS

- **205** publications in top peer-reviewed journals, such as Nature Physics (1), Nature Materials (2), Nano Letters (1), Physical Review Letters (11), Applied Physics Letters (37), and Physical Review B (37); Over **2700** citations on articles published; Total citing articles **1255** (without self-citations); with an h-index of **26** as of Apr. 2011.
- Development of ultra-high efficiency multijunction solar cell using lattice-matched II/VI (ZnCdMg)(SeTe) and III/V (AlGa)(AsSb) direct bandgap materials grown on GaSb and InAs substrates.
- Development of molecular beam epitaxy (MBE) growth technology for fabrication of III-Mn-V ferromagnetic semiconductors (mixed alloys and digital alloys): GaMnAs, InMnAs, GaMnSb and InMnSb
- Comprehensive magnetic anisotropy studies in III-Mn-V alloys via ferromagnetic resonance (FMR). Identification of uniaxial and cubic anisotropy in GaMnAs thin films. This information is of key importance for operation of spin-injection-based spintronic devices
- Studies of the effect of low temperature annealing on electrical and magnetic properties of GaMnAs, showing that the increase of the ferromagnetic transition temperature indirectly linked to the rearrangement of Mn atoms in the crystal lattice. Identification of the thermodynamic limit of free hole concentration, and hence of the mechanism which limits the ferromagnetic transition temperature
- Studies of the effect of Be co-doping on magnetic properties of ferromagnetic GaMnAs, and identification of the mechanism which (counter-intuitively) leads to the observed decrease of the transition temperature caused by such co-doping
- Comprehensive investigation of the index of refraction for II-VI-based semiconductor compounds, including modeling of optical dispersion in these materials

PRESENTATIONS

“II-VI Heterostructures Obtained by Encapsulation of Colloidal CdSe Nanowires by MBE Deposition of ZnSe”, Xinyu Liu, A. M. Mintairov, J. Herzog, F. Vietmeyer, R. Pimpinella, M. Kuno, J. L. Merz, T. H. Kosel, M. Dobrowolska, and J. K. Furdyna, 27th North American Molecular Beam Epitaxy Conference – oral presentation (2010).

“MBE growth of lattice-matched 6.1Å II-VI on GaSb substrates”, X. Liu, D. Ding, S. Wang, S.-N. Wu, X. Zhang, J. Fan, J.-J. Li, X. Lu, S. R. Johnson, D. J. Smith, J. K. Furdyna, and Y.-H. Zhang, The 2010 Electronic Materials Conference – oral presentation (2010).

“Magnetic Anisotropy, Interlayer Exchange Coupling, and Spin Manipulation in GaMnAs”, X. Liu, Physics Seminar, Miami University – oral presentation (**Invited**) (2.17.2010).

“Spin dynamics and manipulation in GaMnAs alloys”, X. Liu, Y. Y. Zhou, E. Harley, L. E. McNeil, J. Wang, J. Qi, Y. Xu, A. Steigerwald, N. Tolk, J. P. Zahn, A. Gamouras, S. March, K. C. Hall, J. K. Furdyna, 2010 SPIE Photonics West – oral presentation (**Invited**) (2010).

“Origin of magnetic circular dichroism in GaMnAs: giant Zeeman splitting vs. spin dependent density of states”, M. Berciu, R. Chakarvorty, Y. Y. Zhou, M. T. Alam, K. Traudt, R. Jakiela, A. Barez, T. Wojtowicz, X. Liu, J. K. Furdyna, and M. Dobrowolska, The 2009 Electronic Materials Conference – oral presentation (2009).

“Temperature Dependence of Anomalous Hall Effect in Metallic (Ga,Mn)As films”, X. Liu, Z. Ge, S. Shen, M. Dobrowolska and J. K. Furdyna, 2009 APS March meeting – oral presentation (2009).

“Scaling of Anomalous Hall Effect in Metallic (Ga,Mn)As films”, X. Liu, Z. Ge, S. Shen, M. Dobrowolska and J. K. Furdyna, The Fest-Symposium "Magnetic excitations in Semiconductors - Bridges to the Next Decade" – poster presentation (2008).

“Ferromagnetic semiconductor memories: devices beyond binary logic”, X. Liu, J.K. Furdyna, M. Dobrowolska, S. Lee, L. P. Rokhinson, Notre Dame MIND – poster presentation (2008).

“Magnetic Resonance and Spin-Wave Excitations in Ferromagnetic Semiconductor GaMnAs”, X. Liu, Condensed Matter Seminar, Department of Physics, University of Notre Dame – oral presentation (**Invited**) (11.16.2007).

“Ferromagnetic Resonance Study in Ferromagnetic Semiconductors: Effects of Magnetic Anisotropy”, X. Liu, 53rd Midwest Solid State Physics Conference – oral presentation (**Invited**) (2006).

“Temperature-dependent photoluminescence of vertically stacked self-assembled CdSe quantum dots in ZnSe”, X. Liu, M. Dobrowolska, J. K. Furdyna, and S.Lee, The 12th International Conference on Modulated Semiconductor Structures (MSS 12) – poster presentation (2005).

“Magnetic anisotropy of strain-engineered InMnAs ferromagnetic films and easy-axis manipulation from out-of-plane to in-plane orientations”, X. Liu, W. L. Lim, Z. Ge, S. Shen, T. Wojtowicz, K. M. Yu, W. Walukiewicz, M. Dobrowolska, and J. K. Furdyna, 27th Int. Conf. on Physics of Semiconductors – oral presentation (2004).

“Ferromagnetic resonance in modulation-doped GaMnAs/GaAlAs:Be heterostructures”, X. Liu, W. L. Lim, M. Dobrowolska, J. K. Furdyna, and T. Wojtowicz, 2004 APS March meeting – oral presentation (2004).

“External control of the direction of magnetization in ferromagnetic InMnAs/GaSb heterostructures”, X. Liu, W. L. Lim, L. V. Titova, T. Wojtowicz, M. Kutrowski, K. J. Yee, M. Dobrowolska, J. K. Furdyna, S. J. Potashnik, M. B. Stone, P. Schiffer, I. Vurgaftman, and J. R. Meyer, 11-th International Conference on Narrow Gap Semiconductors (NGS-11)– poster presentation (2003).

“Ferromagnetic resonance in GaMnAs: effects of magnetic anisotropy”, X. Liu, Y. Sasaki, and J. K. Furdyna, 2003 APS March meeting – oral presentation (2003).

“Sinusoidally-Modulated III-V Semiconductor Superlattices by Molecular Beam Epitaxy”, X. Liu, Y. Sasaki, P. M. Reimer, S. Lee, J. K. Furdyna, The 2001 Electronic Materials Conference – oral presentation (2001).

“Modification of Magnetic Properties of GaMnAs by Paramagnetic $Zn_{1-x}Mn_xSe$ Overlayers”, Xinyu Liu, Yuji Sasaki, and Jacek Furdyna, 2001 APS March meeting – oral presentation (2001).

GRANTS AND SPONSORED PROGRAMS

Title: *Electron Spin Effects in Semiconductor Nanostructures*

Agency: NSF/DMR/CMP

Total Award Amount: \$600,000, Total Award Period Covered: 09/01/10 - 08/31/14.

PI: Prof. M. Dobrowolska; Co-PI: Prof. J. K. Furdyna and Prof. X. Liu.

Title: *Collaborative Proposal: Novel Multijunction Solar Cells for Space and Terrestrial Applications*

Agency: NSF/ECCS

Total Award Amount: \$139,999, Total Award Period Covered: 07/01/10 - 06/30/13.

PI: Prof. Y.-H. Zhang; Co-PI: Prof. J. K. Furdyna and Prof. X. Liu.

Title: *Electron Spin Effects in Semiconductor Nanostructures*

Agency: NSF/DMR/CMP

Total Award Amount: \$480,000, Total Award Period Covered: 08/01/06 - 07/31/11.

PI: Prof. M. Dobrowolska; Co-PI: Prof. J. K. Furdyna and Prof. X. Liu.

Title: *Spin manipulation of confined states*

Agency: Civil Research and Development Foundation (CRDF)

Total Award Amount: \$12,600, Total Award Period Covered: 03/15/08 - 03/14/10

PI: Prof. J. K. Furdyna; Co-PI: Prof. M. Dobrowolska and Prof. X. Liu.

Title: *Design, Fabrication and Testing of Thin-Layer III-Mn-V Ferromagnetic Semiconductor Structures for Tunable Wavelength Photo-Detectors*

Agency: NSA (as Subcontact from Laboratory for Physical Sciences)

Total Award Amount: \$100,000, Total Award Period Covered: 04/01/06-3/31/07.

PI: Prof. J. K. Furdyna; Co-PI: Prof. M. Dobrowolska and Prof. X. Liu.

Title: *Focused-Ion Beam (FIB) Nano-Fabrication and Characterization of Ferromagnetic Semiconductors (pending)*

Agency: University of Notre Dame

Total Award Amount: \$10,000, Total Award Period Covered: 1/01/2007-12/31/2008.

PI: Prof. X. Liu; Co-PI: Prof. M. Dobrowolska.

SCHOLARSHIPS AND FELLOWSHIPS

1992	Outstanding Student Scholarship, <i>U. of Sci. & Tech. of China</i>
1993	Outstanding Student Scholarship, <i>U. of Sci. & Tech. of China</i>
1995	Kwang-Hua Scholarship, <i>Kwang-Hua Education Foundation</i>
1996	Kwang-Hua Scholarship, <i>Kwang-Hua Education Foundation</i>

RECENT AND CURRENT COLLABORATORS (48 MONTHS)

Baxter, D. V. (Indiana University); Berciu, M. (University of British Columbia); Borchers, J. A. (National Institute of Standards and Technology); Chang, A. (Duke University); Chemla, D. S. (Lawrence Berkeley National Laboratory); Dubon, O. D. (UC-Berkeley); Gamelin, D. R. (University of Washington); Grimsditch, M. (Argonne National Laboratory); Hall, K. C. (Dalhousie University); Hyeon, T. (Seoul National University); Janko, B. (University of Notre Dame); Jaroszynski, J. (National High Magnet Field Lab); Kirby, B. J. (National Institute of Standards and Technology); Khodaparast, G. A. (Virginia Tech.); Lee, S. (Korea University); Lyanda-Geller, Y. B. (Purdue University); McNeil, L. (University of North Carolina); Merlin, R. (University of Michigan); Mihaly, G. (Budapest Technical University); Nadgorny, B. (Wayne State); Oh, E. (Chungnam University); Pascher, H. (Bayreuth University); Peiris, F. C. (Kenyon College); Rhyne, J. J. (Los Alamos National Laboratory); Rokhinson, L. P. (Purdue University); Storchak, V. G. (IV Kurchatov Atomic Energy Institute); Tolk, N. (Vanderbilt University); Twardowski, A. (Warsaw University); Walukiewicz, W. (Lawrence Berkeley National Laboratory); Wang, J. (Iowa State University); Wojtowicz, T. (Institute of Physics, Polish Academy of Sciences); Yee, K. J. (Seoul National University); Yu, K. M. (Lawrence Berkeley National Laboratory); Zhang, Y. H. (Arizona State University).

OTHER EXPERIENCE

- Participation as Grand Awards Judge for Physics in Intel International Science and Engineering Fair 2006
- Participation as Judge in the Northern Indiana Regional Science & Engineering Fair 2006, 2008
- Elected president of Student Body of Modern Physics Department, U. of Sci. & Tech. of China, 1992

PROFESSIONAL SOCIETIES

- American Physical Society
- The Minerals, Metals & Materials Society (TMS)
- Sigma Xi, The Scientific Research Society

PUBLICATIONS

Refereed Publications

1. X. Liu, S. Shen, Z. Ge, W. L. Lim, M. Dobrowolska, J. K. Furdyna, and S. Lee, "Scaling relations between anomalous Hall and longitudinal transport coefficients in metallic (Ga,Mn)As films", *Phys. Rev. B* **83**, 144421 (2011).
2. R. E. Pimpinella, A. M. Mintairov, X. Liu, T. H. Kosel, J. L. Merz, J. K. Furdyna, and M. Dobrowolska, "Optical measurements of single CdTe self-assembled quantum dots grown on ZnTe/GaSb", *J. Vac. Sci. Technol. B* **29**, 03C119 (2011).
3. X. Liu, A. M. Mintairov, J. Herzog, F. Vietmeyer, R. E. Pimpinella, M. Kuno, J. L. Merz, T. H. Kosel, M. Dobrowolska, and J. K. Furdyna, "II-VI heterostructures obtained by encapsulation of colloidal CdSe nanowires by molecular beam epitaxy deposition of ZnSe", *J. Vac. Sci. Technol. B* **29**, 03C102 (2011).
4. Jinsik Shin, Shinhee Kim, Sangyeop Lee, Taehee Yoo, Hakjoon Lee, S. Khym, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Asymmetry in the angular dependence of the switching field of GaMnAs film", *J. Appl. Phys.* **109**, 07C308 (2011).

5. K. Dziatkowski, X. Liu, J. K. Furdyna, and A. Twardowski, "Magnetic anisotropy in (Ga,Mn)As grown on vicinal GaAs: Effects of the orientation of microwave magnetic field", *J. Appl. Phys.* **109**, 07C301 (2011).
6. J. Leiner, H. Lee, T. Yoo, Sanghoon Lee, B. J. Kirby, K. Tivakornsasithorn, X. Liu, J. K. Furdyna, and M. Dobrowolska, "Observation of antiferromagnetic interlayer exchange coupling in a $\text{Ga}_{1-x}\text{Mn}_x\text{As}/\text{GaAs}:\text{Be}/\text{Ga}_{1-x}\text{Mn}_x\text{As}$ trilayer structure", *Phys. Rev. B* **82**, 195205 (2010).
7. Sangyeop Lee, Hakjooon Lee, Taehee Yoo, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Influence of uniaxial anisotropy on the domain pinning fields of ferromagnetic $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ films", *J. Appl. Phys.* **108**, 063910 (2010).
8. A. Winter, H. Pascher, H. Krenn, X. Liu, and J. K. Furdyna, "Interpretation of hysteresis loops of GaMnAs in the framework of the Stoner–Wohlfarth model", *J. Appl. Phys.* **108**, 043921 (2010).
9. A. V. Scherbakov, A. S. Salasyuk, A. V. Akimov, X. Liu, M. Bombeck, C. Brüggenmann, D. R. Yakovlev, V. F. Sapega, J. K. Furdyna, and M. Bayer, "Coherent Magnetization Precession in Ferromagnetic (Ga,Mn)As Induced by Picosecond Acoustic Pulses", *Phys. Rev. Lett.* **105**, 117204 (2010).
10. Sunjae Chung, Sanghoon Lee, J.-H. Chung, Taehee Yoo, Hakjooon Lee, B. Kirby, X. Liu, and J. K. Furdyna, "Giant magnetoresistance and long-range antiferromagnetic interlayer exchange coupling in (Ga,Mn)As/GaAs:Be multilayers", *Phys. Rev. B* **82**, 054420 (2010).
11. Shinhee Kim, Hakjooon Lee, Taehee Yoo, Sangyeop Lee, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Mapping of magnetic anisotropy in strained ferromagnetic semiconductor GaMnAs films", *J. Appl. Phys.* **107**, 103911 (2010).
12. Hakjooon Lee, Sunjae Chung, Taehee Yoo, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Reduction in the planar Hall resistance amplitude in the reversal process of Fe film with biaxial easy axes", *J. Appl. Phys.* **107**, 09C508 (2010).
13. Taehee Yoo, S. Khym, Hakjooon Lee, Sunjae Chung, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Asymmetry in the planar Hall resistance of Fe films grown on vicinal GaAs substrates", *J. Appl. Phys.* **107**, 09C505 (2010).
14. Hyung-chan Kim, S. Khym, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Magnetic anisotropy of $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ films with additional nonmagnetic donor doping", *J. Appl. Phys.* **107**, 09C303 (2010).
15. Yungjun Kim, Sunjae Chung, Sanghoon Lee, X. Liu, and J. K. Furdyna, "Asymmetry in the reorientation process of magnetization for crossing the [1-10] and the [110] directions in $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ epilayers", *J. Appl. Phys.* **107**, 09C304 (2010).
16. E. H. C. P. Sinnecker, G. M. Penello, T. G. Rappoport, M. M. Sant'Anna, D. E. R. Souza, M. P. Pires, J. K. Furdyna and X. Liu, "Ion-beam modification of the magnetic properties of $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ epilayers", *Phys. Rev. B* **81**, 245203 (2010).
17. S. Chung, S. Lee, X. Liu, J. K. Furdyna, "Magnetization reorientation in $\text{Ga}_x\text{Mn}_{1-x}\text{As}$ films: Planar Hall effect measurements", *Phys. Rev. B* **81**, 155209 (2010).
18. R. E. Pimpinella, X. Liu, J. K. Furdyna, M. Dobrowolska, A. M. Mintairov, J. L. Merz, "Self-Assembled CdTe Quantum Dots Grown on ZnTe/GaSb", *Journal of Electronic Materials* **39**, 992 (2010).
19. J. Qi, J. A. Yan, H. Park, A. Steigerwald, Y. Xu, S. N. Gilbert, X. Liu, J. K. Furdyna, S. T. Pantelides, and N. Tolk, "Mechanical and electronic properties of ferromagnetic $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ using ultrafast coherent acoustic phonons", *Phys. Rev. B* **81**, 115208 (2010).
20. H. Son, S. Chung, S. Yea, S. Kim, T. Yoo, S. Lee, X. Liu, and J. K. Furdyna, "Vertical gradient of magnetic anisotropy in the ferromagnetic semiconductor (Ga,Mn)As film", *Appl. Phys. Lett.* **96**, 092105 (2010).
21. J. P. Zahn, A. Gamouras, S. March, X. Liu, J. K. Furdyna, and K. C. Hall, "Ultrafast studies of carrier and magnetization dynamics in GaMnAs", *J. Appl. Phys.* **107**, 033908 (2010).
22. M. A. Mayer, P. R. Stone, N. Miller, H. M. Smith, III, O. D. Dubon, E. E. Haller, K. M. Yu, W. Walukiewicz, X. Liu, and J. K. Furdyna, "Electronic structure of $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ analyzed according to hole-concentration-dependent measurements", *Phys. Rev. B* **81**, 045205 (2010).
23. Y. Y. Zhou, X. Liu, J. K. Furdyna, M. A. Scarpulla, and O. D. Dubon, "Ferromagnetic resonance investigation of magnetic anisotropy in $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ synthesized by ion implantation and pulsed laser melting", *Phys. Rev. B* **80**, 224403 (2009).
24. Y. Y. Zhou, X. Liu, J. K. Furdyna, M. A. Scarpulla, O. D. Dubon, "Ferromagnetic Resonance Study of $\text{Ga}_{1-x}\text{Mn}_x\text{As}$ Fabricated on (311) GaAs Wafers by Mn Ion Implantation and Pulsed-Laser Melting", *Journal of Superconductivity and Novel Magnetism* **23**, 87 (2010).
25. J. H. Yu, X. Liu, K. E. Kweon, J. Joo, J. Park, K. T. Ko, D. Lee, S. Shen, K. Tivakornsasithorn, J. S. Son, J.-H. Park, Y.-W. Kim, G. S. Hwang, M. Dobrowolska, J. K. Furdyna, T. Hyeon, "Giant Zeeman splitting in nucleation-controlled doped $\text{CdSe}:\text{Mn}^{2+}$ quantum nanoribbons", *Nature Materials* **9**, 47 (2010).

26. J. Kim, S. Lee, S. Lee, X. Liu, J. K. Furdyna, "Investigation of domain pinning fields in ferromagnetic GaMnAs films using angular dependence of the planar Hall effect", *Solid State Communications* **150**, 27 (2010).
27. T. Yoo, S. Khym, S. Yea, S. Chung, S. Lee, X. Liu, and J. K. Furdyna, "Four discrete Hall resistance states in single-layer Fe film for quaternary memory devices", *Appl. Phys. Lett.* **95**, 202505 (2009).
28. C. Thurn, V. M. Axt, A. Winter, H. Pascher, H. Krenn, X. Liu, J. K. Furdyna, and T. Wojtowicz, "Origin of resonance structures in magneto-optical spectra of InSb and $\text{In}_{1-x}\text{Mn}_x\text{Sb}$ ", *Phys. Rev. B* **80**, 195210 (2009).
29. M. Frazier, J. G. Cates, J. A. Waugh, J. J. Heremans, M. B. Santos, X. Liu, and G. A. Khodaparast, "Photoinduced spin-polarized current in InSb-based structures", *J. Appl. Phys.* **106**, 103513 (2009).
30. S. Chung, H. C. Kim, S. Lee, X. Liu, J. K. Furdyna, "The effect of carrier density on magnetic anisotropy of the ferromagnetic semiconductor (Ga, Mn)As", *Solid State Communications* **149**, 1739 (2009).
31. A. Chernyshov, M. Overby, X. Liu, J. K. Furdyna, Y. Lyanda-Geller, and L. P. Rokhinson, "Evidence for reversible control of magnetization in a ferromagnetic material by means of spin-orbit magnetic field", *Nature Physics* **5**, 656 (2009).
32. S. Shen, X. Liu, K. Tivakornsasithorn, Y. H. Cho, J. K. Furdyna, M. Dobrowolska, Y. H. Hwang, Y. H. Um, "Magneto-optical Studies of Spin Phenomena in CdMnTe Doped with Co and Cr", *J. Elec. Mater.* **38**, 1554 (2009).
33. X. Zhang, S. Wang, D. Ding, X. Liu, J.-H. Tan, J. K. Furdyna, Y.-H. Zhang, D. J. Smith, "Structural Characterization of Integrated II-VI and III-V Heterostructures for Solar Cell Applications", *J. Elec. Mater.* **38**, 1558 (2009).
34. H. Lee, S. Chung, S. Lee, X. Liu, J. K. Furdyna, "Temperature dependence of magnetization in GaMnAs film with critical strain", *Solid State Communications* **149**, 1300 (2009).
35. H. Kim, H. Lee, S. J. Chung, S. Lee, Y. J. Cho, X. Liu, J. K. Furdyna, "Magneto-transport Properties of GaMnAs:Si Ferromagnetic Semiconductors", *J. of the Korean Physical Society* **55**, 304 (2009).
36. D. M. Wang, Y. H. Ren, P. W. Jacobs, S. Fahy, X. Liu, J. K. Furdyna, V. F. Sapega, R. Merlin, "Observation of Insulating Nanoislands in Ferromagnetic GaMnAs", *Phys. Rev. Lett.* **102**, 256401 (2009).
37. M. Berciu, R. Chakarvorty, Y. Y. Zhou, M. T. Alam, K. Traudt, R. Jakiela, A. Barcz, T. Wojtowicz, X. Liu, J. K. Furdyna, M. Dobrowolska, "Origin of Magnetic Circular Dichroism in GaMnAs: Giant Zeeman Splitting versus Spin Dependent Density of States", *Phys. Rev. Lett.* **102**, 247202 (2009).
38. A. Winter, H. Pascher, M. Hofmayer, H. Krenn, T. Wojtowicz, X. Liu, J. K. Furdyna, "Kerr Rotation and Magnetic Circular Dichroism Spectra of Ferromagnetic InMnSb and InMnAs", *Reviews on Advanced Materials Science* **20**, 92 (2009).
39. S. Wang, D. Ding, X. Liu, X.-B. Zhang, D. J. Smith, J. K. Furdyna, Y.-H. Zhang, "MBE growth of II-VI materials on GaSb substrates for photovoltaic applications", *J. Crystal Growth* **311**, 2116 (2009).
40. D. G. Eshchenko, V. G. Storchak, E. Morenzoni, T. Prokscha, A. Suter, X. Liu, J. K. Furdyna, "Low energy μ SR studies of semiconductor interfaces", *Physica B-Condensed Matter* **404**, 873 (2009).
41. Q. Song, K. H. Chow, R. I. Miller, I. Fan, M. D. Hossain, R. F. Kiefl, S. R. Kretzman, C. D. P. Levy, T. J. Parolin, M. R. Pearson, Z. Salman, H. Saadaoui, M. Smadella, D. Wang, K. M. Yu, X. Liu, J. K. Furdyna, W. A. MacFarlane, "Beta-detected NMR study of the local magnetic field in epitaxial GaAs:Mn", *Physica B-Condensed Matter* **404**, 892 (2009).
42. S. Lee, J.-H. Chung, X. Liu, J. K. Furdyna, B. J. Kirby, "Ferromagnetic semiconductor GaMnAs", *Materials Today* **12**, 14 (2009).
43. S. Shen, X. Liu, Y. J. Cho, J. K. Furdyna, M. Dobrowolska, Y. H. Hwang, Y. H. Um, "Ferromagnetic behavior of CdMnCrTe quaternary system", *Appl. Phys. Lett.* **94**, 142507 (2009).
44. T. Yoo, D. Shin, J. Kim, H. Kim, S. Lee, X. Liu, J. K. Furdyna, "Step feature observed in the angular dependence of magnetization switching fields in GaMnAs micro-device", *Current Applied Physics* **9**, 773 (2009).
45. D. Y. Shin, S. Lee, X. Liu, J. K. Furdyna, "Monitoring of magnetization processes in GaMnAs ferromagnetic film by electrical transport measurement", *J. Crystal Growth* **311**, 925 (2009).
46. S. Shen, X. Liu, J. K. Furdyna, M. Dobrowolska, Y. H. Hwang, and Y. H. Um, "Magneto-optical studies of $\text{Cd}_{1-x-y}\text{Mn}_x\text{Co}_y\text{Te}$ ", *J. Appl. Phys.* **105**, 07A931 (2009).
47. H. Lee, S. Chung, S. Lee, X. Liu, and J. K. Furdyna, "Magnetotransport properties of GaMnAs based trilayer structures with different thicknesses of InGaAs spacer layer", *J. Appl. Phys.* **105**, 07C505 (2009).
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