

# Dr. Daegeun Jo

Postdoctoral Researcher

Department of Physics and Astronomy, Uppsala University

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## EDUCATION

Ph.D. in Physics

Department of Physics, Pohang University of Science and Technology

📅 Aug. 2023

📍 Pohang, Republic of Korea

- Supervisor: Prof. Hyun-Woo Lee
- Thesis: Generation, Detection, and Application of Orbital Dynamics

B.S. in Physics

Department of Physics, Hanyang University

📅 Feb. 2017

📍 Seoul, Republic of Korea

## RESEARCH EXPERIENCE

Postdoctoral Researcher

Department of Physics and Astronomy, Uppsala University

📅 Sep. 1. 2023 – Present

📍 Uppsala, Sweden

- Supervisor: Prof. Peter M. Oppeneer

Guest Scientist

Peter Grünberg Institut and Institute for Advanced Simulation, Forschungszentrum Jülich

📅 Apr. 18. 2022 – Jul. 16. 2022

📍 Jülich, Germany

- Group of Prof. Yuriy Mokrousov

## SKILLS

Theoretical calculation for orbitronics and spintronics

- Current-induced orbital and spin responses
- Orbital torque and spin-orbit torque in magnetic heterostructures

Tools

- Tight-binding model
- First-principles calculations (Quantum ESPRESSO, FLEUR) with Wannier90 code
- Programming languages: Python and Fortran
- High-performance computing with MPI

Languages

- Korean, English

## OTHER EXPERIENCE

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### Teaching Assistant

#### Pohang University of Science and Technology

📅 2017 – 2018

📍 Pohang, Republic of Korea

- 2018. Analytical Mechanics for graduate students
- 2017. General Physics II for undergraduate students
- 2017. General Physics Lab. I for undergraduate students

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### Compulsory Military Service

#### Weather Group of Republic of Korea Air Force

📅 2012 – 2014

📍 Republic of Korea

- Discharged at the rank of sergeant

## AWARDS & HONORS

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- 2023. Best Paper Award for Graduate Students in the Department of Physics (POSTECH)
- 2023. B. I. Min Best Condensed Matter Theory Paper Award (POSTECH)
- 2021. Silver Prize at the 27th Samsung Humantech Paper Award (Samsung Electronics Co., Ltd.)
- 2018. Best presentation award (poster) at 2018 Korean Physical Society Fall Meeting
- 2018–2023. Global Ph.D. Fellowship (funded by National Research Foundation)
- 2011. National Science & Technology Scholarship (funded by Korea Student Aid Foundation)

## REPRESENTATIVE PUBLICATIONS

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†: Authors who contributed equally.

- Y.-G. Choi<sup>†</sup>, **D. Jo**<sup>†</sup>, K.-H. Ko<sup>†</sup>, D. Go, K.-H. Kim, H. G. Park, C. Kim, B.-C. Min, G.-M. Choi, and H.-W. Lee, “Observation of the orbital Hall effect in a light metal Ti”, *Nature* **619**, 52–56 (2023).
- **D. Jo**, D. Go, and H.-W. Lee, “Gigantic intrinsic orbital Hall effects in weakly spin-orbit coupled metals”, *Phys. Rev. B* **98**, 214405 (2018).
- D. Go, **D. Jo**, C. Kim, and H.-W. Lee, “Intrinsic Spin and Orbital Hall Effects from Orbital Texture”, *Phys. Rev. Lett.* **121**, 086602 (2018).

## FULL LIST OF PUBLICATIONS

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†: Authors who contributed equally.

- **D. Jo**, D. Go, G.-M. Choi, and H.-W. Lee, “Spintronics meets orbitronics: Emergence of orbital angular momentum in solids”, *npj Spintronics* **2**, 19 (2024).
- H. Moriya<sup>†</sup>, M. Taniguchi<sup>†</sup>, **D. Jo**<sup>†</sup>, D. Go, N. Soya, H. Hayashi, Y. Mokrousov, H.-W. Lee, and K. Ando, “Observation of Long-Range Current-Induced Torque in Ni/Pt Bilayers”, *Nano Letters* **24**, 6459–6464 (2024).
- J. C. Idrobo, J. Rusz, G. Datt, **D. Jo**, S. Alikhah, D. Muradas, U. Nounbe, M. V. Kamalakar, and P. M. Oppeneer, *Direct observation of nanometer-scale orbital angular momentum accumulation*, 2024, [arXiv:2403.09269v1](https://arxiv.org/abs/2403.09269v1) [[cond-mat.mes-hall](https://arxiv.org/abs/2403.09269v1)].
- J. Kim, J. Uzuhashi, M. Horio, T. Senoo, D. Go, **D. Jo**, T. Sumi, T. Wada, I. Matsuda, T. Ohkubo, S. Mitani, H.-W. Lee, and Y. Otani, “Oxide layer dependent orbital torque efficiency in ferromagnet/Cu/oxide heterostructures”, *Phys. Rev. Mater.* **7**, L111401 (2023).
- Y.-G. Choi<sup>†</sup>, **D. Jo**<sup>†</sup>, K.-H. Ko<sup>†</sup>, D. Go, K.-H. Kim, H. G. Park, C. Kim, B.-C. Min, G.-M. Choi, and H.-W. Lee, “Observation of the orbital Hall effect in a light metal Ti”, *Nature* **619**, 52–56 (2023).
- D. Go, **D. Jo**, K.-W. Kim, S. Lee, M.-G. Kang, B.-G. Park, S. Blügel, H.-W. Lee, and Y. Mokrousov, “Long-Range Orbital Torque by Momentum-Space Hotspots”, *Phys. Rev. Lett.* **130**, 246701 (2023).

- H. Hayashi, **D. Jo**, D. Go, Y. Mokrousov, H.-W. Lee, and K. Ando, "Observation of long-range orbital transport and giant orbital torque", *Communications Physics* **6**, 32 (2023).
- J. Kim, J. Uzuhashi, D. Go, **D. Jo**, T. Ohkubo, S. Mitani, H.-W. Lee, and Y. Otani, "Emerging effects of oxygen accumulation on orbital torque", preprint available at Research Square, <https://doi.org/10.21203/rs.3.rs-2451981/v1> (2023).
- D. Lee, D. Go, H.-J. Park, W. Jeong, H.-W. Ko, D. Yun, **D. Jo**, S. Lee, G. Go, J. H. Oh, K.-J. Kim, B.-G. Park, B.-C. Min, H. C. Koo, H.-W. Lee, O. Lee, and K.-J. Lee, "Orbital torque in magnetic bilayers", *Nature Communications* **12**, 6710 (2021).
- D. Go, **D. Jo**, H.-W. Lee, M. Kläui, and Y. Mokrousov, "Orbitronics: Orbital currents in solids", *EPL (Europhysics Letters)* **135**, 37001 (2021).
- D. Go, **D. Jo**, T. Gao, K. Ando, S. Blügel, H.-W. Lee, and Y. Mokrousov, "Orbital Rashba effect in a surface-oxidized Cu film", *Phys. Rev. B* **103**, L121113 (2021).
- K. Zhang, S. Han, Y. Lee, M. J. Coak, J. Kim, I. Hwang, S. Son, J. Shin, M. Lim, **D. Jo**, K. Kim, D. Kim, H.-W. Lee, and J.-G. Park, "Gigantic Current Control of Coercive Field and Magnetic Memory Based on Nanometer-Thin Ferromagnetic van der Waals Fe<sub>3</sub>GeTe<sub>2</sub>", *Advanced Materials* **33**, 2004110 (2021).
- J. Kim, D. Go, H. Tsai, **D. Jo**, K. Kondou, H.-W. Lee, and Y. Otani, "Nontrivial torque generation by orbital angular momentum injection in ferromagnetic-metal/Cu/Al<sub>2</sub>O<sub>3</sub> trilayers", *Phys. Rev. B* **103**, L020407 (2021).
- Z. C. Zheng, Q. X. Guo, **D. Jo**, D. Go, L. H. Wang, H. C. Chen, W. Yin, X. M. Wang, G. H. Yu, W. He, H.-W. Lee, J. Teng, and T. Zhu, "Magnetization switching driven by current-induced torque from weakly spin-orbit coupled Zr", *Phys. Rev. Research* **2**, 013127 (2020).
- **D. Jo**, D. Go, and H.-W. Lee, "Gigantic intrinsic orbital Hall effects in weakly spin-orbit coupled metals", *Phys. Rev. B* **98**, 214405 (2018).
- D. Go, **D. Jo**, C. Kim, and H.-W. Lee, "Intrinsic Spin and Orbital Hall Effects from Orbital Texture", *Phys. Rev. Lett.* **121**, 086602 (2018).

## PRESENTATIONS

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### Oral

- "Theoretical Calculations for Orbitronics: Orbital Hall Effect and Its Detection", Seminar (Material Theory Division, Uppsala University), Uppsala, Sweden, Apr. 12, 2024
- "First-principles calculation of the orbital current and orbital accumulation in metallic layers", DPG Spring Meeting 2024, Berlin, Germany, Mar. 21, 2024
- "Theoretical Calculation of the Orbital Accumulation from the Orbital Hall Effect", Korean Magnetic Society 2023 Winter Conference, Busan, Korea, Nov. 23, 2023
- "Theoretical calculations of the magneto-optical Kerr effect by the orbital Hall effect", Seminar (PGI-1/IAS-1, Forschungszentrum Jülich), Jülich, Germany, May. 25, 2022
- "Giant intrinsic orbital Hall effects in weakly spin-orbit coupled metals", American Physical Society March Meeting 2019, Boston, USA, Mar. 4-8, 2019
- "Intrinsic Orbital Hall Effects in Elemental Solids", 11th BK21+ Young Physicists Workshop, Pohang, Korea, Feb. 14-15, 2019

### Poster

- "Current-Induced Orbital Current and Accumulation in Metallic Layers", 1st KAI-X Global Conference in Physics-International workshop on Orbitronics, Daejeon, Korea, Nov. 21, 2023
- "Current-Induced Orbital and Spin Accumulations in Metallic Layers", 11th International Symposium on Metallic Multilayers (MML 2023), Seoul, Korea, Jul. 24-28, 2023
- "Theoretical calculations of the magneto-optical Kerr effect by the orbital Hall effect", Orbitronics from topological matter to next level electronics (SPICE workshop), Ingelheim, Germany, Jul. 19-22, 2022
- "Orbital Hall effect and orbital torque in weakly spin-orbit coupled materials", Samsung Global Research Symposium, Seoul, Korea, Nov. 22-23, 2019
- "Giant Intrinsic Orbital Hall Effects in Light Metals", 15th SRC Winter Workshop on Topological Matter, Pohang, Korea, Jan. 30-31, 2019
- "Gigantic intrinsic orbital Hall effects in weakly spin-orbit coupled materials", International School on Spintronics and Korea-Japan Spintronics Workshop, Nagoya, Japan, Jan. 21-22, 2019

- "Giant intrinsic orbital Hall effects in weakly spin-orbit coupled systems", 2018 Korean Physical Society Fall Meeting, Changwon, Korea, Oct. 24-26, 2018