Last update: Mar. 06, 2024

Pyeongjae Park

Postdoctoral Researcher

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Education

2016.08 – 2022.08	**Ph.D. in Physics:** Seoul National University, Seoul, Korea Thesis: "Spin dynamics and topological aspects of non-collinear metallic antiferromagnets" Advisor: Prof. Je-Geun Park
2019.10	The 4th Neutron and Muon School: J-PARC, Japan
2012.03 – 2016.08	**BSc in Physics:** Yonsei University, Seoul, Korea (High Honors at Graduation, Class Rank: 1st out of 43)

Work Experience

2023.04 –	**Postdoctoral researcher**: Oak Ridge National Laboratory, USA Advisor: Dr. Andrew Christianson
2022.09 – 2023.03	**Postdoctoral researcher**: Seoul National University, Seoul, Korea Advisor: Prof. Je-Geun Park

Research Interests

- **Frustrated quantum magnetism in two-dimensional lattices**
  - Geometrically frustrated triangular/kagome lattice antiferromagnets
  - Exchange frustration in square, honeycomb, and triangular lattices
- **Spin dynamics**
  - Modeling finite-temperature spin dynamics
  - Exotic spin dynamics in frustrated magnets and metallic magnets
- **Topology in magnetic materials**

- Topological phenomena in metallic antiferromagnets
- Topological spin texture

■ Neutron scattering

- Measuring elementary excitations using inelastic neutron scattering
- Magnetic structure analysis using neutron diffraction

Research Skills

■ Neutron scattering

- Powder/single-crystal neutron diffraction & Rietveld refinement (FullProf)
- **Single-crystal inelastic neutron scattering (Particularly specialized)**
- Extensive experience in conducting neutron scattering experiments across 18 different beamlines at renowned facilities worldwide, including SNS (USA), HFIR (USA), J-PARC (Japan), ISIS (UK), PSI (Switzerland), and ANSTO (Australia)

■ Theoretical calculations

- **Static and dynamical properties of spin systems at finite temperatures (Su(n)ny)**
- Linear spin-wave theory (SpinW, Su(n)ny)
- Nonlinear spin-wave theory: Decay and renormalization of magnons
- Magnon-phonon hybridization

■ Sample synthesis

- Polycrystalline sample growth by solid-state reaction
- Single crystal growth using chemical vapor transport and flux methods

■ Bulk characterization

- Powder/single-crystal X-ray diffraction and Rietveld refinement (FullProf)
- (Magneto-)transport experiments (QD PPMS & Cryogenic Ltd.)
- Magnetic susceptibility measurement (MPMS-XL & MPMS3)

■ X-ray spectroscopy

- X-ray absorption spectroscopy
- Phonon spectroscopy using non-resonant inelastic X-ray scattering

Publication

(*: Co-first authors, †: Corresponding)

1. **Magnetic excitations in non-collinear antiferromagnetic Weyl semimetal Mn_3Sn**
   P. Park, J. Oh, K. Uhlířová, J. Jackson, A. Deák, L. Szunyogh, K.H. Lee, H. Cho, H-L Kim, H. C. Walker, D. Adroja, V. Sechovský, and J.-G. Park†

npj Quantum Materials 3, *63* (2018)

2. **Momentum-Dependent Magnon Lifetime in the Metallic Noncollinear Triangular Antiferromagnet CrB_2**
P. Park, K. Park, T. Kim, Y. Kousaka, K. H. Lee, T. G. Perring, J. Jeong, U. Stuhr, J. Akimitsu, M. Kenzelmann, and J.-G. Park†
Phys. Rev. Lett. 125, *027202* (2020)

3. **Spin-orbit coupling effects on spin-phonon coupling in $Cd_2OS_2O_7$**
T. Kim, C. H. Kim, J. Jeong, **P. Park**, K. Park, K. H. Lee, J. C. Leiner, D. Ishikawa, A. Baron, Z. Hiroi, and J.-G. Park†
Phys. Rev. B 102, *201101(R)* (2020)

4. **Spin waves in the two-dimensional honeycomb lattice XXZ-type van der Waals antiferromagnet $CoPS_3$**
C. Kim, J. Jeong, **P. Park**, T. Masuda, S. Asai, S. Itoh, H.-S. Kim, A. Wildes, and J.-G. Park†
Phys. Rev. B 102, *184429* (2020)

5. **Spin texture induced by non-magnetic doping and spin dynamics in 2D triangular lattice antiferromagnet *h*-$Y(Mn,Al)O_3$**
P. Park*, K. Park*, J. Oh, K. H. Lee, J. C. Leiner, H. Sim, T. Kim, J. Jeong, K. C. Rule, K. Kamazawa, K. Iida, T. G. Perring, H. Woo, S.-W. Cheong, M. E. Zhitomirsky, A. L. Chernyshev, and J.-G. Park†
Nat. Commun. 12, *2306* (2021)

6. **Possible Persistence of Multiferroic Order down to Bilayer Limit of van der Waals Material NiI_2**
H. Ju*, Y. Lee*, K.-T. Kim, I. H. Choi, C. J. Roh, S. Son, **P. Park**, J. H. Kim, T. S. Jung, J. H. Kim, K. H. Kim, J.-G. Park†, and J. S. Lee†
Nano Letters 21, *5126-5132* (2021)

7. **Air-Stable and Layer-Dependent Ferromagnetism in Atomically Thin van der Waals $CrPS_4$**
J. Son*, S. Son*, **P. Park**, M. Kim, Z. Tao, J. Oh, T. Lee, S. Lee, J. Kim, K. Zhang, K. Cho, T. Kamiyama, J. H. Lee, K. F. Mak, J. Shan, M. Kim, J.-G. Park†, and J. Lee†
ACS Nano 15, *16904-16912* (2021)

8. **Antiferromagnetic Kitaev interaction in J_{eff}= 1/2 cobalt honeycomb materials $Na_3Co_2SbO_6$ and $Na_2Co_2TeO_6$**
C. Kim, J. Jeong, G. Lin, **P. Park**, T. Masuda, S. Asai, S. Itoh, H.-S. Kim, H. Zhou, J. Ma, and J.-G. Park†
Journal of Physics: Condensed Matter 34, 045802 (2022)

9. **Field-tunable toroidal moment and anomalous Hall effect in noncollinear antiferromagnetic Weyl semimetal $Co_{1/3}TaS_2$**
P. Park, Y.-G. Kang, J. Kim, K. H. Lee, H.-J. Noh, M. J. Han, and J.-G. Park†
npj Quantum Materials 7, 42 (2022)

10. **Bulk properties of the chiral metallic triangular antiferromagnets $Ni_{1/3}NbS_2$ and $Ni_{1/3}TaS_2$**
Y. Ahn, **P. Park**, C. Kim, K. Zhang, H. Kim, M. Avdeev, J. Kim, M. J. Han, H.-J. Noh, S. Seong, J.-S. Kang, H.-D. Kim, and J.-G. Park†
Phys. Rev. B 108, *054418* (2023)

11. **Spin wave Hamiltonian and anomalous scattering in $NiPS_3$**
A. Scheie*†, **P. Park***†, J. W. Villanova, G. E. Granroth, C. L. Sarkis, H. Zhang, M. B. Stone, J.-G. Park, S.

Okamoto, T. Berlijn, and D. A. Tennant
Phys. Rev. B 108, *104402* (2023) **(Editor's suggestion)**

12. **Bond-dependent anisotropy and magnon decay in cobalt-based Kitaev triangular antiferromagnet**
C. Kim*, S. Kim*, **P. Park**, T. Kim, J. Jeong, S. Ohira-Kawamura, N. Murai, K. Nakajima, A. L. Chernyshev, M. Mourigal, S.-J. Kim and and J.-G. Park†
Nature Physics 19, 1624-1629 (2023)

13. **Rapid Suppression of Quantum Many-Body Magnetic Exciton in Doped van der Waals Antiferromagnet (Ni,Cd)PS_3**
J. Kim*, W. Na*, J. Kim*, **P. Park**, K. Zhang, I. Hwang, Y.-W. Son, J. H. Kim†, H. Cheong†, and J.-G. Park†
Nano Letters 23 (22), 10189-10195 (2023)

14. **Tetrahedral triple-Q ordering and large spontaneous Hall conductivity in the metallic triangular antiferromagnet $Co_{1/3}TaS_2$**
P. Park, W. Cho, C. Kim, Y. An, Y.-G. Kang, M. Avdeev, R. Sibille, K. Iida, R. Kajimoto, K. H. Lee, W. Ju, E.-J. Cho, H.-J. Noh, M. J. Han, S.-S. Zhang, C. D. Batista†, and J.-G. Park†
Nat. Commun. 14, 8346 (2023)

15. **Quantum magnetism in the frustrated square lattice oxyhalides $YbBi_2IO_4$ and $YbBi_2ClO_4$**
P. Park†, G. Sala, Th. Proffen, M. B. Stone, A. D. Christianson, and A. F. May†
Phys. Rev. B 109, *014426* (2024) **(Editor's suggestion)**

16. **Composition dependence of bulk properties in the Co-intercalated transition-metal dichalcogenide $Co_{1/3}TaS_2$**
P. Park†, W. Cho, C. Kim, Y. An, M. Avdeev, K. Iida, R. Kajimoto, and J.-G. Park†
Phys. Rev. B 109, *L060403* (2024)

17. **Anomalous continuum scattering and higher-order van Hove singularity in the strongly anisotropic S = 1/2 triangular lattice antiferromagnet**
P. Park†, E. A. Ghioldi, A. F. May, J. A. Kolopus, A. A. Podlesnyak, J. A. M. Paddison, C. D. Batista, A. E. Trumper, L. O. Manuel, M. B. Stone†, G.B. Halász† and A. D. Christianson†
arXiv:2403.03210

Conference Presentation

[Oral]

1. **Magnetic excitations in non-collinear antiferromagnetic Weyl semimetal Mn_3Sn**
International Conference on Magnetism (ICM) 2018, San Francisco, USA

2. **Magnetic Excitations and Q-dependent magnon lifetime in Non-collinear Metallic Antiferromagnet CrB_2**
APS March Meeting 2020, Denver, USA

3-4. **Spin texture induced by non-magnetic doping and spin dynamics in 2D triangular lattice antiferromagnet *h*-$Y(Mn,Al)O_3$**
International Conference on Strongly Correlated Electron Systems (SCES) 2020, Brazil & Online
APS March Meeting 2022, Chicago ***(Invited speaker)***

5 **Field-tunable toroidal moment and anomalous Hall effect in noncollinear antiferromagnetic Weyl semimetal $Co_{1/3}TaS_2$**
The 9th International Workshop on 2D Materials (2022), Japan & Online

6. **Significant composition dependence of the anomalous Hall effect in the metallic triangular lattice antiferromagnet $Co_{1/3}TaS_2$**
APS March Meeting 2023, Las Vegas, USA

7. **Quantum fluctuations in the highly anisotropic S= 1/2 triangular lattice antiferromagnet**
APS March Meeting 2024, Minneapolis, USA

[Poster]

1. **Magnetic excitations in non-collinear antiferromagnetic Weyl semimetal Mn_3Sn**
APTCP-KIAS Quamtum Materials Symposium 2019, Yongpyong, Korea

2-5. **Magnetic excitations in non-collinear metallic antiferromagnet CrB_2**
11th International Conference on Magnetic and Superconducting Materials, Seoul, Korea (2019)
International Conference on Strongly Correlated Electron Systems (SCES) 2019, Okayama, Japan
The 20th Korea-Taiwan-Japan Symposium on SCES, Seoul, Korea (2020)
APTCP-KIAS Quamtum Materials Symposium 2020, Yongpyong, Korea

6. **Spin texture induced by non-magnetic doping and spin dynamics in 2D triangular lattice antiferromagnet *h*-$Y(Mn,Al)O_3$**
APTCP-KIAS Quamtum Materials Symposium 2021, Online

7-8. **Quantum fluctuations in the highly anisotropic S = 1/2 triangular lattice antiferromagnet**
Analyzing Neutron Spectroscopy Data with (Linear) Spin-Wave Theory, ORNL, USA (2023)
Quantum on the Quad, ORNL, USA (2023)

Honors & Awards

2022.08 **Best Ph.D. Thesis Award**
College of Natural Sciences, Seoul National University, Seoul, Korea

2021.09 **Brain Korea 21 doctoral Scholarship**

2020.09 **Brain Korea 21 doctoral Fellowship**

2020.02 **Best poster award**
APTCP-KIAS Quamtum Materials Symposium 2020, Yongpyong, Korea

2020.01 **Best poster award**
The 20th Korea-Taiwan-Japan Symposium on Strongly Correlated Electron Systems, Seoul, Korea

2019.11 **Best presentation award**
The 4th Neutron and Muon School: J-PARC, Japan

2019.03 **Brain Korea 21 doctoral Scholarship**

2019.02 **Best poster award**
APTCP-KIAS Quamtum Materials Symposium 2019, Yongpyong, Korea

2012-2016 **Recipient of the National Science & Technology Scholarship**
Korea Student Aid Foundation