Spin Summit 2017

Jinggangshan | 井冈山

August 14 – 18, 2017

Dear Participants:

Welcome to Spin Summit 2017! Spin Summit 2017 is the first workshop of the Spin Summit series focusing on the fundamental and applied aspects of spintronics. The meeting will take place in August 14 ~ 18, 2017 in the scenic mountain of Jinggangshan, Jiangxi Province, China.

The program for Spin Summit 2017 includes 29 invited oral presentations and about 30 poster presentations. By bringing together the researchers from China and abroad, the workshop aims to promote effective and mutually beneficial interactions among the participants with plenty of formal and informal discussion time.

We look forward to an inspiring week of scientific discussions, and wish you a fruitful and rewarding experience at Jinggangshan.

On Behalf of the Organizing Committee

Prof. Jiang Xiao & Prof. Haiming Yu

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General Information

Organizing Committee

Chair	Jiang Xiao	Fudan University
Vice Chair	Haiming Yu	Beihang University
Local Chair	Xiaoguang Yu	Jinggangshan University
Committee	Ke Xia	Beijing Normal University
	Xiufeng Han	Institute of Physics, CAS
	Jian Shen	Fudan University
	Qianglin Hu	Jinggangshan University
	Xiaobing Luo	Jinggangshan University
Secretary	Xinyi Zhu	Fudan University

The Vice Chair of current workshop will be the Chair for the next Spin Summit workshop.

Sponsors

- Fudan University
- Jinggangshan University
- Collaborative Innovation Center of Advanced Microstructures (CICAM)
- State Key Laboratory of Surface Physics
- Center for Quantum Control of Fudan University
- Program of Introducing Talents of Discipline to Universities (111 Project B06011)

Venue

Venue Jinggangshan Zhongtailai International Hotel

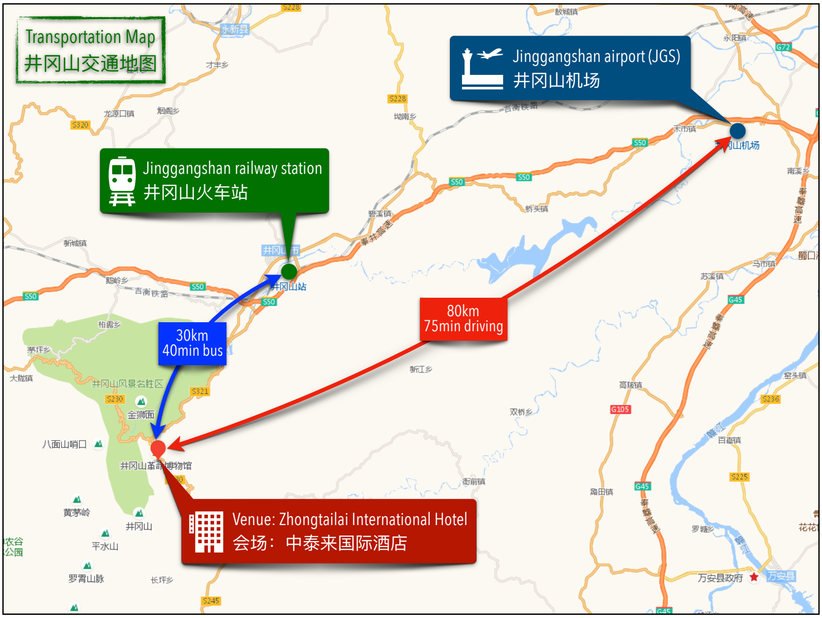
井冈山中泰来国际大酒店

Address 29 Hongjun South Road
Jinggangshan 343600, Jiangxi Province, China

江西省吉安市井冈山市茨坪镇红军南路29号
邮编：343000

- All scientific activities, including talks, poster session, and tea breaks, will take place in the Huangyangjie Hall (黄洋界厅).
- The dinner on the first day of the workshop (August 14) and the lunch on the following days (August 15 - 18) will be pre-arranged as buffet meal by the organizer at the hotel. And they are all free-of-charge for all participants and all accompany persons.
- The dinner on August 15 - 18 are NOT pre-arranged. All participants are encourage to explore the small town of Ciping to enjoy the numerous restaurants.

Maps & Transportation



- **By air**: The Jinggangshan Airport (JGS) is about 80km away from the venue. The taxi from the airport to the venue takes about 75 minutes and 300 RMB.
- **By rail**: The Jinggangshan Railway station is about 30km from the venue. The bus from the station to the Ciping town *Bus station* (see map below) takes about 40 minutes and 5 RMB.
- **Car rental at airport**: Check http://www.ctrip.com.
- **The town of Ciping** (see map below) is small, basically everything is within walking distance.
- It is NOT possible to drive to other scenic area of Jinggangshan by private cars. To reach those areas, you have to take the tourist bus at the *Tourist Bus station* shown on the map.


Ciping town Map
茨坪镇地图
North
Tourist Bus station
旅游区汽车站
Lots of food here
天街
Bus station
汽车站
Venue 会场
500 m
挹翠湖
井冈山汽车站
井冈山体育馆
天乐府大酒店
天街购物广场
井冈山饭店
南山公园
井冈山人民医院
黄竹坳路
长坑路

Outdoor Activities

- The big Jinggangshan contains 11 scenic zones and 76 scenic spots with a total area of 261 square km. The ticket accessing all scenic spots costs about 280 RMB and is valid for 5 days via fingerprint access.
- There are also several nice hiking trails that do not require purchasing tickets. Please inquire at the front desk.

Scientific Program

Monday (August 14)	
07:00 - 14:42	Arrival and Register
14:06 - 15:12	Tea time
15:12 - 17:00	**Poster session**
17:00 - 19:00	Buffet dinner
19:00 - 19:36	**Spin Peltier effect** Sadamichi Maekawa *Japan Atomic Energy Agency*
19:36 - 20:12	**STT-MRAM and Interface Spintronics** Tai Min *Xi'an Jiaotong University*
20:12 - 20:20	**Opening remarks**

Tuesday (August 15)	
07:00 - 08:30	Breakfast
08:30 - 09:06	**Theoretical issues of magnons in magnetic insulators** Gerrit E. W. Bauer *Tohoku University*
09:06 - 09:42	**Spin Seebeck effect and Magnon Drag Effect in YIG/Metallic Hybrid Structures** Caihua Wan *Institute of Physics, Chinese Academy Sciences*

09:42 - 10:18	**Magnon-polaron transport in magnetic insulators** Ka Shen *Delft University of Technology*
10:18 - 10:48	Tea time
10:48 - 11:24	**Current-induced magnetization switching in atom-thick tungsten engineered perpendicular magnetic tunnel junctions with large tunnel magneto-resistance** Weisheng Zhao *Beihang University*
11:24 - 12:00	**Spin-torque oscillators based on magnetoresistance effect** Zhongming Zeng *Suzhou Institute of Nano-Tech and Nano-Bionics, CAS*
12:00 - 13:30	Buffet lunch
13:30 - 17:00	Informal discussions
17:00 - 19:00	Self-organized dinner
19:00 - 19:36	**Condensation and superfluidity in magnetic insulators** Yaroslav Tserkovnyak *University of California, Los Angeles*
19:36 - 20:12	**One minute Oral Introduction for Posters**
20:12 - 21:00	**Poster Session**

Wednesday (August 16)	
07:00 - 08:30	Breakfast
08:30 - 09:06	**Skyrmion Topological Spintronics** Wanjun Jiang *Tsinghua University*

09:06 - 09:42	**Single skyrmion creation by magnetic field pulses** Alireza Qaiumzadeh *Norwegian University of Science and Technology*
09:42 - 10:18	**Strain-controlled Skyrmion Creation, Annihilation and Propagation in Ferroelectric/Ferromagnetic Hybrid systems** Na Lei *Beihang University*
10:18 - 10:48	Group photo & Tea time
10:48 - 11:24	**Three-dimensional localized spin textures in chiral magnets** Haifeng Du *High Magnetic Field Laboratory, Chinese Academy of Sciences*
11:24 - 12:00	**Spin-torque driven magnetic droplet dynamics** Yaowen Liu *Tongji University*
12:00 - 13:30	Buffet lunch
13:30 - 14:06	**Spin-valley phenomena in van der Waals heterobilayer moire** Wang Yao *University of Hong Kong*
14:06 - 14:42	**Spintronics at FM-topological insulator interface** Wei Han *Peking University*
14:42 - 15:12	Tea time
15:12 - 17:00	**Poster session**
17:00 - 19:00	Banquet dinner (Location TBD)

Thursday (August 17)

07:00 - 08:30	Breakfast
08:30 - 09:06	**Magnonic Topological Insulator and Spin Waves Devices** Xiangrong Wang *Hong Kong University of Science and Technology*
09:06 - 09:42	**Interplay between spin wave and domain wall in quasi-one-dimansional perpendicular- magnetic-anisotropy materials** Shang-Fan Lee *Academia Sinica*
09:42 - 10:18	**Spin wave polarization in antiferromagnetic domain wall** Jin Lan *Fudan University*
10:18 - 10:48	Tea time
10:48 - 11:24	**Cavity Spintronics** Can-Ming Hu *University of Manitoba*
11:24 - 12:00	**Ultrafast spin exchange-coupling torque via photo-excited charge-transfer processes** Haibin Zhao *Fudan University*
12:00 - 13:30	Buffet lunch
13:30 - 17:00	Informal discussions
17:00 - 19:00	Self-organized dinner
19:00 - 19:36	**Magnetization dynamics in Rashba ferromagnets from microscopic theory** Mikhail Titov *Radboud University*

19:36 - 20:12	**Spin Hall angle and spin diffusion length of Pt and Pd** Haifeng Ding *Nanjing University*
20:12 - 21:00	**Poster Session**

Friday (August 18)

07:00 - 08:30	Breakfast
08:30 - 09:06	**Spintronics based on Antiferromagnets and Ferrimagnets** Kyung-Jin Lee *Korea University*
09:06 - 09:42	**Manipulation of antiferromagnetic moments** Cheng Song *Tsinghua University*
09:42 - 10:18	**Magnetization dissipation in antiferromagnetic materials** Zhe Yuan *Beijing Normal University*
10:18 - 10:48	Tea time
10:48 - 11:24	**Non-volatile Memory with Zero Magnetic Moment** Luqiao Liu *Massachusetts Institute of Technology*
11:24 - 12:00	**Antiferromagentic proximity effect and domain switching in single crystalline antiferromagentic films** Yizheng Wu *Fudan University*
12:00 - 13:30	Buffet lunch
13:30 - 17:00	Informal discussions

17:00 - 19:00	Self-organized dinner
19:00 - 19:36	**Determining spin-orbit torques easily: new domain wall depinning analysis scheme in comparison to spin torque magnetometry** Kyujoon Lee *Johannes Gutenberg University Mainz*
19:36 - 20:12	**Observation of spin-orbit magnetoresistance in metal films on magnetic insulators** Di Wu *Nanjing University*
20:12 - 20:20	**Closing Remarks**

	Saturday (August 19)
07:00 - 08:30	Breakfast
08:30 -	Departure

Abstracts for Invited Talks

T01: Single skyrmion creation by magnetic field pulses

Alireza Qaiumzadeh

Norwegian University of Science and Technology

Skyrmions, nanoscale swirling magnetic structures, are topological solitons that might be utilized as magnetic bits in the next generation of compact memory devices, thanks to their small size and intrinsic stability. It is believed that nano-scale static skyrmions with a fixed topological number Q=\pm 1, are stabilized in the presence of a chiral Dzyaloshinskii-Moriya interaction (DMI), so-called DMI stablized skyrmions while long-range dipole interaction stabilizes bubble skyrmions with an integer topological number and much larger diameters.

In this talk I will present our recent proposal for ultrafast creation of isolated skyrmions in a collinear ferromagnetic sample with finite DMI by applying a short (effective) magnetic field pulse. We examine the phase diagram of pulse width and amplitude for the nucleation and show how a spin-wave instability, via magnonic spin-orbit torques, destabilizes the uniform ground state and transforms it to a metastable skyrmionic state. Our finding could ultimately be used to design future skyrmion-based devices [1].

[1] V. Flovik, A. Qaiumzadeh, A. K. Nandy, C. Heo, and Theo Rasing, arXiv:1703.05181

Spin Seebeck effect and Magnon Drag Effect in YIG/Metallic Hybrid Structures

Caihua Wan

Institute of Physics, Chinese Academy of Sciences

Spin caloritronics, aiming to reuse exponentially growing waste energy in current nanoelectronics, has gradually evolved as a main branch of spintronics. Among different thermo- and magneto-transport phenomena, spin Seebeck effect (SSE) in ferromagnetic insulators are most attractive because of their capabilities to harvest pure spin current via thermal gradient. In this talk, we will first ambiguously show that SSE can not only be observed in heavy metals YIG/Cu/Pt but also in normal ferromagnetic metals such as YIG/Interlayer/Permalloy systems [1]. The spin Hall angle of permalloy obtained from this experiment is nearly comparable to that of Pt, which indicates application potentials of permalloy in spin-orbitronics. Second we will also demonstrate a clear evidence of magnon-drag effect in Pt/YIG/Pt system besides of the SSE [2]. Our experimental results show that this effect could also be used as a powerful tool to transfer "angular momentum" information over long distances even in polycrystalline YIG system. Above all, YIG, a typical ferrimagnetic insulator has been demonstrated as both excellent spin current resource and transport channel for the coming spin caloritronic or even magnonic applications.

[1] H. Wu et al., Phys. Rev. B, 92, 054404 (2015).
[2] H. Wu et al., Phys. Rev. B, 93, 060403(R) (2016).

Cavity Spintronics

Can-Ming Hu

University of Manitoba

Strong coupling between magnons and microwave photons has recently been theoretically proposed [1] and experimentally investigated using both microwave transmission [2-4] and electrical detection methods [5]. These works build the foundation for the emerging field of Cavity Spintronics [6], where the development of spintronics merges with the advancement in cavity quantum electrodynamics and cavity polaritons, creating new theoretical and experimental avenues for studying wave physics, developing quantum technology, and facilitating spintronics applications.

Based on the achievements of pioneers of Cavity Spintronics, this talk aims to provide a brief introduction of this exciting new frontier of condensed matter physics research to colleagues working on magnetism, spintronics, microwave and quantum technologies. Some of the recent work done by our group at the University of Manitoba, in collaborations with John Xiao's group at University of Delaware, Chia-Ling Chien'group at Johns Hopkings University, Hong Guo's group at McGill University, Wei Lu's group at Chinese Academy of Science, Yang Xiao's group at Nanjing University of Aeronautics and Astronautics, Jianqiang You's group at Beijing Computational Science Research Center, and Sebastian Goennenwein's group at Walther-Meißner-Institut, will be reported [5-8].

[1] Ö. O. Soykal and M. E. Flatté, Phys. Rev. Lett. 104, 077202 (2010).
[2] H. Huebl, C.W. Zollitsch, J. Lotze, F. Hocke, M. Greifenstein, A. Marx, R. Gross, and S. T. B. Goennenwein, Phys. Rev. Lett. 111, 127003 (2013).
[3] Y. Tabuchi, S. Ishino, T. Ishikawa, R. Yamazaki, K. Usami, and Y. Nakamura, Phys. Rev. Lett. 113, 083603 (2014).
[4] X. Zhang, C.-L. Zou, L. Jiang, and H. X. Tang, Phys. Rev. Lett. 113, 156401 (2014).
[5] L.H Bai, M. Harder, Y. P. Chen, X. Fan, J. Q. Xiao, and C.-M. Hu, Phys. Rev. Lett. 114, 227201 (2015).
[6] C.-M. Hu, Phys. Canada, 72, 76 (2016); arXiv: 1508.01966.
[7] B.M. Yao, Y.S. Gui, Y. Xiao, H. Guo, X.S. Chen, W. Lu, C.L. Chien, C.-M. Hu, Phys. Rev. B, 92, 184407 (2015).
[8] For more information, please check: http://www.physics.umanitoba.ca/~hu/

Manipulation of antiferromagnetic moments

Cheng Song

Tsinghua University

After the observation of tunneling anisotropic magnetoresistance (TAMR) at room temperature in antiferromagnet-based junctions [1], recently we provided an alternative approach to obtaining TAMR in alfa'-FeRh-based junctions driven by the magnetic phase transition of alfa'-FeRh and resultantly large variation of the density of states in the vicinity of MgO tunneling barrier, referred to as phase transition tunneling anisotropic magnetoresistance (PT-TAMR). The junctions with only one alfa'-FeRh magnetic electrode show a PT-TAMR ratio up to 20% at room temperature. The difference between experimental and theoretical values, obtained by k-resolved transmission distribution calculation, is mainly ascribed to the natural formation of one unit cell-thick non-magnetic gamma-FeRh at the alfa'-FeRh/MgO interface. Both the polarity and magnitude of the PT-TAMR can be modulated strongly by interfacial engineering at the alfa'-FeRh/MgO interface [2]. Besides the magnetic field, some recent progresses on the modulation or switching of antiferromagnetic stacks by electrical means, electric field [3] and current [4], would be also briefly discussed.

[1] Y.Y. Wang, et al. Phys. Rev. Lett. 109, 137201 (2012)
[2] X.Z. Chen, et al. Nature Commun. accepted (2017)
[3] Y.Y. Wang, et al. Adv. Mater. 27, 3196 (2015)
[4] G.Y. Shi, et al. Phys. Rev. B 95, 104435 (2017)

Observation of spin-orbit magnetoresistance in metal films on magnetic insulators

Di Wu

Nanjing University

A new type of magnetoresistance (MR) effect is observed in a bilayer structure Cu[Pt]/Y3Fe5O12 (YIG), where the Cu/YIG interface is decorated with nanosize Pt islands. Although having the same angular dependence on the magnetization direction as the spin Hall MR (SMR), this new MR is apparently not caused by the SMR from either Cu or Pt because of the negligible spin-orbit coupling in Cu and the discontinuity of the Pt islands. This MR almost disappears when the Pt islands are absent or located away from the Cu/YIG interface, evidencing the indispensable role of the Pt decoration of the Cu/YIG interface. Together with the first principle calculations and the numerical Boltzmann simulations, which reproduce the angular- and Cu thickness-dependences of the observed MR, we demonstrate that it is the predicted [Phys. Rev. B 90, 161412(R) (2014)] spin-orbit MR caused by the Rashba spin-orbit coupling at Cu/YIG interface enhanced by Pt decoration.

Theoretical issues of magnons in magnetic insulators

Gerrit E. W. Bauer

Tohoku University

Magnetic insulators are a class of versatile materials with great technological importance. The most important magnetic insulators are arguably the man-made yttrium iron garnet (YIG), ferrimagnet with Curie transitions far above room temperature and record magnetic quality [1-2]. It is the material of choice to study spin waves or magnons that live in the GHz until THz band.

Magnons in insulators can be excited by microwaves, light absorption and scattering, and thermal gradients, as well as by heavy-metal electric contacts. They are detected magneto-optically as well as electrically. The process between magnon creation and annihilation is governed by transport, which can be ballistic as well as diffuse. Difficulties in understanding magnons in YIG stem from the complicated spin wave band structure and the coupling between magnons and phonons. The interaction with photons as enhanced by cavities or plasmonic effects opens new vistas to manipulate magnons.

The present talk addresses theoretical issues of magnon physics in YIG and their experimental relevance [3-8].

[1] V. Cherepanov, I. Kolokolov, V. L'vov, The Saga of YIG: Spectra, Phys. Rep. 229, 81 (1993).
[2] M. Wu and A. Hoffmann (eds.), Solid State Physics 64, 1 (2013).
[3] K. Shen et al., Phys. Rev. Lett. 115, 197201 (2015).
[4] J. Barker et al., Phys. Rev. Lett. 117, 217201 (2016).
[5] B. Flebus et al., Phys. Rev. B 95, 144420 (2017).
[6] S. Sharma et al., arXiv:1706.04106.
[7] L.J. Cornelissen et al., arXiv:1706.04373
[8] B. Zare Rameshti et al., to be published.

Ultrafast spin exchange-coupling torque via photo-excited charge-transfer processes

Haibin Zhao

Fudan University

Control of coherent spin precession in ferromagnets is currently a popular topic due to its importance in magnetic recording and spintronic devices. The search for non-thermal excitation mechanisms motivates extensive research to overcome the disadvantages of thermal ones. The main idea is to utilize the interaction between magnetization and photo-excited carriers that are selectively optical pumped, where the recombination time of photocarriers is much shorter than the heat diffusion process. A promising approach is through ferromagnetic–antiferromagnetic (FM–AFM) exchange coupling, as small modulation of the exchange-coupling strength might lead to notable changes in magnetic properties. Recent studies demonstrated that short laser pulses can introduce non-thermal spin reorientation and dynamics in AFM materials much faster than in FM materials. But the question is still open whether it is possible to drive FM magnetization at the speed of AFM materials through FM–AFM exchange across heterostructure interface. In this talk, I will present optical excitation of spin precession in Fe/CoO exchange-coupled heterostructure using time-resolved magneto-optic Kerr effect (TRMOKE) [1, 2]. Photoexcited charge-transfer processes in AFM CoO layer create a strong transient exchange-coupling torque on FM Fe layer through FM–AFM exchange coupling. The efficiency of spin precession excitation is significantly higher and the recovery is notably faster than the thermal induced demagnetization procedure. This efficient excitation mechanism originates from the modulation of the uniaxial magnetic anisotropy induced by the FM/AFM exchange coupling. Our results will help promote the development of low-energy consumption magnetic device concepts for fast spin manipulation at room temperature.

[1] Z. Zheng, Y. Z. Wu, H. B. Zhao, et al., Appl. Phys. Lett. 110, 172401 (2017).
[2] X. Ma, H. B. Zhao, G. Luepke, et al., Nature Communications 6, 8800 (2015).

Spin Hall angle and spin diffusion length of Pt and Pd

Haifeng Ding

Nanjing University

We resolve the controversy over the quantification of the spin Hall angle (SHA) and spin diffusion length (SDL) of the nonmagnetic (NM) metals of Pt and Pd by spin pumping with various ferromagnetic (FM) pumping sources. The pumped spin current not only transmits and reflects at the FM/NM interface, but also suffers an interfacial spin loss (ISL) whose magnitude varies for different interfaces. The spin-charge conversion and ISL are investigated for Pt and Pd with various FM combinations as a function of FM and NM layer thicknesses by means of (i) effective spin mixing conductance, (ii) microwave photo-resistance, and (iii) inverse spin Hall effect measurements. By taking into account the ISL, we obtain consistent values of SHA and SDL for Pt and Pd, regardless of the ferromagnet used.

Three-dimensional localized spin textures in chiral magnets

Haifeng Du

High Magnetic Field Laboratory, Chinese Academy of Science

The emergence of a topologically nontrivial vortex-like magnetic structure, the magnetic skyrmion, has launched new concepts for memory devices. Extensive studies have theoretically demonstrated the ability to encode information bits by using a chain of skyrmions in confined geometries. So far it is generally assumed that skyrmion is two-dimensional (2D) localized magnetic structure. In this talk, we report experimental evidence of three-dimensional (3D) skyrmions in confined helimagnets. The 3D skyrmion will give rise lots of novel phenomena that can not be observed in 2D one. Moreover, we report the discovery of another 3D localized spin texture, termed as magnetic bobber, in chiral magnets.

[1]. Du, H. F., et al., Nature Communications., 6, 8506 (2015)
[2]. Zhao X. B., and Du H. F., et al., PNAS, 113, 4918 (2016)
[3]. Wang. C., and Du H. F., et al., Nano Letters (2017)
[4]. Jin. C. M., and Du H. F., et al., Nature Communications., (2017)

Spin wave polarization in antiferromagnetic domain wall

Jin Lan

Fudan University

As a collective quasiparticle excitation of the magnetic order in magnetic materials, spin wave, or magnon when quantized, can propagate in both conducting and insulating materials. Manipulating spin waves by using magnetic textures on the same magnetic materials provide more reconfigurabilites than structures based on different magnetic materials. As interface between domains, magnetic domain wall is the simplest magnetic texture widely existing in magnetic materials. Here we study the behaviors of the bound-state and scattering-state spin waves in ferromagnetic and antiferromagnetic domain walls. Specifically, we investigate the role of the polarization degree of freedom of spin waves in the antiferromagnetic case. We propose that the domain wall can be used to effective control the behaviors of the spin waves, therefore can be used to construct various spin wave devices. Inversely, we study the domain wall motion by spin waves, and show that domain wall can be effectively manipulated by controlling the linear polarization direction of spin waves.

Magnon-polaron transport in magnetic insulators

Ka Shen

Delft University of Technology

We theoretically study the transport properties of magnon polaron, the hybridization states of the magnon and phonon in the presence of magnetoelastic coupling in magnetic insulators. We will discuss the coherent dynamics of magnon polaron induced by a focused ultrafast laser[1,2], as well as the incoherent transport in spin Seebeck configuration [3,4]. Specifically, for the former case, we will show the different propagating characteristics due to thermal (laser heating) and non-thermal (magneto-optical) effects, while for the latter one, we will analyze the origin of the anomaly in the magnetic field dependence of spin Seebeck coefficients.

[1] Shen and Bauer, PRL 115, 197201 (2015)
[2] Hashimoto et al., Nature Commnun. 8, 15859 (1017)
[3] Kikkawa et al., PRL 117, 207203 (2016)
[4] Flebus et al., PRB 95, 144420 (2017)

Determining spin-orbit torques easily: new domain wall depinning analysis scheme in comparison to spin torque magnetometry

Kyujoon Lee

Johannes Gutenberg-Universität Mainz

In spintronics, an efficient method for manipulating magnetization in magnetic materials is a key issue. Spin transfer torque (STT) uses a spin-polarized current to manipulate the magnetization [1]. STT was initially the mechanism used for current induced domain wall motion (CIDWM). However, for applications in racetrack memories more efficient torques are needed. Recently the new concept of spin orbit torques (SOT) has been discovered and studied by many groups [2-4]. One source of SOTs is the spin orbit interaction at the interface of a heavy normal metal and a ferromagnetic layer due to the inverse spin galvanic effect and a second source is the bulk spin Hall effect. The resulting transfer of >1hbar/electron enables magnetization manipulation with high efficiency.

We have determined the SOTs by spin torque magnetometry [5] in Ta(5 nm) \Co20Fe60B20(1 nm)\MgO(2 nm) nanostructures. In analyzing the spin torque magnetometry signals, we have employed different methods of analysis for the SOTs at different magnetization tilting angles [6-8]. Based on the angular dependence of the spin-orbit torques we calculate the non-trivial corresponding current equivalent effective out-of-plane fields acting on a domain wall (DW). The effective fields of the SOT were for comparison measured by depinning measurements [9]. By developing a 1D model we compared the effective field values measured by the two different methods and find that the effective field measured by the depinning technique is proportional but not equal to the effective fields measured by spin torque magnetometry. By comparing these different techniques to quantify the spin-orbit torques [6-8], we ascertain their reliability to describe and predict spin texture dynamics such as domain wall motion. The combined results allow us to develop a robust method to quantify the torques reliably, which is a key step to the development of novel systems with tailored torques [10].

[1] O. Boulle et al., Mater. Sci. Eng. R 72, 159, (2011);
[2] I. M. Miron et al., Nat. Mater. 9, 230 (2010);
[3] K. Garello et al., Nat. Nanotechnol. 8, 587 (2013);
[4] R. Lo Conte et al., Phys. Rev. B 91, 014433 (2015);
[5] T. Schulz et al. to be submitted (2016);
[6] Kim, J. et al. Nat. Mater. 12, 240 (2013);
[7] Garello, K. et al. Nat. Nanotech. 8, 587 (2013);
[8] Fan, Y. et al. Nat. Mater. 13, 699 (2014);
[9] Schulz, T. et al. Appl. Phys. Lett. 107, 122405 (2015);
[10] Schulz, T. et al. Phys. Rev. B 95, 224409 (2017).

Spintronics based on Antiferromagnets and Ferrimagnets

Kyung-Jin Lee

Korea University

Spintronics is a multidisciplinary field whose central theme is the active manipulation of spin degrees of freedom in solid-state systems [1]. The core magnetic system for spintronics research has been ferromagnets since they serve as spin-polarizers/detectors and offer non-volatile memory and logic technologies. Recently, much effort has been expended in employing antiferromagnets as core elements in spintronic applications because of their immunity to external magnetic fields and fast dynamics [2-8]. In this talk, I will review the recent progress of antiferromagnetic spintronics. Furthermore, I will also discuss several recent studies using ferrimagnets, which exhibit both ferromagnetic and antiferromagnetic properties in spin transport and dynamics and provides a way to merge advantages of two extreme magnetic systems.

[1] I. Zutic, J. Fabian, and S. Sarma, Rev. Mod. Phys. 76, 323 (2004).
[2] T. Wungwirth, X. Marti, P. Wadley, and J. Wunderlich, Nat. Nano. 11, 231 (2016).
[3] P. Wadley et al., Science 351, 587 (2016).
[4] S. Fukami et al., Nat. Mat. 15, 535 (2016).
[5] Y.-W. Oh et al., Nat. Nano. 11, 878 (2016).
[6] R. Cheng et al., Phys. Rev. Lett. 113, 207603 (2016).
[7] O. Gomonay, T. Jungwirth, and J. Sinova, Phys. Rev. Lett. 117, 017202 (2016).
[8] T. Shiino et al, Phys. Rev. Lett. 117, 087203 (2016).

Non-volatile Memory with Zero Magnetic Moment

Luqiao Liu

Massachusetts Institute of Technology

There has been great interest recently in using antiferromagnetic materials (AFM) as opposed to FM to store information. Compared with FM, AFM exhibit fast dynamics as well as robust protection against external magnetic fields, which can enable spintronic devices with fast speed and high density. However, the cancellation of total magnetic moment and the disappearance of magnetoresistance effect in AFM pose great difficulties on developing spintronic devices out of them. In this talk, I will discuss our recent study on rare earth based ferrimagnetic alloys which has antiferromagnetically coupled sublattices, net zero magnetic moment and electrically controllable magnetic state. Particularly, I will show that the inequality of the two sub-lattices provides finite electrical signal for convenient reading mechanism and spin orbit torque (SOT) induces magnetic switching allows for efficient writing mechanism[1]. Moreover, I will also discuss our recent experiment work which integrates those compensated ferrimagnet with topological insulators, where the efficiency of spin orbit torque switching can are significantly improved [2].

[1] J. Finley, L. Q. Liu, Physical Review Applied, 6, 054001 (2016)
[2] J. Han, A. Richardella, S. S. Siddiqui, J. Finley, N. Samarth, and L. Liu. Preprint at arXiv: 1703.07470 (2017).

Magnetization dynamics in Rashba ferromagnets from microscopic theory

Mikhail Titov

Radboud University

Spin-orbit and spin-transfer torques are competing forces that drive magnetic domains in the heavy-metal/ferromagnet bi-layers in the presence of electric current. In this talk I present a microscopic theory of both effects that is obtained from generalised Kubo formalism for a disordered electron system and completely avoids the notion of spin currents and spin Hall effect. I also treat the Gilbert damping on the same footing. In this formalism the torques are naturally related to susceptibility tensors that can be evaluated microscopically for any given model. In this talk I mainly focus on the torques arising in a heavy-metal/ferromagnet bilayers and demonstrate that spin-orbit interactions are generally responsible for a giant enhancement of spin transfer toques. I show that as the result of spin-orbit coupling the so-called beta torque is naturally decoupled to the in-palne and out-of plane components that become different by several orders of magnitude. The same behaviour is characteristic for the Gilbert damping. Finally I discuss theory applications for spin torques arising in heterostructures involving topological insulators.

Strain-controlled Skyrmion Creation, Annihilation and Propagation in Ferroelectric/Ferromagnetic Hybrid systems

Na Lei

Beihang University

Magnetic skyrmions are topologically protected spin textures, which are experimentally observed in both bulk non-centrosymmetric crystals and interfacial symmetry broken thin film. Due to their small size, high stability and low current density required for motion, skyrmions exhibit great potential in high-density and low-power spintronic devices. On the roadmap to future applications, the efficient creation, annihilation and manipulationof a single skyrmion in magnetic nanostructures are essential. Here the control of magnetic skyrmions creation, annihilation and pinning through strain is studied by micromagnetic simulations. A single stable skyrmion can be created by a vertical voltage pulse in Pd/Fe/Ir hybrid structure on Pb(Zr1-xTix)O3 nanowire with -1.8 V pulse voltage from 1.2 ns to 2.0 ns. Then the skyrmion is pinned by the vertical voltage independent of its polarity during its propagation along the wire driven by applied current. Alternatively, writing and erasing a magnetic skyrmion by strain are also proposed and studied for memory device to avoid Joule heating from current driving skyrmion motion. ±1.2V voltage pulses within 2.0 ns are applied to realize a cycle of the creation and annihilation. Experimentally, we report the observation of magnetic skyrmions inPt/Co/W multilayers with interfacial Dzyaloshinskii–Moriya interaction (DMI) at room temperature. The magnetic structures of the film are examined by Lorentz transmission electron microscopy (LTEM) and magnetic force microscopy (MFM), and both labyrinth domain and skyrmions are observed with varying the magnetic field. The magnetic skyrmions diameters are around 120nm. Qualitative and quantitative analyses of DMI coefficient in Pt/Co/W multilayers are performed through domain wall creep by magneto-optical Kerr microscopy. The strain controlled skyrmion creation and annihilation are also studied. The report of magnetic skyrmions in Pt/Co/W multilayers offer a new candidate with the large spin orbit torque from Pt and W, with which the high efficiency of current induced skyrmion motion could be expected.

Spin Peltier effect

Sadamichi Maekawa

Japan Atomic Energy Agency

The flow of electron spin, the so-called spin current, is a key concept in the recent progress in spintronics [1]. The generation of the spin current by heat is the spin Seebeck effect [2] and has been studied extensively [3]. Its reciprocal is the spin Peltier effect and has recently been reported [4,5].

We present the microscopic theory of the inter-conversion between heat and spin current in metal /ferromagnet hybrids [6,7].

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Interplay between spin wave and domain wall in quasi-one-dimansional perpendicular-magnetic-anisotropy materials

Shang-Fan Lee

Academia Sinica

Spin waves (SW) can induce rich domain wall (DW) motion in a perpendicular-magnetic-anisotropy (PMA) nanowire. For Bloch DWs, which usually exists in bulk materials and two-dimensional materials with PMA, the induced motions are relatively simple. For Néel DWs in thin and/or narrow wires, the induced motions can be forwards or backwards, with or without oscillations. In-plane magnetization tilt angle resulting from the fluctuation of the effective field of the magnetization response in the DW region plays an essential role in these dynamics of SW interacting with a DW. The transmission of the propagating SW is a complex function of the in-plane tilt angle, especially in the low-frequency regime. We performed simulations on a quasi-one-dimensional nanowire with PMA and established a one-dimensional analytical model, which considered three energy terms and successfully described the main features of the interaction between SW and DW.

STT-MRAM and Interface Spintronics

Tai Min

Xi'an Jiaotong University

Spin-transfer-torque (STT) MRAM has emerged as one of the most promising commercial candidate for future L2/L3 cache and DRAM replacement due to its non-volatility, fast read and write time, small size, infinite endurance and compatibility with CMOS technology. There are still many remaining challenges for commercialization of STT-MRAM as disruptive memory technology. Especially, how to reduce the critical switching current efficiently at sub-20nm dimension, the underline engineering challenge is related to the interface engineering of the critical magnetic tunneling junction. The interface engineering plays more and more important roles for low critical switching current while maintaining adequate thermal energy barrier, increasing tunneling magneto-resistance (TMR). In this talk, we will review the recent progress and outlook of STT-MRAM and its future development to the interface effects of atomic engineered magnetic heterojunctions.

Spin-valley phenomena in van der Waals heterobilayer moire

Wang Yao

University of Hong Kong

In monolayer transition metal dichalcogenides (TMDs), a newly emerged class of 2D semiconductors, the low energy carriers are described by massive Dirac cones located at K and -K corners of the hexagonal Brillouin zone. These massive Dirac Fermions at K and -K valleys, being time reversal of each other, have interesting phenomena associated with their valley index, including the valley optical transition selection rules, valley Hall effects, and valley magnetic moment, which enable the use of both valley and spin (via spin-valley coupling) as information carriers in electronics. Van der Waals stacking of 2D semiconductors into heterostructures further provides a powerful approach towards designer quantum materials that extend the exotic properties of the building blocks. As a generic aspect of these vdW heterostructures, the inevitable lattice mismatch always leads to the formation of Moiré pattern (i.e. periodic variation of local atomic registries). I will show that the vdW Moire can endow heterostructures unprecedented properties including: (i) electrically switchable lateral superstructures of topological insulators; (ii) nano-patterned spin optics, and spin-orbit coupled excitonic superlattices.

The work is supported by Croucher Foundation and the Research Grant Council of Hong Kong.

Skyrmion Topological Spintronics

Wanjun Jiang

Tsinghua University

Symmetry breaking together with a strong spin-orbit interaction give rise to many exciting opportunities for the condensed matter physics community. Topologically protected magnetic skyrmions are one of the examples. In this talk, I will first present our experimental progress in the electric creation and manipulation of magnetic skyrmions at room temperature in a common material system - heterostructures with an interfacial inversion symmetry breaking. This is enabled by the inhomogeneous current induced spin-orbit torques in a Ta/CoFeB/TaOx trilayer. Secondly, I will demonstrate experimentally a spin-topology driven dynamics of magnetic skyrmion – the skyrmion Hall effect. Namely, an accumulation of skyrmions at the transverse side of the device is experimentally achieved. Thirdly, strategy towards sub-50 nanometer skyrmions at room temperature in the absence of magnetic field will be discussed. Finally, some open questions and future focus points will be addressed.

Spintronics at FM-topological insulator interface

Wei Han

Peking University

Topological insulators (TIs), a class of quantum materials, have special gapless edge/surface states, where the spin polarization of the Dirac fermions is locked to the momentum direction. This spin–momentum locking property gives rise to very interesting spin-dependent physical phenomena such as the Edelstein and inverse Edelstein effects.

In this talk, I will first present our experimental results that demonstrate the inverse Edelstein effect in the surface states of a topological Kondo insulator, SmB6. At low temperatures when only surface carriers are present, a clear spin signal is observed. Furthermore, the magnetic field angle dependence of the spin signal is consistent with spin–momentum locking property of surface states of SmB6. The second part of my talk will focus on the exchange coupling between the spins in the topological surface states and the magnetization in a ferromagnetic insulator. The spin pumping efficiency can be greatly enhanced due to the topological surface states.

Current-induced magnetization switching in atom-thick tungsten engineered perpendicular magnetic tunnel junctions with large tunnel magneto-resistance

Weisheng Zhao

Beihang University

Perpendicular magnetic tunnel junctions (MTJs) based on MgO/CoFeB structures are of particular interest for spin-transfer torque magnetic random access memories (STT-MRAMs)[1]. However, the major challenge of combining both a large tunnel magnetoresistance ratio (TMR), strong interfacial perpendicular magnetic anisotropy (iPMA) and a low junction resistance are still to be met[2]. In this talk, we report STT switching in perpendicular MTJs consisting of double MgO/CoFeB interfaces and atom-thick W layers, which simultaneously demonstrate a TMR larger than 220% and a resistance area product lower than 7.5 Ω·μm2. High resonant tunneling transmission in the W capping layer contributes to the TMR being larger than with Ta [3]. The STT switching threshold current density is as low as 2.8 MA/cm2 for MTJ nano-pillars with a 45 nm radius thanks to the lower damping in the Co/W interface [4]. By using the capping layer design, strong iPMA can also be achieved [5-6].

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Magnonic Topological Insulator and Spin Waves Devices

Xiangrong Wang

Hong Kong University of Science and Technology

Magnetic materials are highly correlated spin systems that do not respect the time-reversal symmetry. The low-energy excitations of magnetic materials are spin waves whose quanta are magnons. Like electronic materials that can be topologically nontrivial, a magnetic material can also be topologically nontrivial with topologically protected edge spin waves. Unlike the normal spin waves that are very sensitive to the system changes and geometry, these edge spin waves are robust against internal and external perturbations such as geometry changes and spin wave frequency change. Therefore, the magnetic topological matter is of fundamental interest and technologically useful in magnonics. Here, we show that ferromagnetically interacting spins on a two-dimensional honeycomb lattice with nearest-neighbour interactions and governed by the Landau-Lifshitz-Gilbert equation, can be topologically nontrivial with gapped bulk spin waves and gapless edge spin waves. These edge spin waves are indeed very robust against defects under topological protection. An interesting functional magnonic device called beamsplitter and interferometer can be made out of a domain wall in a strip. It is shown that an in-coming spin wave beam along one edge splits into two spin wave beams propagating along two opposite directions on the other edge after passing through a domain wall.

Spin-torque driven magnetic droplet dynamics

Yaowen Liu

Tongji University

Magnetic droplets, localized in the nanocontact (NCs) in a magnetic thin film with perpendicular anisotropy, have recently received considerable attention because of their potential applications in the high frequency spin-torque nano-oscillators (STNOs) [1, 2]. In such type of STNOs, the energy dissipated by damping is compensated by the energy input from the current-induced STT effect, so that the droplet is expected to be strongly localized in the NC region and to have its spins precessing in phase around the film normal with a very large precession angle. In this talk, by using the micromagnetic simulations, we will present our recent study on the magnetic droplet dynamics. Firstly, we report a particular type of such internal dynamics—the perimeter excitation modes (PEMs) associated with periodic spatial deformations of the magnetic droplet perimeter [3]. Secondly, we have studied the stability of magnetic droplets and found that magnetic droplet soliton pairs, nucleated by two separated nano-contact spin torque oscillators, can merge into a single larger droplet soliton when the energy balance between the spin torque and damping is destroyed [4]. Furthermore, multiple droplets with a random initial phase can phase-lock into a single resonance state by using an oscillating microwave magnetic field [5]. Finally, we propose an effective approach to tuning magnetic droplet dynamics by using electric fields. Four types of dynamic modes, including droplet excitation, transition state, propagation spin wave mode, and chaotic state, are observed in an circular shaped magnetic tunnel junction through electric-field induced magnetic anisotropy change.

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Condensation and superfluidity in magnetic insulators

Yaroslav Tserkovnyak

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“Two-fluid” spin dynamics in magnetic insulators, which stands broadly for the interplay between the coherent and incoherent degrees of freedom, is attracting a growing interest in the fields of spintronics and nonequilibrium magnetism. I will review recent developments, both theoretical and experimental, including the problems of (1) thermoelectric pumping of magnonic condensates, (2) two-fluid theory of spin superfluidity and its spin Seebeck signatures, and (3) coherent control and detection of the spin chemical potential, all within a unified framework of nonequilibrium thermodynamics. At the core of the discussion will be quantum transport of heat and spin at interfaces and dynamic phase transitions associated with spontaneous coherence in the bulk.

Antiferromagentic proximity effect and domain switching in single crystalline antiferromagentic films

Yizheng Wu

Fudan University

Antiferromagnet(AFM) is one of fundamental magnetic systems, and now is attracting great attention to design new type of spintronics devices beyond the exchange bias effect. The spintronics devices based on AFM are predicted to realize stable high-density memory integration due to its zero moment and other nontrivial properties. In order to achieve better performance and new functionality, it is critic to have the capability to tune the AFM spin properties and switch the spin orientation in AFM domains. In this talk, I will talk about our recent studies on tuning the AFM spin orientation by the magentic proximity effect in NiO/CoO bilayer and studying the AFM domain switching in Fe/CoO(001) system.

Utilizing x-ray linear dichroism (XMLD) and magneto-optic Kerr effect (MOKE) measurement, we investigated antiferromagnetic proximity effect in epitaxial CoO/NiO/MgO(001) systems. We found NiO antiferromagnetic spin undergoes a spin reorientation transition from in plane to out of plane with increasing NiO thickness, with the existence of vertical exchange spring spin alignment in thick NiO. More interestingly, the Néel temperature of CoO layer was greatly enhanced by the adjacent NiO layer, with the enhancement closely depending on the spin orientation of adjacent NiO layer. This phenomenon was attributed to different exchange coupling strength at AFM/AFM interface depending on the relative spin directions. Our results indicate a new route to modify the AFM spin configuration and the AFM ordering temperature through magnetic proximity effect near room temperature, which should further benefit the designing of AFM spintronics devices.

In contrast to the extensive study of spin dynamics in ferromagnetic materials, spin switching dynamics in antiferromagnets is much less studied due to the difficulty of probing antiferromagnetic spins. We investigated AFM switching dynamics in single crystalline Fe/CoO bilayers on MgO(001). We demonstrate that the CoO AFM switching dynamics is a Kolmogorov-Avrami process in which the thermal activation energy creates AFM domain nucleation centers which further expand by domain wall propagation. From the temperature- and thickness-dependent measurements, we are able to retrieve quantitatively the important parameter of the CoO AFM activation energy, which is shown to increase linearly with CoO thickness. Moreover, we also find that the CoO AFM acrivation energy decrease with the applied field, which is due to the formaition of the exchange spin of Fe spins near the Fe/CoO interface.

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Magnetization dissipation in antiferromagnetic materials

Zhe Yuan

Beijing Normal University

Damping in magnetization dynamics characterizes the dissipation of magnetic energy and is essential for improving the performance of spintronics-based devices. While the damping of ferromagnets has been well studied and can be artificially controlled in practice, the damping parameters of antiferromagnetic materials are nevertheless little known for their physical mechanisms or numerical values. In this talk, I will show how we calculate the damping parameters in antiferromagnetic dynamics using the generalized scattering theory of magnetization dissipation combined with the first-principles transport computation. For the PtMn, IrMn, PdMn and FeMn metallic antiferromagnets, the damping coefficient associated with the motion of magnetization (alpha_m) is one to three orders of magnitude larger than the other damping coefficient associated with the variation of the Néel order (alpha_n), in sharp contrast to the assumptions made in the literature. The linewidth of antiferromagnetic resonance is strongly enhanced by the large value of alpha_m indicating its significant influence on antiferromagnetic dynamics. I will also discuss the damping at the interface of ferromagnetic and antiferromagnetic materials.

Spin-torque oscillators based on magnetoresistance effect

Zhongming Zeng

Suzhou Institute of Nano-Tech and Nano-Bionics, Chinese Academy of Sciences

Spin torque oscillators (STOs) based on magnetoresistance effect have attracted intense attention due to their potential applications in microwave source, wireless microwave communications and microwave detector because of their unique characteristic such as simple structure, nanoscale size, frequency agile, and easy integration. This talk addresses the recent developments and breakthroughs in the STO research including our results on STOs achieved also with no bias field.

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2	Akshaykumar Salimath	Pinning Behavior of Skyrmions in Disordered Materials
3	Alaa el dine MERHE	Ultrafast modification of the magnetic anisotropy in transition metal-rare earth alloys
4	Azizur	Magnetic field induced irreversible phase transition in parent anti ferromagnetic materials over a long range of temperature
5	Bowen Dong	Study of Spin Hall Magnetoresistance in Pt/Ferromagnetic Insulator Hybrid Structures
6	Fengjun Zhuo	TBD
7	Guoyi Shi	Spin-orbit torque in MgO/CoFeB/Ta/CoFeB/MgO symmetric structure with interlayer antiferromagnetic coupling
8	Hong Xia	The Spin Doppler effect induced by isotropic and anisotropic interfacial Dzyaloshinskii-Moriya interaction
9	Hong Xia	The Spin Doppler effect induced by isotropic and anisotropic interfacial Dzyaloshinskii-Moriya interaction
10	Hui Zhao	SMR around the magnetization compensation point in compensated ferrimagnets
11	Jiangwei Cao	Spin orbit torques induced magnetization reversal through asymmetric domain wall propagation in Ta/CoFeB/MgO structures
12	Jianyu Zhang	Spin wave propagation in perpendicularly magnetized nm-thick yttrium iron garnet films
13	Jingyu Shi	Revealing the impact of ultrafast demagnetization process on the magnetic reversal in L10 FePt films using double laser pulses excitation
14	Liuqing Shen	Ultrafast optical control of magnetization in yttrium iron garnet films
15	Md Shah Alam	Spin wave reflection and propagation in nanometer-thick Heusler alloy thin film.
16	Moslem Zare Bidsardareh	Spin-transfer torque and giant magnetoresistance in a monolayer phosphorene with ferromagnetic/normal/ferromagnetic (F/N/F) hybrid structure.
17	Papa Birame NDIAYE	Quantum Anomalous Hall effects in chiral non-collinear antiferromagnets

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19	Qihan Zhang	Spin Hall magnetoresistance rectification and spin pumping with different dependency on magnetization dynamics
20	Rohollah Khoshlahni	Topological and dynamical properties of magnetic Skyrmions
21	WANG CHEN	Wave Nature and Spin Seebeck Effect in Transverse Configurations
22	Weichao Yu	TBD
23	Wenwen Kong	Electrical detection of magnetization dynamics in ultrathin CoFeB film with perpendicular anisotropy
24	Wenyu, Xing	Electric Field Effect in Multilayer Cr2Ge2Te6: a Ferromagnetic Two-Dimensional Material
25	Xiang Zhou	Disentanglement of bulk and interfacial spin Hall effect in ferromagnet/normal metal interface
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27	Yawen Zhao	TBD
28	Yuma Nakamura	Intrinsic Charge Transport in Stanene: Roles of Buckling and Electron-Phonon Coupling
29	Yuqiang Zheng	Spin Hall Magnetoresistance in Ta/Pt/CoFeB/MgO multilayers
30	Zhicheng Wang	Room temperature spin transport in InAs nanowire lateral spin valve
31	Zhihao Duan	longitudinal spin seebeck effect in ferromagnetic
32	Zhongzhi Luan	Enhanced spin Hall magnetoresistance by a metallic capping layer

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82	Wang Chen	University of Electronic Science and Technology of China	cwangad@connect.ust.hk	Poster
83	Weichao Yu	Fudan University	yuwc13@fudan.edu.cn	Poster
84	Wenwen Kong	Lanzhou University	kongww16@lzu.edu.cn	Poster
85	Wenyu Xing	Peking University	wenyuxing@pku.edu.cn	Poster
86	Xiang Zhou	Tongji University	09zhouxiang@tongji.edu.cn	Poster
87	Xiansi Wang	University of Electronic Science and Technology of China	justice19901220@gmail.com	Poster
88	Yawen Zhao	Beijing Normal University	ywzhao8023@163.com	Poster
89	Yuma Nakamura	Tohoku University	y.nakamura001@imr.tohoku.ac.jp	Poster
90	Yuqiang Zheng	Lanzhou University	zhengyq11@lzu.edu.cn	Poster
91	Zhicheng Wang	University of Science and Technology Beijing	zhichengwang@126.com	Poster
92	Zhihao Duan	Nanjing University	ZHDuanldm@qq.com	Poster
93	Zhongzhi Luan	Nanjing University	lzhzhi@163.com	Poster
94	Xinyi Zhu	Fudan University	quantum@fudan.edu.cn	Secretary

Date/Time	Aug. 14 (Mon)	Aug. 15 (Tue)	Aug. 16 (Wed)	Aug. 17 (Thu)	Aug. 18 (Fri)	Aug. 19 (Sat)
07:00 - 08:30	Arrival and Register	Breakfast				
08:30 - 09:06		Gerrit Bauer	Wanjun Jiang	Xiangrong Wang	Kyung-Jin Lee	Departure
09:06 - 09:42		Caihua Wan	A. Qaiumzadeh	Shang-Fan Lee	Cheng Song	
09:42 - 10:18		Ka Shen	Na Lei	Jin Lan	Zhe Yuan	
10:18 - 10:48		Tea time	Group photo & Tea time	Tea time		
10:48 - 11:24		Weisheng Zhao	Haifeng Du	Can-Ming Hu	Luqiao Liu	
11:24 - 12:00		Zhongming Zeng	Yaowen Liu	Haibin Zhao	Yizheng Wu	
12:00 - 13:30		Buffet Lunch				
13:30 - 14:06		Informal discussions	Wang Yao	Informal discussions	Informal discussions	**Legend**
14:06 - 14:42	Tea time		Wei Han			Insulatronics
14:42 - 15:12			Tea time			Spin-transfer torque
15:12 - 15:48	Poster session		Poster session			Skyrmion
15:48 - 16:24						Spin in low dimension
16:24 - 17:00						Magnonics
17:00 - 19:00	Buffet dinner	Self-organized Dinner	Banquet	Self-organized Dinner		Opto-magnetism
19:00 - 19:36	S. Maekawa	Y. Tserkovnyak		Mikhail Titov	Kyunjoon Lee	Spin-orbit coupling
19:36 - 20:12	Tai Min	Poster Oral Intro.	Free time	Haifeng Ding	Di Wu	Antiferromagnetism
20:12 - 21:00	Opening Remark	Poster session		Poster Session	Closing Remark	Poster Session

The buffet lunch/dinner is covered by the organizer and takes place at the hotel. **The self-organized dinner** is NOT pre-arranged, and we encourage all participants to take the adventure of feeding yourselves in the jungle of restaurants at the Sky Street (see the map on Page 5).