

## **Tae Gwan Park, Ph.D.**

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# *Curriculum Vitae*

## **RESEARCH EXPERIENCE**

- Oct. 2023 – present     **Postdoctoral Researcher**  
Center for Nanophase Materials Sciences, Oak Ridge National Laboratory (ORNL), USA
- Mar. 2023 – Oct. 2023     **Postdoctoral Researcher**  
Natural Science Research Institute, Korea Advanced Institute of Science and Technology (KAIST), Korea

## **EDUCATION**

- Mar. 2017 – Feb. 2023     **Ph.D. in Physics, Korea Advanced Institute of Science and Technology (KAIST), Korea**  
Dissertation: Ultrafast optical coherent control of 2D layered materials with interlayer coupling and vibrations
- Mar. 2011 – Feb. 2017     **B.S. in Physics, Pusan National University (PNU), Korea**  
Graduated with the highest honor (1 out of 58, GPA: 4.12/4.5)  
(Military service, Republic of Korea Marine Corps, Apr. 2012 – Jan. 2014)

## **RESEARCH INTERESTS**

- ✓ Ultrafast carrier dynamics in low-dimensional quantum materials including topological insulators and van der Waals heterostructures with sharp interface.
- ✓ Coherent phonons including the photoinduced strain (acoustic) waves by ultrafast laser actions and their confinement effects at nanoscale.
- ✓ Characterizing the electrical properties of novel semiconductors and quantum materials by employing broadband THz spectroscopy in a non-contact manner
- ✓ Modulating and switching of (quantum) materials in ultrafast timescale via light-driven phononic transitions.

## KEY SKILLS

- ✓ **Ultrafast optical spectroscopy:** set-up and analysis on transient absorption/reflection spectroscopy, coherent phonon spectroscopy with  $\mu\text{m}$  spatial resolution (for exfoliated 2D materials) based on Ti-sapphire oscillator (80 MHz, MAITAI) and regenerative amplifier (1 kHz, Spitfire).
- ✓ **Terahertz (THz) spectroscopy:** set-up and analysis on THz time-domain spectroscopy (TDS), optical pump and THz probe (OTPD) measurements based on the above lasers.
- ✓ **Nonlinear optical characterization:** set-up and analysis on nonlinear transmission (NLT), polarization-resolved second harmonic generation with  $\mu\text{m}$  spatial resolution.
- ✓ **Home-made mode-locked oscillators:** Optical parametric oscillator (OPO) with synchronous pumping from commercial Ti-sapphire oscillators. Yb:KYW (passive mode-locking) and Cr:ZnS (continuous wave generation).
- ✓ **Scientific software:** Up-to-date analysis, communication, visualization, and presentations with MATLAB, Mathematica, MS office, LaTeX and Origin. Most of my experimental setups were automated using MATLAB codes.

## HONORS AND AWARDS

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| Aug. 2020            | <b>Best Presentation Award</b> , Optical Society of Korea  |
| Jul. 2020            | <b>Outstanding teaching assistant award</b> , Spring semester  |
| Mar 2011 – Feb. 2017 | <b>National Science and Engineering Undergraduate Scholarship</b> , funded by Korea Student Aid Foundation |

## PUBLICATION

- [12] **T. G. Park**, C. Kim, E.-T. Oh, H. R. Na, S.-H. Chun, S. Lee, and F. Rotermund, “Ultrafast acousto-optic modulation at the near-infrared spectral range by interlayer vibrations”, *accepted in Nanophotonics* (2024).
- [11] **T. G. Park**, E.-C. Shin, J. Park, E.-T. Oh, S. Baek, H. R. Na, S.-H. Chun, S. Lee, Y.-H. Kim, F. Rotermund, “Ultrafast switching of topological invariants by light-driven strain”, *preprint: arXiv:2306.09766* (2023)., *under review* (2023).
- [10] **T. G. Park**, E.-T. Oh, S. Kim, Y. Ou, J. Moodera, H. Kim, F. Rotermund, “Ultrafast formation of quantized interlayer vibrations in  $\text{Bi}_2\text{Se}_3$  by photoinduced strain waves”, *Opt. Express* 30, 35988-35998 (2022).
- [9] **T. G. Park**, J. H. Jeon, S.-H. Chun, S. Lee, F. Rotermund, “Ultrafast interfacial carrier dynamics and persistent topological surface states of  $\text{Bi}_2\text{Se}_3$  in heterojunctions with  $\text{VSe}_2$ ”, *Commun. Phys.* 5, 1-11 (2022).
- [8] **T. G. Park**, H. R. Na, S.-H. Chun, W. B. Cho, S. Lee, F. Rotermund, “Coherent control of interlayer vibrations in  $\text{Bi}_2\text{Se}_3$  van der Waals thin-films”, *Nanoscale* 13, 19264-

19273 (2021).

- [7] **T. G. Park\***, B. K. Choi\*, J. Park, J. Kim, Y. J. Chang, F. Rotermund, “Interlayer Coupling and Ultrafast Hot Electron Transfer Dynamics in Metallic VSe<sub>2</sub>/Graphene van der Waals Heterostructures”, *ACS Nano* 15, 7756-7764 (2021).  
\*equal contribution, Also appeared in domestic newspaper ([The JoongAng](#))
- [6] J. J. Yoo, G. K. Seo, M. R. Chua, **T. G. Park**, Y. Liu, F. Rotermund, Y.-K. Kim, V. Bulovic, S. S. Shin, M. G. Bawendi, J. Seo, “Efficient perovskite solar cells via improved carrier management”, *Nature* 590, 587 (2021). ([journal cover](#))
- [5] L. Wang, W. Chen, Y. Zhao, Y. Wang, Z. Pan, H. Lin, G. Zhang, Z. Lin, J. E. Bae, **T. G. Park**, F. Rotermund, P. Loiko, X. Mateos, M. Mero, U. Griebner, V. Petrov, “Single-walled carbon-nanotube saturable absorber assisted Kerr-lens mode-locked Tm:MgWO<sub>4</sub> laser”, *Opt. Lett.* 45, 6142 (2020).
- [4] F. Yue, P. Loiko, M. Chen, J. M. Serres, Y. Wang, J. Li, L. Basyrova, E. Dunina, A. Kornienko, L. Fomicheva, S. Dai, Z. Chen, J. E. Bae, **T. G. Park**, F. Rotermund, V. Jambunathan, A. Lucianetti, T. Mocek, M. Aguiló, F. Díaz, U. Griebner, V. Petrov, X. Mateos, “Spectroscopy and diode-pumped laser operation of transparent Tm:Lu<sub>3</sub>Al<sub>5</sub>O<sub>12</sub> ceramics produced by solid-state sintering”, *Opt. Express* 28, 28399 (2020).
- [3] Y. Zhao, L. Wang, Y. Wang, J. Zhang, P. Liu, X. Xu, Y. Liu, D. Shen, J. E. Bae, **T. G. Park**, F. Rotermund, X. Mateos, P. Loiko, Z. Wang, X. Xu, J. Xu, M. Mero, U. Griebner, V. Petrov, W. Chen, “SWCNT-SA mode-locked Tm:LuYO<sub>3</sub> ceramic laser delivering 8-optical-cycle pulses at 2.05 μm”, *Opt. Lett.* 45, 459 (2020).
- [2] J. E. Bae, **T. G. Park**, E. Kifle, X. Mateos, M. Aguiló, F. Díaz, C. Romero, J. R. V. de Aldana, H. Lee, F. Rotermund, “Carbon nanotube Q-switched Yb:KLuW surface channel waveguide lasers”, *Opt. Lett.* 45, 216 (2020).
- [1] Y. Zhao, W. Chen, L. Wang, Y. Wang, Z. Pan, X. Dai, H. Yuan, H. Cai, Y. Zhang, J. E. Bae, **T. G. Park**, F. Rotermund, P. Loiko, J. M. Serres, X. Mateos, D. Shen, U. Griebner, V. Petrov, “Graphene mode-locked Tm, Ho-codoped crystalline garnet laser producing 70-fs pulses near 2.1 μm”, *OSA Continuum* 2, 2593 (2019). ([editor's pick](#))

## INVITED SCIENTIFIC SEMINAR

- [1] **T. G. Park**, Ultrafast probing and manipulating the material properties by light-sound conversion (Sejong University, May. 2023 at Seoul, Korea)

## INTERNATIONAL CONFERENCES

\*1 invited talk, 5 oral and 1 poster presentations

- [7] **T. G. Park**, E.-T. Oh, H. R. Na, S.-H. Chun, S. Lee and F. Rotermund, High-speed acousto-optic modulation at optical communication band by ultrafast laser induced hypersonic vibrational coherence (Conference on Lasers and Electro-Optics, Europe CLEO/Europe, Jun. 2023, Munich, Germany, *Oral presentation*)

- [6] **T. G. Park** and F. Rotermund, Ultrafast control of topological surface and bulk charge transport through hypersonic vibrational coherence (The 14<sup>th</sup> Asia-Pacific Conference on Near-Field Optics, APNFO 14, Jun. 2023, Busan, Korea, [invited talk](#))
- [5] **T. G. Park**, E.-C. Shin, J. Park, E.-T. Oh, S. Baek, H. R. Na, S.-H. Chun, S. Lee, Y.-H. Kim, F. Rotermund, Ultrafast switching of topological invariants by light-driven interlayer vibrations (Conference on Lasers and Electro-Optics, CLEO, May. 2023, San Jose, USA, *Oral presentation*)
- [4] **T. G. Park**, J. Park, E.-T. Oh, H. R. Na, S.-H. Chun, S. Lee, F. Rotermund, Photoinduced Non-thermal Topological Phase Transition in Bi<sub>2</sub>Se<sub>3</sub> Driven by Coherent Interlayer Vibrations (Pacific Rim Conference on Lasers and Electro-Optics, CLEO-PR, Jul. 2022, Sapporo, Japan, *Oral presentation*)
- [3] **T. G. Park**, B. K. Choi, J. Park, J. Kim, Y. J. Chang, F. Rotermund, Ultrafast Carrier Dynamics and Interlayer Coupling in 1T-VSe<sub>2</sub>/Graphene van der Waals Heterostructures (Pacific Rim Conference on Lasers and Electro-Optics (CLEO-PR), Aug. 2020, Sydney, Australia, *Oral presentation*)
- [2] **T. G. Park**, B. K. Choi, J. Park, J. Kim, Y. J. Chang, F. Rotermund, Ultrafast hot electron transfer in metallic VSe<sub>2</sub>/Graphene van der Waals Heterostructures (SPIE Photonics West, Feb. 2020, San Francisco, USA, *Oral presentation*)
- [1] **T. G. Park**, J. E. Bae, S. Y. Choi, F. Rotermund, Nonlinear Optical Characterization of Carbon Nanotube Saturable Absorbers Applications for Passive Mode-Locked near 1  $\mu\text{m}$  (Asia Pacific Laser Symposium (APLS), May 2018, Xian, China, *Poster presentation*)

## DOMESTIC CONFERENCES

\*2 invited talk, 2 oral, and 14 poster presentations

- [18] **T. G. Park**, J. Park, E.-T. Oh, C. Kim, F. Rotermund, Ultrafast probing and controlling matter with confined coherent acoustic phonons (Optics and Photonics Congress 2023, OPC, Aug. 2023, Jeju, Korea, [invited talk](#))
- [17] **T. G. Park**, E.-C. Shin, J. Park, E.-T. Oh, S. Baek, H. R. Na, S.-H. Chun, S. Lee, Y.-H. Kim, F. Rotermund, Ultrafast switch of topological phases via light-driven strain (Advanced Lasers and Their Applications, ALTA, May 2023, Jeju, Korea, *Poster presentation*)
- [16] **T. G. Park**, F. Rotermund, Ultrafast control of topological phases by light-driven vibrational coherence (Korean Physics Society Spring, Apr. 2023, Daejeon, Korea, [invited talk](#))
- [15] **T. G. Park**, E.-T. Oh, J. Park, H. R. Na, S.-H. Chun, S. Lee, F. Rotermund, Probing the coupling between topological states and photoinduced interlayer vibrations by time-resolved THz spectroscopy (Asia Pacific Physics Conference, APPC15, Aug. 2022, Online, Korea, *Poster presentation*)
- [14] **T. G. Park**, E.-T. Oh, H. R. Na, S.-H. Chun, S. Lee, F. Rotermund, Coherent control

- of optical properties of Bi<sub>2</sub>Se<sub>3</sub> at near-infrared wavelengths through photoinduced interlayer vibrations (Optics and Photonics Congress, Jul. 2022, Jeju, Korea, *Poster presentation*)
- [13] **T. G. Park**, E.-T. Oh, H. R. Na, S.-H. Chun, S. Lee, F. Rotermund, Optical Property Control in Bi<sub>2</sub>Se<sub>3</sub> with Coherent Interlayer Vibrations at Near-Infrared Wavelengths (Advanced Lasers and Their Applications, ALTA, May 2022, Jeju, Korea, *Poster presentation*)
- [12] **T. G. Park**, H. R. Na, S.-H. Chun, W. B. Cho, S. Lee, F. Rotermund, Ultrafast dual-pump and probe spectroscopy for precise interlayer vibration control in Bi<sub>2</sub>Se<sub>3</sub> thin-films (Optical Society of Korea, Jan. 2022, Daejeon, Korea, *Oral presentation*)
- [11] **T. G. Park**, J. H. Jeon, S.-H. Chun, S. Lee, F. Rotermund, Weak interfacial interactions and hot electron transfer at VSe<sub>2</sub>-Bi<sub>2</sub>Se<sub>3</sub> van der Waals junction interfaces, International Conference on Advanced Materials and Devices ICAMD, Dec. 2021, Jeju, Korea, *Poster presentation*)
- [10] **T. G. Park**, J. H. Jeon, S.-H. Chun, S. Lee, F. Rotermund, Ultrafast Interfacial Acoustic Phonons and Carrier Dynamics in VSe<sub>2</sub>/Bi<sub>2</sub>Se<sub>3</sub> van der Waals Heterostructures (Optical Society of Korea, Jul. 2021, Online, Korea, *Poster presentation*)
- [9] **T. G. Park**, H. R. Na, S.-H. Chun, W. B. Cho, S. Lee, F. Rotermund, Ultrafast Coherent Control of Interlayer Lattice Dynamics in Layered Bi<sub>2</sub>Se<sub>3</sub> (Advanced Lasers and Their Applications, ALTA, May 2021, Online, Korea, *Poster presentation*)
- [8] **T. G. Park**, B. K. Choi, J. Park, J. Kim, Y. J. Chang, F. Rotermund, Ultrafast interlayer hot electron transfer dynamics in 1T-VSe<sub>2</sub>/Graphene van der Waals heterostructures (Advanced Lasers and Their Applications, ALTA, Aug. 2020, Online, Korea, *Poster presentation*, [Best Presentation Award](#), *Optical Society of Korea*)
- [7] **T. G. Park**, B. K. Choi, J. Park, J. Kim, Y. J. Chang, F. Rotermund, Hot electron transfer characteristics in metallic VSe<sub>2</sub>/graphene van der Waals heterostructures (Optical Society of Korea, Jul. 2020, Busan, Korea, *Poster presentation*)
- [6] **T. G. Park**, B. K. Choi, J. Park, J. Kim, Y. J. Chang, F. Rotermund, Ultrafast Carrier Dynamics in Metallic Single-layer VSe<sub>2</sub> and Graphene Heterostructures (International Conference on Advanced Materials and Devices, ICAMD, Dec. 2019, Jeju, Korea, *Poster presentation*)
- [5] **T. G. Park**, W. T. Kim, J. Park, F. Rotermund, Ultrafast Carrier Dynamics in Perovskite Solar Cells (Korea Nuclear Society, Oct. 2019, Goyang, Korea, *Oral presentation*)
- [4] **T. G. Park**, S. Kim, H. Kim, F. Rotermund, Pump-probe spectroscopy studies of coherent acoustic phonons in layered two-dimensional materials (Advanced Lasers and Their Applications, ALTA, May 2019, Jeju, Korea, *Poster presentation*)
- [3] **T. G. Park**, F. Rotermund, Ultrafast Laser-induced Coherent Acoustic Phonons in Topological Insulator Bi<sub>2</sub>Se<sub>3</sub> (KAIX Thematic Fair for Advanced Optical Science, Dec. 2018, Daejeon, Korea, *Poster presentation*)
- [2] **T. G. Park**, W. B. Cho, S. Y. Choi, F. Rotermund, Cavity design and analysis for

graphene mode-locked Cr:ZnS Mid-IR Laser (Advanced Lasers and Their Applications (ALTA), May 2018, Jeju, Korea, *Poster presentation*)

- [1] **T. G. Park**, S. Choi, J. E. Bae, F. Rotermund, Mode-locked Yb:KYW laser with single-walled carbon nanotubes at 1  $\mu\text{m}$  (Optical Society of Korea, Feb. 2018, Gwangju, Korea, *Poster presentation*)

## PROFESSIONAL ACTIVITIES

Journal Reviewer      Optics Express, Journal of the Optical Society of America B