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# Wei Han

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## Professional Experiences

- **Assistant Professor** 2014.10 -- Present  
International Center for Quantum Materials  
Peking University, Beijing, China  
Principle investigator: *Lab for Spintronics and Emergent Materials*
- **Postdoctoral Fellow** 2012.02 – 2014.10  
IBM Almaden Research Center, San Jose, CA, USA

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## Education

- **Ph. D., Physics** 2006.09 – 2012.01  
University of California, Riverside, Riverside, CA, USA  
Dissertation: “*Spin Transport and Relaxation in Graphene and Germanium*”
- **B. S., Materials Physics** 2002.09 – 2006.07  
University of Science and Technology of China, China

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## Research Interests

- Spintronics in low dimensional quantum materials
- Spin Hall effect and spin orbit torque
- Novel materials and interface states
- Molecular beam epitaxy

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## Awards and Honors

- 2016 IUPAP Young Scientist Prize in Magnetism (c9), 2016
- 1000 Talents award for Young Scientists of China, 2015
- APS GMAG student dissertation award, American Physics Society, 2012
- Robert T. Poe Memorial Graduate Scholarship Award, UCR, 2012
- Chinese Government Award for Outstanding Students Abroad, Chinese government, 2012

- Chancellor's & college dissertation fellowship UCR, 2011
- Leo Falicov student award, American Vacuum Society 56<sup>th</sup> national meeting, 2009
- Benjamin C. Shen memorial graduate scholarship award, UCR, 2009
- Dean's distinguished fellowship, UCR, 2006-2008
- Outstanding student scholarship, USTC, 2004, 2005
- Zhang Zongzhi Sci-Tec scholarship, USTC, 2003

## Professional Activities

- Member, American Physical Society (2008-present)
- Manuscript referee, *Physics Review Letters*, *Reports on Progress in Physics*, *Nano Lett*, *Journal of American Chemical Society*, *Physics Review B*, *Applied Physics Letters*, *Journal of Magnetism and Magnetic Materials*, *Nanotechnology*, et al.

## Journal Publications

- [43] Qi Song, Hongrui Zhang, Tang Su, Wei Yuan, Yangyang Chen, Wenyu Xing, Jing Shi, Ji Rong Sun, and **W. Han**, “*Observation of Inverse Edelstein Effect in Rashba-Split 2DEG between SrTiO<sub>3</sub> and LaAlO<sub>3</sub> at Room Temperature*”, **under review at Science Advances**.
- [42] P. Xu, **W. Han**, P. M. Rice, J. Jeong, M. G. Samant, K. Mohseni, H. L. Meyerheim, S. Ostanin, I. V. Maznichenko, I. Mertig, E. K. U. Gross, A. Ernst, and S. S. P. Parkin “*Reversible formation of two-dimensional electron gas at the LaFeO<sub>3</sub>/SrTiO<sub>3</sub> interface via control of oxygen vacancies*”, **Advanced Materials**, **in press** (2016).
- [41] W. Yuan, T. Wang, T. Su, Q. Song, W. Xing, Y. Chen, and **W. Han**, “*Positive Exchange Bias between Permalloy and Twined (11-10)-Cr<sub>2</sub>O<sub>3</sub> Films*”, **J. Magn. Magn. Mater.** 422, 397-401 (2017).
- [40] Q. Song, J. Mi, D. Zhao, T. Su, W. Yuan, W. Xing, Y. Chen, T. Wang, T. Wu, X. H. Chen, X. C. Xie, C. Zhang, J. Shi, and **W. Han**, “*Spin Injection and Inverse Edelstein Effect in the Surface States of Topological Kondo Insulator SmB<sub>6</sub>*”, **Nat. Commun.** 7:13485 (2016).
- [39] W. Zhang\*, **W. Han\***(Co-1st), S.-H. Yang, Y. Sun, Y. Zhang, B. Yan, and S. S. P. Parkin, “*Facet dependent giant spin Hall effect in single crystalline antiferromagnetic Ir-Mn*”, **Science Advances**, 2, e1600759 (2016).
- [38] W. Yuan, T. Su, Q. Song, W. Xing, Y. Chen, T. Wang, Z. Zhang, X. Ma, P. Gao, J. Shi, and **W. Han**, “*Crystal Structure Manipulation of the Exchange Bias in an Antiferromagnetic Film*”, **Scientific Reports** 6, 28397 (2016).

- [37] Y. Zhao, Q. Song, S.-H. Yang, T. Su, W. Yuan, S. S. P. Parkin, J. Shi, and **W. Han**, “*Experimental Investigation of Temperature-Dependent Gilbert Damping in Permalloy Thin Films*” **Scientific Reports**, 6, 22890 (2016).
- [36] **W. Han**, “*Perspectives for Spintronics in 2D Materials*”, **APL Materials**, 4, 032401 (2016).
- [35] K.-U. Demasius, T. Phung, W. Zhang, B. P. Hughes, S.-H. Yang, A. Kellock, **W. Han**, A. Pushp, and S. S. P. Parkin, “*Enhanced spin-orbit torques by oxygen incorporation in tungsten films*”, **Nat. Commun.** 7:10644 (2016).
- [34] X. Zhang, Y. Zhao, Q. Song, S. Jia, J. Shi, and **W. Han**, “*Magnetic anisotropy of the single crystalline ferromagnetic insulator  $\text{Cr}_2\text{Ge}_2\text{Te}_6$* ”, **Jpn. J. Appl. Phys.** 55, 033001 (2016).
- [33] W. Yuan, Y. Zhao, C. Tang, T. Su, Q. Song, J. Shi, and **W. Han**, “*Epitaxial growth and properties of  $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$  thin films with micrometer wide atomic terraces*”, **Appl. Phys. Lett.** 107, 022404 (2015).
- [32] W. Zhang\*, **W. Han**\*(Co-1st), X. Jiang, S.-H. Yang, and S. S. P. Parkin, “*Role of transparency of platinum-ferromagnet interfaces in determining the intrinsic magnitude of the spin Hall effect*”, **Nat. Phys.**, 11, 496–502 (2015).
- [31] **W. Han**, R. K. Kawakami, M. Gmitra, and J. Fabian, “*Graphene spintronics*”, **Nat. Nanotech.** 9, 794-807 (2014).
- [30] **W. Han**, X. Jiang, A. Kajdos, S.-H. Yang, S. Stemmer, and S. S. P. Parkin, “*Spin injection and detection in lanthanum- and niobium-doped  $\text{SrTiO}_3$  using the Hanle technique*”, **Nat. Commun.** 4:2134 (2013).
- [29] D. Sun, T. P. Basel, B. R. Gautam, **W. Han**, X. Jiang, S. S. P. Parkin, and Z. V. Vardeny, “*Giant magneto-electroluminescence from hybrid spin-organic spin organic light emitting diodes*”, **Spin** 04, 1450002 (2014).
- [28] A. G Swartz, K. M. McCreary, **W. Han**, H. Wen, and R. K Kawakami, “*A systematic approach to interpreting Hanle spin precession data in non-local spin valves*”, **Proc. SPIE** Vol. 8813, 881328, (2013).
- [27] D. Sun, T. Basel, B. Gautam, **W. Han**, X. Jiang, S. S. P. Parkin, and Z. V. Vardeny, “*Room-temperature magnetically modulated electroluminescence from hybrid organic/inorganic spintronics devices*”, **Appl. Phys. Lett.** 103, 042411 (2013).
- [26] M. Li, **W. Han**, X. Jiang, J. Jeong, M. G. Samant, and S. S. P. Parkin, “*Suppression of ionic liquid gate induced metallization of  $\text{SrTiO}_3(001)$  by oxygen*”, **Nano. Lett.** 13, pp 4675–4678 (2013).
- [25] A. G. Swartz, K. M. McCreary, **W. Han**, J. J. I. Wong, P. M. Odenthal, H. Wen, J.-R. Chen, R. K. Kawakami, Y. Hao, R. S. Ruoff, and J. Fabian, “*Integrating MBE materials with graphene to induce novel spin-based phenomena*”, **J. Vac. Sci. Technol. B** 31, 04D105 (2013).

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- [24] A. G. Swartz, J.-R. Chen, K. M. McCreary, P. M. Odenthal, **W. Han**, and R. K. Kawakami, “*Effect of in situ deposition of Mg adatoms on spin relaxation in graphene*”, **Phys. Rev. B** 87, 075455 (2013).
- [23] L. T. Chang, **W. Han**, Y. Zhou, J. Tang, I. A. Fischer, M. Oehme, J. Schulze, R. K. Kawakami, and K. L. Wang, “*Comparison of Spin Lifetimes in n-Ge Characterized between Three-Terminal and Four-Terminal Nonlocal Hanle Measurements*”, **Semicond. Sci. Technol.** 28, 015018 (2013).
- [22] K. M. McCreary, A. G. Swartz, **W. Han**, J. Fabian, R. K. Kawakami, “*Direct Detection of Magnetic Moment Formation in Graphene*”, **Phys. Rev. Lett.** 109, 186604 (2012).
- [21] J. J. I. Wong, A. G. Swartz, R. Zheng, **W. Han**, and R. K. Kawakami, “*Electric Field Control of the Verwey Transition and Induced Magnetoelectric Effect in Magnetite*”, **Phys. Rev. B** 86, 060409(R) (2012).
- [20] **W. Han**, J.-R. Chen, D. Wang, K. M. McCreary, H. Wen, A. G. Swartz, J. Shi, and R. K. Kawakami, “*Spin Relaxation in Single Layer Graphene with Tunable Mobility*”, **Nano Lett** 12, 3443–3447 (2012).
- [19] **W. Han**, K. M. McCreary, K. Pi, W. H. Wang, Yan Li, H. Wen, J. R. Chen, R. K. Kawakami, “*Spin Transport and Relaxation in Graphene*”, **J. Magn. Magn. Mater.** 324, 369 (2012).
- [18] **W. Han**, J. R. Chen, K. M. McCreary, H. Wen, R. K. Kawakami, “*Enhanced spin injection efficiency and extended spin lifetimes in graphene spin valves*”, **Proc. SPIE** Vol. 8100, 81000Q, (2011).
- [17] Y. Zhou\*, **W. Han**\*(Co-1st), L.-T. Chang, F. Xiu, M. Wang, M. Oehme, I. A. Fischer, J. Schulze, R. K. Kawakami, and K. L. Wang, “*Electrical spin injection and transport in Germanium*”, **Phys. Rev. B** 84, 125323 (2011).
- [16] **W. Han**, R. K. Kawakami, “*Spin Relaxation in Single Layer and Bilayer Graphene*”, **Phys. Rev. Lett.** 107, 047207 (2011).
- [15] **W. Han**, K. Pi, K. M. McCreary, Y. Li, J. J. I. Wong, A. G. Swartz, and R. K. Kawakami, “*Tunneling Spin Injection into Single Layer Graphene*”, **Phys. Rev. Lett.** 105, 167202 (2010).
- [14] Y. Li, **W. Han**, A. G. Swartz, K. Pi, J. J. I. Wong, S. Mack, D. D. Awschalom, and R. K. Kawakami, “*Oscillatory spin polarization and magneto-optical Kerr effect in Fe<sub>3</sub>O<sub>4</sub> thin films on GaAs(001)*”, **Phys. Rev. Lett.** 105, 167203 (2010).
- [13] A. G. Swartz, J. Ciraldo, J. J. I. Wong, Y. Li, **W. Han**, T. Lin, S. Mack, J. Shi, D. D. Awschalom, and R. K. Kawakami, “*Epitaxial EuO thin films on GaAs*”, **Appl. Phys. Lett.** 97, 112509 (2010).
- [12] K. Pi, **W. Han**, K. M. McCreary, A. G. Swartz, Y. Li, and R. K. Kawakami, “*Manipulation of Spin Transport in Graphene by Surface Chemical Doping*”, **Phys. Rev. Lett.** 104, 187201 (2010).

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- [11] F. Xiu, Y. Wang, J. Kim, P. Upadhyaya, Y. Zhou, X. Kou, **W. Han**, R. K. Kawakami, J. Zou, and K. L. Wang, "Room-Temperature Electric-Field Controlled Ferromagnetism in  $Mn_{0.05}Ge_{0.95}$  Quantum Dots", **ACS Nano**, 4 (8), pp 4948–4954 (2010).
- [10] K. M. McCreary, K. Pi, A. G. Swartz, **W. Han**, W. Bao, C. N. Lau, F. Guinea, M. I. Katsnelson, and R. K. Kawakami, "Effect of cluster formation on graphene mobility", **Phys. Rev. B** 81, 115453 (2010).
- [9] J. J. I. Wong, L. Ramirez, A. G. Swartz, A. Hoff, **W. Han**, Y. Li, and R. K. Kawakami, "Tailoring interlayer exchange coupling of ferromagnetic films across MgO with Fe nanoclusters", **Phys. Rev. B** 81, 094406 (2010).
- [8] Y. Zhou\*, **W. Han**\*(Co-1st), Y. Wang, F. Xiu, J. Zou, R. K. Kawakami, and K. L. Wang, "Investigating the origin of Fermi level pinning in Ge Schottky junctions using epitaxially grown ultrathin MgO films", **Appl. Phys. Lett.** 96, 102103 (2010).
- [7] **W. Han**, Y. Zhou, Y. Wang, Y. Li, J. J. I. Wong, K. Pi, A. G. Swartz, K. M. McCreary, F. Xiu, K. L. Wang, J. Zou, and R. K. Kawakami, "Growth of single-crystalline, atomically smooth MgO films on Ge(001) by molecular beam epitaxy", **J. Crystal Growth**, 312, 44 (2010).
- [6] **W. Han**, K. Pi, W. H. Wang, K. M. McCreary, Y. Li, W. Bao, P. Wei, J. Shi, C. N. Lau, and R. K. Kawakami, "Spin transport in graphite and graphene spin valves", **Proc. SPIE**, Vol. 7398, 739819 (2009).
- [5] K. Pi, K. M. McCreary, W. Bao, **Wei Han**, Y. F. Chiang, Yan Li, S.-W. Tsai, C. N. Lau, and R. K. Kawakami, "Electronic doping and scattering by transition metals on graphene," **Phys. Rev. B** 80, 075406 (2009).
- [4] Y. Zhou, M. Ogawa, M. Bao, **W. Han**, R. K. Kawakami, and K. L. Wang, "Engineering of tunnel junctions for prospective spin injection in germanium", **Appl. Phys. Lett.** 94, 242104 (2009).
- [3] **Wei Han**, K. Pi, W. Bao, K. M. McCreary, Yan Li, W. H. Wang, C. N. Lau, and R. K. Kawakami, "Electrical detection of spin precession in single layer graphene spin valves with transparent contacts", **Appl. Phys. Lett.** 94, 222109 (2009).
- [2] **Wei Han**, W. H. Wang, K. Pi, K. M. McCreary, W. Bao, Yan Li, F. Miao, C. N. Lau, and R. K. Kawakami, "Electron-Hole Asymmetry of Spin Injection and Transport in Single-Layer Graphene", **Phys. Rev. Lett.** 102, 137205 (2009).
- [1] W. H. Wang\*, **W. Han**\*(Co-1st), K. Pi, K. M. McCreary, F. Miao, W. Bao, C. N. Lau, and R. K. Kawakami, "Growth of atomically smooth MgO films on graphene by molecular beam epitaxy", **Appl. Phys. Lett.** 93, 183107 (2008).

\* Equal contribution.

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## Patents

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- [1] **W. Han**, Y. Zhou, K. L. Wang, R. K. Kawakami “*Epitaxial growth of single crystalline MgO on Germanium,*” US20110089415.

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### Invited Conference Talks

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- [15] “*Spin and charge conversion in quantum materials*”, Low Temperature Physics conference, Shaoguan, P. R. China (Nov. 2016).
- [14] “*Spin and charge conversion in 2D quantum materials*”, The 2nd Joint Workshop on Condensed Matter Science, Beijing, P. R. China (Nov. 2016).
- [13] “*Towards efficient spin orbit torque*” 2016 MMM conference, New Orleans, USA (Oct. 2016).
- [12] “*Spin to Charge Conversion in 2D Quantum Materials*” The 6th Annual World Congress of Nano Science & Technology, Singapore (Oct. 2016).
- [11] “*Spin and charge conversion in quantum materials*”, Rice-ICQM Joint workshop, Beijing, P. R. China (Oct. 2016).
- [10] “*Spin to Charge Conversion in Quantum Materials*”, 6th ICQs Conference, Beijing, P. R. China (June 2016).
- [9] “*Interface Effects on Spin-Orbit Torque and Gilbert damping*”, ICNS Mini-Symposium on Spintronics and 2D Materials, Halle, Germany (May 2016).
- [8] “*Role of transparency of platinum-ferromagnet interface in determining intrinsic magnitude of spin Hall effect*”, APS March Meeting, Baltimore, Maryland, USA (Mar, 2016).
- [7] “*Role of transparency of platinum-ferromagnet interface in determining intrinsic magnitude of spin Hall effect*”, SPIE (Spintronics VII), San Diego, CA, USA (Aug. 2015).
- [6] “*Interface transparency of spin orbit torque*”, Low Temperature Physics conference, Hangzhou, P. R. China (Apr. 2015).
- [5] “*Spin injection and detection in La and Nb doped SrTiO<sub>3</sub>*”, 4th ICQs Conference, Beijing, P. R. China (June 2014).
- [4] “*Spin Injection and Detection in La- and Nb-Doped Strontium Titanate*”, 41st Conference on the Physics and Chemistry of Surfaces and Interfaces, Santa Fe, NM, USA (Jan 2014).
- [3] “*Spin injection and detection in lanthanum- and niobium-doped SrTiO<sub>3</sub>*”, Physical Sciences Symposia-2013, Boston, MA, USA (Sept 2013).
- [2] “*Spin Injection and Relaxation in Graphene*”, APS March Meeting, Boston, MA, USA (Feb. 2012).
- [1] “*Spin Injection and Relaxation in Graphene*”, SPIE (Spintronics IV), San Diego, CA, USA (Aug. 2011).



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**Invited Seminars**

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- [19] “*Towards Efficient Spin and Charge Conversion*”, Seminar, Center for 2D Materials, National University of Singapore, Singapore (Oct. 2016).
- [18] “*Spin to Charge Conversion in topological surface states of SmB<sub>6</sub>*”, South University of Science and Technology of China, Shenzhen, P. R. China (July 2016).
- [17] “*Two Extreme Cases for Spin Orbit Coupling*”, Seminar, Institute of Physics, CAS, Beijing, P. R. China (Dec. 2015).
- [16] “*Introduction of the spin orbit torque*”, Spintronics workshop, Peking University, Beijing, P. R. China (July 2015).
- [15] “*Manipulation of magnetism by pure spin current*”, Seminar, East China Normal University, Shanghai, P. R. China (June 2015).
- [14] “*Two Extreme Cases for Spin Orbit Coupling*”, Seminar, Institute of Semiconductors, CAS, Beijing, P. R. China (June 2015).
- [13] “*Interface transparency of spin orbit torque*”, Spintronics workshop, Beijing Normal University, Beijing, P. R. China (May 2015).
- [12] “*Two Extreme Cases for Spin Orbit Coupling*”, Seminar, Department of Physics, Beijing Normal University, Beijing, P. R. China (Apr. 2015).
- [11] “*Two Extreme Cases for Spin Orbit Coupling*”, Seminar, Department of Physics, University of Science and Technology, Hefei, Anhui, P. R. China (Mar. 2015).
- [10] “*Interface transparency of spin orbit torque*”, UT Austin-PKU workshop, Austin, TX, USA (Feb. 2015).
- [9] “*Graphene: A Promising Material for Spintronics*”, Seminar, Department of Materials and Engineering, University of Science and Technology, Hefei, Anhui, P. R. China (Jan 2015).
- [8] “*Graphene spintronics*”, Seminar, School of Physics and Technology, Wuhan University, Wuhan, Hubei, P. R. China (June 2014).
- [7] “*Spintronics in Graphene and Complex Oxides*”, Seminar, Department of Physics, Carnegie Mellon University, PA, USA (Feb. 2014).
- [6] “*Spintronics in Graphene and Complex Oxides*”, Seminar, Department of Physics, Washington State University, WA, USA (Feb. 2014).
- [5] “*Spintronics in Graphene and Complex Oxides*”, Seminar, International Center for Quantum Materials, Peking University, Beijing, P. R. China (Dec. 2013).
- [4] “*Spin Transport in Graphene and Germanium*”, IBM Almaden research center, San Jose, CA, USA (Oct. 2011).

- [3] “*Spin Transport and Relaxation in Graphene*”, Seminar, Cornell University, Ithaca, NY, USA (Sept. 2011).
- [2] “*Spin Transport in Graphene and Germanium*”, Seminar, Department of Physics, Penn State University, PA, USA (July 2011).
- [1] “*Spin Injection and Relaxation in Graphene*”, Seminar, Device Research Laboratory, University of California, Los Angeles, CA, USA (Apr. 2011).

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### Conference Section Chairs

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- [3] Section Chair: “Session X13: Invited Session: Hall-Bar Structure for the Detection of Spin/Valley Hall Effect”. March Meeting of the American Physical Society, Baltimore, MD, USA (Mar. 2016)
- [2] Section Chair: “Session D40: Invited Session: Graphene Spintronics and Magnetism”. March Meeting of the American Physical Society, Denver, CO, USA (Mar. 2014)
- [1] Section Chair: “Graphene Analogs and Novel 2D Materials II”, 41st Conference on the Physics and Chemistry of Surfaces and Interfaces, Santa Fe, NM, USA (Jan. 2014).