CURRICULUM VITAE

JUNG HOON HAN

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Citizenship: Korea
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EDUCATION:

BS Physics	Seoul National University	1991
PhD Physics	University of Washington	1997

Thesis Advisor: David J. Thouless
Thesis Subject: Dynamics of the Compressible Quantum Hall Edge

AWARDS:

1991-1997	Korea Foundation for Advanced Studies Fellowship
1994	Sebastian-Karrer Award, University of Washington

EMPLOYMENT:

2011.9-present	Professor, Sungkyunkwan University
2005.9-2011.8	Associate professor, Sungkyunkwan University
2003.9-2005.8	Assistant professor, Sungkyunkwan University
2001.8-2003.8	Assistant professor, Konkuk University
1999.9-2001.7	Postdoctoral Fellow, UC Berkeley (with prof. Dung-Hai Lee)
1997.9-1999.8	Postdoctoral Fellow, APCTP
1991-1997	TA/RA, University of Washington

MAJOR ACCOMPLISHMENTS:

- Proposed one of the three mechanisms in multiferroics in 2006-2007; many materials since discovered following our mechanism
- Proposed the stability of two-dimensional Skyrmion lattice in 2009; verified a year later
- Proposed the notion of orbital chirality in 2011; verified by CD-ARPES

- Springer book "Skyrmions in condensed matter" due for completion in 2014

RESEARCH SUMMARY:

- **Quantum Hall Effect**: My thesis work was on developing Green's function technique for compressible edge dynamics in a quantum Hall droplet. The method was different in philosophy from the more mainstream Luttinger liquid approach popular with most people at the time, and yet yielded much of the same result. It was also flexible enough to deal with both compressible and incompressible edge structures. My first paper on this subject, which took me two years to complete, was published in 1997, titled "Dynamics of compressible edge and bosonization", and received 32 citations so far.

- **High-Temperature Superconductivity**: My first post-doctoral work with Dung-Hai Lee on high-temperature superconductivity was to use the $t-J$ model slave-boson mean-field theory (SBMFT) to calculate both the vortex structure and the tunneling spectra of a d-wave superconductor. The work took six months to complete, and was well-received when it came out due to its being the only unrestricted SBMFT calculation of the vortex state on the market ["Structure of a vortex in the $t-J$ model", 46 citations as of 2013]. The work received another wave of attention after Patrick Lee and Xiao-Gang Wen proposed their staggered current scenario in response to Laughlin's d-density-wave idea. Our re-analysis of the vortex core solution indeed yielded staggered current patterns in good accord with Lee and Wen's general predictions.

- **Multiferroics**: My entry into the multiferroics world was due to a colleague of mine at SKKU, Je-Geun Park, who had been interested in one such compound, $YMnO_3$, for some years. His neutron diffraction results found the movement of Mn ions taking place at the onset of magnetism, and the amount of Mn displacement was relatively big. I contributed by constructing a Ginzburg-Landau argument for the coupling of displacement and magnetism. The paper we produced in 2005, "Direct observation of a coupling among spin, lattice, and electric dipole moment in multiferroic $YMnO_3$", has been heavily cited (51 times as of 2013).

  My real involvement in multiferroics began as a result of the APW workshop that took place in Beijing, 2005. Professor Tokura gave a talk on multiferroic $TbMnO_3$ and mentioned some work by Katsura, Nagaosa, and Balatsky that explained his findings. At that time I was searching for new projects and this new theme seemed quite interesting. I set out to reproduce their results but initially failed. Only after a one-week visit to professor Nagaosa did I figure out how to do it properly, but then the results I got with Chenglong Jia, my post-doc, was different from the KNB result. Together with professor Nagaosa and his post-doc Shigeki Onoda, we summarized our results in two papers over the next two years. The new term, which I initially called the "bond polarization", was re-invented and re-named in 2008 by Arima as the metal-ligand hybridization and since then came to be recognized as the third mechanism of magnetically

induced multiferroicity, after spin-current and exchange-striction mechanisms. Our two papers have citations of 57 and 80 times each as of 2013.

- **Skyrmions**: After a one-day visit to professor Nagaosa in the summer of 2008, I started working on MnSi and its anomalous Hall effect. Because I knew so little about it, it was considered safer to construct some simple lattice model and analyze it numerically. The phase diagram, worked out six months after the start, surprisingly revealed several kinds of Skyrmion lattice phases. As we were finishing up the project, a Science paper by Pfleiderer group showing the hexagonal Bragg spots came out making the field-induced Skyrmion lattice a reality.

  Our simulation indicated that Skyrmion lattice would be easier to observe in two dimensional thin films as opposed to the three-dimensional bulk sample probed by Pfeiderer group. Professor Tokura's group, upon the suggestion of professor Nagaosa, took up this idea and immediately found the two-dimensional Skyrmion lattice by Lorentz TEM technique. Since then, for about two years, a proliferation of discoveries followed reporting Skyrmion lattice in a variety of compounds. A number of other theory projects I pursued afterwards were on Skyrmion dynamics in both metallic and insulating hosts, Skyrmion generation by electrical current, and the energetics of three-dimensional Skyrmion crystal formation.

- **Multi-orbital Physics**: The surface physics makes essential use of the Rashba interaction for interpreting many of the phenomena. The strength of the Rashba parameter is typically chosen on phenomenological grounds. With Changyoung Kim, an experimentalist at Yonsei University, I have developed a microscopic picture on the origin of Rashba interaction based in an essential way on the degeneracy of orbital states. The orbital degeneracy proved to be a crucial requisite for the substantial Rashba interaction to appear on surfaces and interfaces, as much as the large size of the spin-orbit interaction itself. Our collaboration was summed up in the PRL paper, "Orbital angular momentum-based origin of Rashba-type surface band splitting", published in 2011. Our proposal, and interpretation of some ARPES experiment based on it published in another PRL paper shortly afterwards, "Chiral orbital angular momentum in the surface states of Bi_2Se_3", seem to have taken the notice of the surface science and the topological insulator communities alike.

  I took up the question further to ask what would happen on the multi-orbital surface bands in the absence of spin-orbit interaction. The answer we found was that the orbital angular momentum couples to the linear momentum of the Bloch electrons to form a chiral structure in momentum space, in direct analogy with the chiral spin structure expected in the spin Rashba system. The new effect we dubbed the "orbital Rashba effect" can be seen in the circular dichroism ARPES setup, as was done by Changyoung's group immediately following our theoretical proposal. Some follow-up calculations also showed that orbital analogues of Dzyaloshinskii-Moriya interaction should show up in the strong correlation limit, giving rise to exotic ordering of orbitals with real-space textures.

- **Spin-orbit-coupled Bose-Einstein condensate**: After a visit to Hui Zhai at IAS, Tsinghua University, Beijing, I had an idea to pursue the

theory of spinor BEC under rotation when the condensate is endowed with artificial spin-orbit interaction. With my post-doc Xiao-Qiang Xu, we did extensive numerical calculation to map out the various phases that would occur under the rotation and reported the findings in a PRL, "Spin-orbit coupled Bose-Einstein condensate under rotation", published in 2011. The field was just beginning, with at least two other theory papers of overlapping nature as ours emerging shortly after ours. Our second paper dealing with the hydrodynamics of the spin-orbit BEC also came out in a PRL paper, "Emergence of chiral magnetism in spinor Bose-Einstein condensates with Rashba coupling", in 2012.

- **Springer Tracks book**: Professor Atsushi Fujimori is one of the editors of Springer Tracks on Modern Physics (STMP). He kindly suggested that I write one of the series. I took this honor with much enthusiasm (and fear). The tentative title of the book is "Topological Aspects of Spin-orbit-coupled Systems", discussing aspects of Berry phase-driven anomalous Hall and spin Hall effects, real-space topological effects found in Skyrmion matter, and topological insulators. The planned finish of the book will be around the end of 2014.

RELATED EXPERIENCE:

- Participant, Les Houches Summer School on "Topological Aspects of Low-Dimensional Systems", July (1998).
- Local Organizing Committee, APCTP Winter School on Strongly Correlated Systems, February (1999/2002-2005).
- Participant, ITP workshop on "High-Temperature Superconductivity", August (2000).
- Visiting Scientist, University of Tokyo, Jan. 23-Feb. 13, (2003); February (2006); October (2006); January (2007).
- Sabbatical leave at UC Berkeley, Sept. 2007-Feb. 2008.
- Organizing committee, 8th Asia-Pacific Workshop on Novel Quantum Materials, Yonsei university, July 5-7, 2009.
- Organizer of the Quantum Materials Symposium (QMS13) held at Muju, Jan. 28-Feb. 1, 2013.
- Organizer of the Bad Metal Mott Quantum Criticality workshop held at APCTP Headquarter in Pohang, July 15-19, 2013.
- Program coordinator for APCTP, Jan. 2012- Dec. 2013.
- Visiting scholar at MIT, Jan. 2014 - Jan. 2015.

SELECTED SEMINARS AND INVITED TALKS:

1. "Dynamics of the Compressible Quantum Hall Edge", Simon Fraser University, Canada, July 8, 1997.

2. "Ground State Wave Functions in the Lowest Landau Level", Umeå University, Sweden, August 18, 1998.

3. "Effective Mass of a Vortex in a Clean BCS Superconductor", *Quantum Coherence in Mesoscopic and Macroscopic Systems*, 5th CTP Workshop on Statistical Physics (Seoul National University, Dec. 16-19, 1998).

4. "Structure of a Quantized Vortex in the t-J Model", University of Washington, Seattle, April 26, 2000.

5. "Implications of Inhomogeneity in Cuprate Superconductors", University of Strasbourg, France, October 23, 2001.

6. "Order Parameter Characterization of Cuprate Superconductors", Invited tutorial talk at Korean Superconducting Society meeting (Kyungju, Korea, Aug. 20-22, 2002).

7. "Tunneling Spectra of Inhomogeneous d-wave Superconductor", Invited talk at New3SC Meeting (San Diego, Jan. 16-21, 2003)

8. "Implications of Inhomogeneity in d-wave Superconductor", University of Washington, Seattle, Jan. 23, 2003.

9. "Quasiparticle Interference around a Vortex in High-T_c Superconductor", 7th APCTP Workshop on Strongly Correlated Electron Systems (Muju Resort, Korea, Feb. 19-22, 2003)

10. "Spontaneous Hexagon Organization in Pyrochlore Lattice", 5th Korea-Japan-Taiwan Workshop on Strongly Correlated Electrons (Busan, Korea, Dec. 10-11, 2004)

11. "Valence bond solid order through spin-lattice coupling", KIAS Workshop on Emergent Quantum Phases in Strongly Correlated Electron Systems (KIAS, Oct. 24-29, 2005).

12. "Phases of Mott-Hubbard Bilayers, KIAS-JNC Conference on Material Science and Condensed Matter Physics (KIAS, May 24-26, 2006).

13. "Bond polarization induced by magnetic order", KIAS-APCTP Workshop on "Quantum Materials" (KIAS, July 19-22, 2006).

14. "Bond polarization induced by magnetic order", 6th Recontres du Vietnam (Hanoi, August 6-12, 2006).

15. "Spin-polarization coupling in multiferroic transition-metal oxides", 6th Asia-pacific workshop on frontiers of condensed matter science and symposium on 20 years anniversary of discovery of YBCO (Academia Sinica, Taiwan, Apr. 13-16, 2007).

16. "Vector spin chirality and its role in multiferroics", ISSP Seminar (ISSP, June 26, 2007).

17. "Multiferroic behaviors in $TbMnO_3$ and $BiMn_2O_5$", Quantum Materials seminar (UC Berkeley, Sept. 20, 2007).

18. "Vector spin chirality in classical and quantum spin systems, 1st workshop for emergent materials research (POSTECH, May 23-24, 2008).

19. "Multiferroic behavior in spin-chirality and exchange-striction-driven compounds, Topological aspects of solid state physics workshop (ISSP, June 2-22, 2008).

20. "A tale of two chiralities in frustrated spin systems", From correlated electrons to nanoscale materials (KIAS, Sept. 1-3, 2008).

21. "Theory of magnetic field-induced metaelectric critical end point in $BiMn_2O_5$", A3 foresight program (Shanghai, Dec. 7-9, 2008).

22. "Aspects of vector spin chirality in multiferroic materials", The Hong Kong forum of physics (Hong Kong, Dec. 13-15, 2008).

23. "Skyrme crystal phases and anomalous Hall conductivity in a model for MnSi", Topological order: from quantum Hall systems to magnetic materials, APCTP-MPIPKS seminar and workshop (Dresden, Germany, June 29-July 24, 2009).

24. "Skyrmions and anomalous Hall effect in a Dzyaloshinskii-Moriya magnet", A3 foresight program workshop (Huangshan, Oct. 24-29, 2009).

25. "Skyrmions and anomalous Hall effect in a Dzyaloshinskii-Moriya magnet", Frontiers in condensed matter physics (KIAS, Dec. 16-19, 2009).

26. "Multiferroics Review", APCTP-A3 winter school and workshop on frontiers in electronic quantum matter (Feb. 1-5, 2010, Phoenix Park, Korea)

27. "Skyrmion Spin Texture in Magnetic Metals", APCTP-KIAS Joint Workshop on Quantum Entanglement and Dynamics in Correlated Many-Body Systems (May 17-21, 2010, Pohang, Korea)

28. "Skyrmion Spin Texture in Magnetic Metals", 2010 Hangzhou Workshop on Quantum Matter (May 18-22, 2010, Hangzhou, China)

29. "Skyrmion Lattices in Two- and Three-Dimensional Chiral Magnets and Beyond", Seminar at Department of Applied Physics, University of Tokyo (Oct. 1, 2010)

30. "Topological Numbers and Its Physical Manifestation", A3 foresight program workshop (Kyoto, Nov. 8-11, 2010).

31. "From ARPES to Theory: A case study of one electron-doped superconductor and one topological insulator", 11th KJT Symposium on Strongly Correlated Electron System (Feb. 10-12, 2011, Jeju, Korea)

32. "Dynamics of Skyrmions in Chiral Magnets", Frontiers in Condensed Matter (KIAS, May 9-11, 2011).

33. "Aspects of Skyrmion Dynamics", 3rd International Workshop on Quantum Condensation (QC11) (HKUST, Jul. 4-15, 2011).

34. "Skyrmion Dynamics in Metallic Chiral Magnet", 34th International Workshop on Condensed Matter Theories (APCTP, Nov. 7-11, 2011).

35. "Emergence of Orbital Angular Momentum by Inversion Symmetry Breaking and Its Detection by Circular Dichroism ARPES" (A3 Foresight Program Joint Research on Novel Properties of Complex Oxides, Hainan Island, Dec. 17-21, 2011)

36. "Skymions in Condensed Matter" (Colloquium at Fudan University, Mar. 20, 2012)

37. "Skymions in Condensed Matter" (Colloquium at Zhejiang University, Mar. 23, 2012)

38. "Theoretical Aspects of Rashba-BEC Condensate" (UK-Korea Workshop on SCES, Rutherford Appleton Laboratory, Oxfordshire, UK, Apr. 12-13, 2012)

39. "Chiral Orbital Angular Momentum in Non-Centrosymmetric Band Structure" (International Conference on Heavy Electrons and Novel Quantum Phases, Gyeungju, July 5-7, 2012)

40. "Skyrmion Dynamics in Metallic Chiral Ferromagnet" (19th International Conference on Magnetism with SCES, Busan, July 8-13, 2012)

41. "Orbital Rashba Effects and Its Implications" (IAS Asia-Pacific Workshop on Condensed Matter Physics, Hong Kong, Dec. 14-16, 2012)

42. "(Some) topological aspects of three-band Hamiltonian" (Workshop on disordered and topological systems, Zhejiang University, Hangzhou, March 18-22, 2013)

43. "A new look at Rashba-related phenomena from multi-orbital perspective" (Biweekly Seminar, IASTU, June 19, 2013)

44. "Emergence of Orbital Chirality in Multi-Orbital Surface Bands" (Seminar at MIT, May 8, 2014)

45. "Emergence of Orbital Chirality in Multi-Orbital Surface Bands" (Seminar at Boston University, April 2, 2014)

46. "Emergence of Orbital Chirality in Multi-Orbital Surface Bands" (Seminar at University of Toronto, April 22, 2014)

47. "Skyrmion in Chiral Magnets" (Colloquium, University at Buffalo, April 24, 2014)

48. "Emergence of Orbital Chirality in Multi-Orbital Surface Bands" (Seminar at Boston College, May 8, 2014)

49. "Thermal Hall Effect of Spins in a Paramagnet" (2015 Hangzhou Workshop on Quantum Matter and Asia-Pacific Workshop on Strongly Correlated System)

TEACHING EXPERIENCE:

- General Physics
- Thermal and Statistical Physics (undergraduate/graduate)
- Classical Mechanics (undergraduate/graduate)
- Classical Electrodynamics (undergraduate/graduate)
- Mathematical Physics (undergraduate)
- Quantum Mechanics (graduate)
- Topics on Quantum Mechanics (undergraduate)
- Theory of Superconductivity (graduate)
- Solid State Physics (graduate)
- Introduction to Nanoscience (undergraduate)

BOOK:

- "Skyrmions in Condensed Matter Systems" (Springer Tracks in Modern Physics, projected completion by end of 2014)

PUBLICATIONS:

1. "Critical and Bicritical Properties of Harper's Equation with Next-Nearest-Neighbor Coupling" J. H. Han, D. J. Thouless, H. Hiramoto, and M. Kohmoto, Phys. Rev. B **50**, 11365 (1994).
2. "Dynamics of Compressible Edge and Bosonization", J. H. Han, and D. J. Thouless, Phys. Rev. B **55**, 1926 (1997).
3. "Theory of the Breakdown of the Quantum Hall Effect", V. Tsemekhman, K. Tsemekhman, C. Wexler, J. H. Han, and D. J. Thouless, Phys. Rev. B **55**, 10201 (1997).
4. "Green's Function Approach to the Edge Spectral Density", J. H. Han, Phys. Rev. B **56**, 15806 (1997).
5. "Edge of a Half-Filled Landau Level, S.-R. Eric Yang and J. H. Han, Phys. Rev. B **57**, 12681 (1998).
6. "Ground State Wave Functions of General Filling Factors in the Lowest Landau Level", J. H. Han and S.-R. Eric Yang, Phys. Rev. B **58**, 10163 (1998).
7. "Structure of a Vortex in the t-J Model", Jung Hoon Han and Dung-Hai Lee, Phys. Rev. Lett. **85**, 1110 (2000).
8. "Numerical Test of the Disk Trial Wavefunction for a Half-Filled Landau Level", S.-R. Eric Yang, Min-Chul Cha, and Jung Hoon Han, Phys. Rev. B **62**, 8171 (2000).

9. "Antiferromagnetism, Stripes, and Superconductivity in t-J model with Coulomb Interaction", Jung Hoon Han, Qiang-Hua Wang and Dung-Hai Lee, Int. J. Mod. Phys. B **15**, 1117 (2001).

10. "Superfluid Density in the D-density-wave Scenario", Qiang-Hua Wang, Jung Hoon Han, and Dung-Hai Lee, Phys. Rev. Lett. **87**, 077004 (2001).

11. "Staggered Currents in the Vortex Core of Cuprate Superconductors", Jung Hoon Han, Qiang-Hua Wang, and Dung-Hai Lee, Phys. Rev. B, **64**, 064512 (2001).

12. "Staggered Currents in the Mixed State", Qiang-Hua Wang, Jung Hoon Han, and Dung-Hai Lee, Phys. Rev. Lett. **87**, 167004 (2001).

13. "Pairing Near the Mott Insulating Limit", Qiang-Hua Wang, Jung Hoon Han, and Dung-Hai Lee, Phys. Rev. B **65**, 054501 (2001).

14. "Low-Frequency Optical Conductivity in Inhomogeneous d-wave Superconductors", Jung Hoon Han, Phys. Rev. B **66** 054517 (2002).

15. "Signature of a Collective Spin Mode in the Local Tunneling Spectra of a *d*-wave Superconductor", Jung Hoon Han, Phys. Rev. B **67**, 094506 (2003).

16. "Tunneling Spectra of Inhomogeneous *d*-wave Superconductor", Jung Hoon Han, Int. J. Mod. Phys. B **17**, 3484 (2003).

17. "Dynamical mean-field theory of the Hubbard-Holstein model at half-filling: Zero temperature metal-insulator and insulator-insulator transitions", Gun Sang Jeon, Tae-Ho Park, Jung Hoon Han, Hyun C. Lee, and Han-Yong Choi, Phys. Rev. B **70**, 125114 (2004).

18. "Effective Vortex Mass from Microscopic Theory", Jung Hoon Han, June Seo Kim, Min Jae Kim, and Ping Ao, Phys. Rev. B **71**, 125108 (2005).

19. "Effects of the two-gap nature on the microwave conductivity of polycrystalline MgB_2 films with a critical temperature of 39K", Sang Young Lee, J. H. Lee, Jung Hoon Han, S. H. Moon, H. N. Lee, James C. Booth, and J. H. Claassen, Phys. Rev. B **71**, 104514 (2005).

20. "Direct observation of a coupling among spin, lattice, and electric dipole moment in multiferroic $YMnO_3$", Seongsu Lee, A. Pirogov, Jung Hoon Han, J.-G. Park, A. Hoshikawa, and T. Kamiyama, Phys. Rev. B **71**, 180413 (2005).

21. "Lattice-coupled antiferromagnet on frustrated lattices", Chenglong Jia, Jung Ho Nam, June Seo Kim, and Jung Hoon Han, Phys. Rev. B **71**, 212406 (2005).

22. "Valence-bond-solid order in antiferromagnets with spin-lattice coupling", Chenglong Jia and Jung Hoon Han, Phys. Rev. B **73**, 172411 (2006).

23. "Spin-lattice interaction effect in frustrated antiferromagnets", Chenglong Jia and Jung Hoon Han, Physica B **378-380**, 884 (2006).

24. "Phases of Mott-Hubbard bilayers: Theoretical model", Jung Hoon Han and Chenglong Jia, Phys. Rev. B **74**, 075105 (2006).

25. "The electronic states of two oppositely doped Mott insulators bilayers", T. C. Ribeiro, A. Seidel, Jung Hoon Han, and D.-H. Lee, Europhys. Lett. **76**, 891 (2006).

26. "Bond electronic polarization induced by spin", Chenglong Jia, Shigeki Onoda, Naoto Nagaosa and Jung Hoon Han, Phys. Rev. B **74**, 224444 (2006).

27. "Coupling of phonons and spin waves in a triangular antiferromagnet", Jung Hoon Kim and Jung Hoon Han, Phys. Rev. B **76**, 054431 (2007).

28. "Microscopic theory of spin-polarization coupling in multiferroic transition metal oxides", Chenglong Jia, Shigeki Onoda, Naoto Nagaosa and Jung Hoon Han, Phys. Rev. B **76**, 144424 (2007).

29. "Exciton formation in graphene bilayer", Raoul Dillenschneider and Jung Hoon Han, Phys. Rev. B **78**, 045401(2008).

30. "Vector Chiral States in Low-Dimensional Quantum Spin Systems", Raoul Dillenschneider, Jung Hoon Kim, and Jung Hoon Han, Journal of the Korean Physical Society **53**, 732 (2008).

31. "Nematic and chiral order for planar spins on a triangular lattice", Jin-Hong Park, Shigeki Onoda, Naoto Nagaosa and Jung Hoon Han, Phys. Rev. Lett. **101**, 167202(2008).

32. "Quantum theory of multiferroic helimagnets: Collinear and Helical Phases", Hosho Katsura, Shigeki Onoda, Jung Hoon Han and Naoto Nagaosa, Phys. Rev. Lett. **101**, 187207 (2008).

33. "Chiral spin states in the pyrochlore Heisenberg magnet: fermionic mean-field theory and variational Monte Carlo calculations", Jung Hoon Kim and Jung Hoon Han, Phys. Rev. B **78**, 180410 (2008).

34. "Theory of magnetic field-induced critical end point in $BiMn_2O_5$", Gun Sang Jeon, Jin-Hong Park, Kee Hoon Kim, and Jung Hoon Han, Phys. Rev. B **79**, 104437 (2009).

35. "Skyrmions and anomalous Hall effect in a Dzyaloshinskii-Moriya spiral magnet", Su Do Yi, Shigeki Onoda, Naoto Nagaosa, and Jung Hoon Han, Phys. Rev. B **80**, 054416 (2009).

36. "Observation of a multiferroic critical end point", Jae Wook Kim, S. Y. Haam, Y. S. Oh, S. Park, S.-W. Cheong, P. A. Sharma, M. Jaime, N. Harrison, Jung Hoon Han, Gun-Sang Jeon, P. Coleman, and Kee Hoon Kim, PNAS **106**, 15573-15576 (2009).

37. "Duality argument for the chiral-nematic phase of planar spins", Jung Hoon Han, Journal of the Korean Physical Society **55**, 1540 (2009).

38. "Hierarchy of spin and valley symmetry breaking in quantum Hall single layer graphene", Zhihua Yang, and Jung Hoon Han, Phys. Rev. B (2010).

39. "Real-space Observation of a Two-dimensional Skyrmion Crystal", X. Z. Yu, Y. Onose, N. Kanazawa, J. H. Park, J. H. Han, Y. Matsui, N. Nagaosa, and Y. Tokura, Nature **465**, 901 (2010).

40. "Skyrmion Lattice in Two-Dimensional Chiral Magnet", Jung Hoon Yan, Jiadong Zang, Zhihua Yang, Jin-Hong Park, Naoto Nagaosa, Phys. Rev. B **82**, 094429 (2010).

41. "Intrinsic Quasi-particle Dynamics of Topological Metallic States", S. R. Park, W. S. Jung, G. R. Han, Y. K. Kim, Chul Kim, D. J. Song, Y. Y. Koh, S. Kimura, K. D. Lee, N. Hur, J. Y. Kim, B. K. Cho, J. H. Kim, Y. S. Kwon, Jung Hoon Han and C. Kim, New J. Phys. **13**, 013008 (2011).

42. "Landau Level States on a Topological Insulator Thin Film", Zhihua Yang and Jung Hoon Han, Phys. Rev. B **83**, 045415 (2011).

43. "Calorimetric Evidence for Nodes in the Overdoped $Ba(Fe_{0.9}Co_{0.1})_2As_2$" Dong-Jin Jang, A. B. Vorontsov, I. Vekhter, K. Gofryk, Z. Yang, S. Ju, J. B. Hong, Jung Hoon Han, Y. S. Kwon, F. Ronning, J. D. Thompson and T. Park, New J. Phys. **13**, 023036 (2011).

44. "Zero-temperature Phases for Chiral Magnets in Three Dimensions", Jin-Hong Park and Jung Hoon Han, Phys. Rev. B **83**, 184406 (2011).

45. "Dynamics of Skyrmion Crystals in Metallic Thin Films", Jiadong Zang, Maxim Mostovoy, Jung Hoon Han, and Naoto Nagaosa, Phys. Rev. Lett. **107**, 136804 (2011).

46. "Orbital-Angular-Momentum Based Origin of Rashba-Type Surface Band Splitting", Seung Ryong Park, Choong H. Kim, Jaejun Yu, Jung Hoon Han, and Changyoung Kim, Phys. Rev. Lett. **107**, 156803 (2011).

47. "Spin-Orbit Coupled Bose-Einstein Condensate Under Rotation", Xiao-Qiang Xu and Jung Hoon Han, Phys. Rev. Lett. **107**, 200401 (2011).

48. "Warping Effects in the Band and Angular-momentum Struictures of the Topological Insluator Bi_2Te_3", Wonsig Jung, Yeongkwan Kim, Beomyoung Kim, Yoonyoung Koh, Chul Kim, Masaharu Matsunami, Shin-ichi Kimura, Masashi Arita, Kenya Shimada, Jung Hoon Han, Juyoung Kim, Beongki Cho, and Changyoung Kim, Phys. Rev. B **84**, 245435 (2011).

49. "Chiral Orbital-Angular Momentum in the Surface States of Bi_2Se_3", Seung Ryong Park, Jinhee Han, Chul Kim, Yoon Young Koh, Changyoung Kim, Hyungjun Lee, Hyoung Joon Choi, Jung Hoon Han, Kyung Dong Lee, Nam Jung Hur, Masashi Arita, Kenya Shimada, Hirofumi Namatame, and Masaki Taniguchi, Phys. Rev. Lett. **108**, 046805 (2012).

50. "Emergence of Chiral Magnetism in Spinor Bose-Einstein Condensates with Rashba Coupling", Xiao-Qiang Xu and Jung Hoon Han, Phys. Rev. Lett. **108**, 185301 (2012).

51. "Orbital Rashba Effect and Its Detection by Circular Dichroism Angle-resolved Photoemission Spectroscopy", Jin-Hong Park, Choong H. Kim, Jun-Won Rhim, and Jung Hoon Han, Phys. Rev. B **85**, 195401 (2012).

52. "Skyrmion Generation by Current", Youngbin Tchoe and Jung Hoon Han, Phys. Rev. B **85**, 174416 (2012).

53. "Skyrmion dynamics and disintegration in a spin-1 Bose-Einstein condensate", Xiao-Qiang Xu and Jung Hoon Han, Phys. Rev. A **86**, 063619 (2012).

54. "Orbital chirality and Rashba interaction in magnetic bands", Jin-Hong Park, Choong H. Kim, Hyun-Woo Lee, and Jung Hoon Han, Phys. Rev. B **87**, 041301(R) (2013).

55. "Skyrmion Dynamics in Multiferroic Insulators", Ye-Hua Liu, You-Quan Li, and Jung Hoon Han, Phys. Rev. B **87**, 100402(R) (2013).

56. "Three-band model for quantum Hall and spin Hall effects", Gyungchoon Go, Jin-Hong Park, and Jung Hoon Han, Phys. Rev. B **87**, 155112 (2013).

57. "Orbital Dzyaloshinskii-Moriya exchange interaction", Panjin Kim and Jung Hoon Han, Phys. Rev. B **87**, 205119 (2013).

58. "Interaction of itinerant electrons and spin fluctuations in electron-doped cuprates", Seung Ryong Park, Takao Morinari, Dong Joon Song, Choon Shik Leem, Chul Kim, Sung Kyun Choi, Kyujin Choi, Jae Hoon Kim, Felix Schmitt, Sung Kwan Mo, Dong Hui Lu, Zhi-Xun Shen, Hiroshi Eisaki, Takami Tohyama, Jung Hoon Han, and Changyoung Kim, Phys. Rev. B **87**, 174527 (2013).

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