

Dr. Tao Yu – Curriculum Vitae

GENERAL INFORMATION

Gender: Male

Birth Date: December 4, 1988

Birth Place: Laiyang, Shandong, P. R. China

Citizenship: China

CONTACT INFORMATION

Office Address: Theory Department

Max Planck Institute for the Structure and Dynamics of Matter

22761, Hamburg, Germany

Cell: +31-06-12104491

Email: tao.yu@mpsd.mpg.de

EDUCATION

09/2012-03/2018, Doctor of Philosophy, Department of Physics,

University of Science and Technology of China

- Major: Condensed Matter Physics
- Dissertation: *Dynamics of Spin, Valley Polarization and Bogoliubov Quasiparticle in Semiconductors, Cold Atoms, Transition Metal Dichalcogenides and Superconductors*
- Supervisor: Prof. Dr. M. W. Wu

09/2008-06/2012, Bachelor of Science, School of Materials Science and Engineering,

Central South University

- Thesis Topic: *Electron Spin Relaxation in n-type GaAs_{1-x}Bi_x*
- Supervisor: Prof. Dr. M. W. Wu

AWARDS AND SCHOLARSHIPS

2017, China Aerospace Science and Technology Corporation (CASC) Scholarship

2015, Dean Award of the Chinese Academy of Sciences

2014, National Scholarship for Outstanding Graduate Students

2009, National Scholarship for Outstanding Undergraduate Students

PROFESSIONAL EXPERIENCE

02/2020-present, Post-doctoral researcher (Emmy Noether project), Max Planck Institute for the Structure and Dynamics of Matter, Germany

08/2019-09/2019, ICC-IMR Young Fellow, Institute for Materials Research, Tohoku University, Japan

02/2018-01/2020, Post-doctoral researcher, Kavli Institute of NanoScience, Delft University of Technology, the Netherlands

09/2015-01/2016, Teaching assistant of “*Theory of Solid Physics*” for graduate students

03/2014-06/2014, Teaching assistant of “*Solid Physics*” for undergraduate students

RESEARCH FOCUS

- **Unconventional superconductivity:** topological properties, ultrafast engineering and

Keldysh formalism for dynamics; superconducting mechanism in magic-angle twisted bilayer graphene and cuprate family.

- **Phases in strongly correlated system:** approaches of path integral, renormalization group and numerical methods.
- **Magnetism:** chiral interactions between magnons and various quasiparticles; magnon linear and nonlinear transports; spin-momentum locking of waves; skyrmion topological dynamics.
- **Spintronics:** many-body spin dynamics in semiconductor, graphene, and cold atoms; various spin phenomena such as spin Hall, spin pumping and Seebeck effects.
- **Semiconductor optics:** valley dynamics in monolayer/bilayer transition metal dichalcogenides; many-body excitonic states; optical engineering of quantum states.

PUBLICATIONS (corresponding author†, co-first author*)

—Preprints:

39. **T. Yu**, D. M. Kennes, A. Rubio, and M. A. Sentef, “*Nematicity Arising from a Chiral Superconducting Ground State in Magic-Angle Twisted Bilayer Graphene under In-Plane Magnetic Fields*”, [arXiv:2101.01426](#), Phys. Rev. Lett. (under review).
38. Y. Y. Yao, R. R. Cai, **T. Yu** (theory), Y. Tsutsumi, Y. Ma, W. Y. Xing, Y. Ji, X.-C. Xie, S.-H. Yang, S. Maekawa, and W. Han, “*Giant oscillatory Gilbert damping in superconductor/ferromagnet/superconductor junctions*”, Science Advances (under review).
37. T. S. Li*, **T. Yu*** (theory), X. F. Cui, K. X. Zhang, J. Y. Liu, Q. S. Meng, H. B. Cai, N. Pan, B. Wang, Z. C. Dong and X. P. Wang, “*Magnetically-Sensitive Valley Polarization Reversal and Revival of Defect-Localized Excitons in WSe_2 - WS_2* ”, [arXiv:1903.06899](#).

—PRL, SA:

36. **T. Yu**, C. Wang, M. A. Sentef, and G. E. W. Bauer, “*Spin-Wave Doppler Shift by Magnon Drag in Magnetic Insulators*”, Phys. Rev. Lett. **126**, 137202 (2021), [press release “A speed limit for spins” at Max Planck Institute](#).
35. X. Zhang, G. E. W. Bauer, and **T. Yu†**, “*Unidirectional Pumping of Phonons by Magnetization Dynamics*”, Phys. Rev. Lett. **125**, 077203 (2020).
34. **T. Yu** and G. E. W. Bauer, “*Noncontact Spin Pumping by Microwave Evanescent Fields*” (Editors’ Suggestion), Phys. Rev. Lett. **124**, 236801 (2020).
33. **T. Yu**, Y.-X. Zhang, S. Sharma, X. Zhang, Y. M. Blanter, and G. E. W. Bauer, “*Magnon Accumulation in Chirally Coupled Magnets*”, Phys. Rev. Lett. **124**, 107202 (2020).
32. I. Bertelli, J. J. Carmiggelt, **T. Yu** (theory), B. G. Simon, C. C. Pothoven, G. E. W. Bauer, Y. M. Blanter, J. Aarts, and T. van der Sar, “*Magnetic resonance imaging of spin-wave transport and interference in a magnetic insulator*”, Sci. Adv. **6**, eabd3556 (2020), [press release “Direct MRI-like view of spin waves” at Max Planck Institute](#).
31. **T. Yu**, Y. M. Blanter, and G. E. W. Bauer, “*Chiral pumping of spin waves*”, Phys. Rev. Lett. **123**, 247202 (2019).

—Invited Books and Reviews:

30. **T. Yu**, Z. C. Luo, and G. E. W. Bauer, “*Chiral Spintronics*” (a full review article), **Physics Reports** (to be submitted).

29. W. C. Yu, **T. Yu**, and G. E. W. Bauer, “*Indirect Interactions between Magnets*” in “*The 2021 Magnonics Roadmap*” (Perspective Article), *J. Phys.: Condens. Matter* (2020), DOI: [10.1088/1361-648X/abec1a](https://doi.org/10.1088/1361-648X/abec1a).
28. **T. Yu** and G. E. W. Bauer, “*Chiral Coupling to Magnetodipolar Radiation*” (comprehensive review chapter) in *Chirality, magnetism, and magnetoelectricity: Separate phenomena and joint effects in metamaterial structures*, Edited by E. Kamenetskii (Springer International Publishing, 2021).

—PRB, PRA, PRR and others:

27. **T. Yu**, M. Claassen, D. M. Kennes, and M. A. Sentef, “*Optical Manipulation of Domains in Chiral Topological Superconductors*”, *Phys. Rev. Research* **3**, 013253 (2021).
26. **T. Yu**, “*Nonreciprocal surface magnetoelastic dynamics*”, *Phys. Rev. B* **102**, 134417 (2020).
25. K. Yamamoto, W. C. Yu, **T. Yu**, J. Puebla, M. R. Xu, S. Maekawa, and G. E. W. Bauer, “*Non-reciprocal pumping of surface acoustic waves by spin wave resonances*” (**Editors’ Choice**), *J. Phys. Soc. Jpn.* **89**, 113702 (2020).
24. W. C. Yu†, **T. Yu**†, and G. E. W. Bauer, “*Circulating cavity magnon polaritons*”, *Phys. Rev. B* **102**, 064416 (2020).
23. H. C. Wang*, J. L. Chen*, **T. Yu*** (theory), C. P. Liu*, C. Y. Guo*, S. Liu*, K. Shen*, H. Jia*, T. Liu, J. Y. Zhang, M. A. Cabero, Q. M. Song, S. Tu, M. Z. Wu, X. F. Han, K. Xia, D. P. Yu, G. E. W. Bauer, and H. M. Yu, “*Nonreciprocal coherent coupling of nanomagnets by exchange spin waves*” (**cover paper**), *Nano Res.* (2020), <https://doi.org/10.1007/s12274-020-3251-5>.
22. **T. Yu**, H. C. Wang, M. A. Sentef, H. M. Yu, and G. E. W. Bauer, “*Magnon trap by chiral spin pumping*” (**Editors’ Suggestion**), *Phys. Rev. B* **102**, 054429 (2020).
21. J. W. Rao, Y. P. Wang, Y. Yang, **T. Yu**, Y. S. Gui, X. L. Fan, D. S. Xue, and C.-M. Hu, “*Interactions between a magnon mode and a cavity photon mode mediated by traveling photons*”, *Phys. Rev. B* **101**, 064404 (2020).
20. **T. Yu**, X. Zhang, S. Sharma, Y. M. Blanter, and G. E. W. Bauer, “*Chiral coupling of magnons in waveguides*” (**Editors’ Suggestion**), *Phys. Rev. B* **101**, 094414 (2020) .
19. B. M. Yao, **T. Yu**† (theory), X. Zhang, W. Lu, Y. S. Gui, C.-M. Hu, and Y. M. Blanter, “*The microscopic origin of magnon-photon level attraction by traveling waves: Theory and experiment*”, *Phys. Rev. B* **100**, 214426 (2019).
18. J. L. Chen*, **T. Yu*** (theory), C. P. Liu*, T. Liu*, K. Shen*, J. Y. Zhang, S. Tu, M. S. Alam, K. Xia, M. Z. Wu, Y. M. Blanter, G. E. W. Bauer, and H. M. Yu, “*Excitation of unidirectional exchange spin waves by a nanoscale magnetic grating*” (**Editors’ Suggestion**), *Phys. Rev. B* **100**, 104427 (2019).
17. B. M. Yao, **T. Yu**† (theory), Y. S. Gui, J. W. Rao, Y. T. Zhao, W. Lu†, and C.-M. Hu†, “*Coherent control of magnon radiative damping with cavity photon states*”, *Commun. Phys.* **2**, 161 (2019).
16. **T. Yu**, S. Sharma, Y. M. Blanter, and G. E. W. Bauer, “*Surface dynamics of rough magnetic films*”, *Phys. Rev. B* **99**, 174402 (2019).
15. **T. Yu**, C. P. Liu, H. M. Yu, Y. M. Blanter, and G. E. W. Bauer, “*Chiral excitation of spin waves by magnetic nanowire gratings*”, *Phys. Rev. B* **99**, 134424 (2019).

14. F. Yang, **T. Yu**, and M. W. Wu, “Anomalous Hall effect in semiconductor quantum wells in proximity to chiral p -wave superconductors”, [Phys. Rev. B **97**, 205301 \(2018\)](#).
13. **T. Yu** and M. W. Wu, “Gauge-invariant theory of quasiparticle and condensate dynamics in response to terahertz optical pulses in superconducting semiconductor quantum wells. II. $(s+p)$ -wave superconductivity in the strong spin-orbit coupling limit”, [Phys. Rev. B **96**, 155312 \(2017\)](#).
12. **T. Yu** and M. W. Wu, “Gauge-invariant theory of quasiparticle and condensate dynamics in response to terahertz optical pulses in superconducting semiconductor quantum wells. I. s -wave superconductivity in the weak spin-orbit coupling limit”, [Phys. Rev. B **96**, 155311 \(2017\)](#).
11. **T. Yu** and M. W. Wu, “Quasiparticle spin relaxation with superconducting-velocity-tunable state in GaAs (100) quantum wells in proximity to s -wave superconductor”, [Phys. Rev. B **94**, 205305 \(2016\)](#).
10. **T. Yu** and M. W. Wu, “Gapped triplet p -wave superconductivity in strong spin-orbit-coupled semiconductor quantum wells in proximity to s -wave superconductor”, [Phys. Rev. B **93**, 195308 \(2016\)](#).
9. **T. Yu** and M. W. Wu, “Valley depolarization dynamics and valley Hall effect of exciton in mono- and bilayer MoS_2 ”, [Phys. Rev. B **93**, 045414 \(2016\)](#).
8. **T. Yu** and M. W. Wu, “Spin diffusion in ultracold spin-orbit coupled ^{40}K gas”, [Phys. Rev. A **92**, 013607 \(2015\)](#).
7. **T. Yu** and M. W. Wu, “Hot-electron effect in spin relaxation of electrically injected electrons in intrinsic Germanium” ([IOP select](#)), [J. Phys.: Condens. Matter **27**, 255001 \(2015\)](#).
6. **T. Yu** and M. W. Wu, “Theory of optical spectra and depolarization dynamics in bilayer WS_2 from viewpoint of excimers”, [Phys. Rev. B **90**, 035437 \(2014\)](#).
5. **T. Yu** and M. W. Wu, “Valley depolarization due to inter- and intra-valley electron-hole exchange interactions in monolayer MoS_2 ”, [Phys. Rev. B **89**, 205303 \(2014\)](#).
4. **T. Yu** and M. W. Wu, “Anomalous D’yakonov-Perel’ spin relaxation in InAs (110) quantum wells under strong magnetic field: Role of Hartree-Fock self-energy”, [Phys. Rev. B **89**, 045303 \(2014\)](#).
3. Y. Zhou, **T. Yu**, and M. W. Wu, “Anomalous D’yakonov-Perel’ spin relaxation in semiconductor quantum wells under strong magnetic field in Voigt configuration”, [Phys. Rev. B **87**, 245304 \(2013\)](#).
2. **T. Yu** and M. W. Wu, “Spin relaxation in ultracold spin-orbit coupled ^{40}K gas”, [Phys. Rev. A **88**, 043634 \(2013\)](#).
1. X. Z. Liu, **T. Yu** (theory), Q. P. Wei, Z. M. Yu, and X. Y. Xu, “Enhanced diamond nucleation on copper substrates by employing an electrostatic self-assembly seeding process with modified nanodiamond particles”, [Colloids and Surface A: Physicochem. Eng. Aspects **412**, 82 \(2012\)](#).

CONFERENCES

11. **T. Yu**, “*Chiral spintronics with magnetic insulators*” (**invited**), oral presentation at “Sol-SkyMag 2021 conference”, San Sebastian, **Spain**, June 21-24, 2021.
10. **T. Yu**, “*Nonreciprocal surface magnetoelastic dynamics*” (**invited**), oral presentation at “Spin Mechanics VII”, Gerolfingen, **Germany**, August 9-12, 2021.
9. **T. Yu**, “*Pairing Nature and Optical Control of Superconducting State in Magic-Angle Twisted Bilayer Graphene*”, oral presentation at APS March Meeting (online), **USA**, March 15-19, 2021.
8. **T. Yu**, “*Microscopic mechanism of level attraction from coherence-dissipation competition*”, poster presentation at “GRC Spin Dynamics in Nanostructures” conference, Les Diablerets, **Switzerland**, July 6-12, 2019.
7. **T. Yu**, “*Chiral pumping of spin waves*” (**invited**), invited presentation at “Spin Caloritronics X” conference, Groningen, **The Netherlands**, May 20-24, 2019.
6. **T. Yu**, “*Surface dynamics of magnons*” (**invited**), oral presentation at “Collective Spin Dynamics in Nanostructures” conference, KITP Beijing, **China**, October 1-20, 2018.
5. **T. Yu**, “*Gauge-invariant theory of quasiparticle and condensate dynamics in response to THz optical pulses in superconductor*”, poster presentations at SPICE, Mainz, **Germany**, May 15-18, 2018.
4. **T. Yu** and M. W. Wu, “*Gapped triplet p-wave superconductivity in strong spin-orbit-coupled semiconductor quantum wells in proximity to s-wave superconductor*” and “*Quasiparticle spin relaxation with superconducting-velocity-tunable state in GaAs (100) quantum wells in proximity to s-wave superconductor*”, oral and poster presentations at APS March Meeting, New Orleans, Louisiana, **USA**, March 13-17, 2017.
3. **T. Yu** and M. W. Wu, “*Spin diffusion in ultracold spin-orbit coupled ^{40}K gas*” and “*Valley depolarization dynamics and valley Hall effect of exciton in mono- and bilayer MoS_2* ”, oral presentations at APS March Meeting, Baltimore, Maryland, **USA**, March 14-18, 2016.
2. **T. Yu** and M. W. Wu, “*Theory of optical spectra and depolarization dynamics in bilayer WS_2 from viewpoint of excimers*”, poster presentation at Fundamental optical processes in semiconductors (FOPS)-2015, Breckenridge, CO, **USA**, August 2-7, 2015.
1. **T. Yu** and M. W. Wu, “*Spin relaxation in ultracold spin-orbit coupled ^{40}K gas*”, oral presentation at the 15th magnetic meeting, Guilin, **China**, Nov. 15-20, 2013.

REFERENCES

—Theorists:

1. Prof. Dr. Gerrit E. W. Bauer
 Institute for Materials Research & WPI-AIMR & CSRN
 Tohoku University
 Sendai 980-8577, Japan
 Email: G.E.Bauer@tudelft.nl

2. Prof. Dr. Michael A. Sentef
Max Planck Institute for the Structure and Dynamics of Matter
Institute for Theoretical Physics, University of Bremen
22761 Hamburg, Germany
Email: michael.sentef@mpsd.mpg.de

3. Prof. Dr. Dante M. Kennes
Department of Physics
RWTH Aachen University
Aachen, 52056 Germany
Email: Dante.Kennes@rwth-aachen.de

—**Experimentalists:**

4. Prof. Dr. Toeno van der Sar
Kavli Institute of Nanoscience
Delft University of Technology
Lorentzweg 1, 2628 CJ Delft, The Netherlands
Email: t.vandersar@tudelft.nl

5. Prof. Dr. Can-Ming Hu
Department of Physics and Astronomy
University of Manitoba
Winnipeg, Canada R3T 2N2
Email: Can-Ming.Hu@umanitoba.ca