JingleiPing

Research Associate, Department of Physics and Astronomy, University of Pennsylvania

☎ (240) 461-8847 | ✉ jping@sas.upenn.edu | ⌂ http://www.pingjl.com

Research Interests

- Development of biosensing devices and systems enabled by two-dimensional (2D) materials
- Translation of 2D electronics into applications in point-of-care early disease diagnosis, drug testing, healthcare, and environmental monitoring

Education

University of Maryland–College Park
Ph.D. Chemical Physics, Advisors: Prof. Michael Fuhrer (thesis advisor), Prof. Ellen Williams 2013

Sun Yat-sen University
M. Phil. Condensed Matter Physics, Advisor: Prof. Zhibing Li 2008
B.S. Materials Physics (with highest honor) 2003

Research Experience

University of Pennsylvania 2014–present
Research Associate/Postdoctoral Fellow, Supervisor: Prof. A. T. Charlie Johnson

- Created a miniaturized sensing robot enabled by embedded 2D bioelectronics for multiplexed detection of toxins in tap water in real time. (Manuscript in preparation) Formulated proposals as principal investigator (PI) or co-PI based on this research.
- Quantified the bio-transduction mechanism of transistors based on 2D materials. (Published) Developed multiple electrical biosensing techniques on this basis:
  - Scalable aptasensors for drug detection with high sensitivity. (Published)
  - Scalable nucleic acid biosensors with high-sensitivity (10 aM), potential applications including single-nucleotide-polymorphism detection and point-of-care diagnosis of diseases, e.g. HIV infection and pancreatic cancer. (Published and patent pending)
  - Breast cancer biosensors with a broad analytical range enabled by graphene-nanoparticle hybrid. (Published)
- Pioneered a bias-free methodology for measuring Faradaic current at nano-bio interface with negligible heat dissipation (aW μm^{-2}) and electrical perturbation (<pA). (Published) Developed various all-electronic biosensing techniques based on this methodology:
  - Real time monitoring pH of human serum with potential applications in tumor monitoring and early cancer diagnosis. (Published and patent pending)
  - Rapid structural and functional analysis of protein-nanoparticle assemblies. (Published)
  - High-sensitivity (pM) neuropeptide biosensors for quantification of binding kinetics and affinities for the reaction of neuropeptides to engineered receptor. (Manuscript submitted) Formulated a proposal as principal investigator on this basis.
- Developed (via chemical vapor deposition) various large-scale (inch-size) 2D materials that can be translated into biosensing devices: 1T'-$MoTe_2$ monolayers, (published) MoS_2 monolayers at desired positions using a seeded growth method, (published) and high-quality wafer-scale continuous monolayer boron nitride (BN).

Monash University 2013
Occupational Trainee, Supervisor: Prof. Michael S. Fuhrer
- Developed a graphene-based nano-hybrid via chemical vapor deposition with controllable transparency, conductivity, and magnetoresistance. (Published)
- Set up a new lab with equipment including a molecular beam epitaxy system, an atomic force microscope, a Raman spectroscopy system, and a cryostat. Designed and built a computerized CVD system.
- Involved in designing an MBE-STM system for in situ characterization & electrical measurement of as-grown low-dimensional materials and an ultra-high-vacuum and ultra-low-temperature STM system. Communicated with the manufacturers.
- Received training for EBSD, STEM (including EELS) and HRTEM in Monash Centre for Electron Microscopy (MCEM).

University of Maryland 2008–2013
Research Assistant, Supervisor: Prof. Ellen D. Williams and Prof. Michael S. Fuhrer
- Discovered a novel disorder-induced magnetoresistance in single-band two-dimensional systems. (Published)
- Developed a TEM-based technique for precise distinguishing of layer-number and stacking-order of multi-layer graphene. (Published)
- Quantified 1/f noise of multi-layer graphene using high-accuracy electrical measurement techniques.

Sun Yat-sen University, State Key Lab. of Optoelectronic Materials 2003-2008
Research Assistant, Supervisor: Prof. Zhibing Li
- Formulated the mechanism of field-emission from localized electron state by using theories of quantum mechanics and non-equilibrium Green function. (Published)

Funding

- NIH 2017
  Center of Excellence in Environmental Toxicology
  Nanosensor system for real-time monitoring of multiple water toxins
  Role: co-PI of a Pilot Project

Honors and Awards

- Alexander Family Supplemental Fellowship, 2008
- Graduation with honor: Graduate Excellence Award, 2003
- Yang Nai Ying Fellowship, awarded to the top 1/30 student of the Material Physics Program, 2002
- The First Prize Scholarship, 2000, 2001, 2003
- Lucent/Bell Laboratory Fellowship, awarded to top 3/152 students, 1999-2003

Patents

1. *Scalable back-gated functionalized graphene field effect transistors for detection of DNA and other target molecules.*
   A. T. Charlie Johnson, **Jinglei Ping**, and Ramya Vishnubhotla, International Application No. PCT/US2017/022108
2. *pH sensing technique based on graphene electrodes.*
   A. T. Charlie Johnson and **Jinglei Ping**, International Application No. PCT/US2071/022103

3. *Multiplexed detection of water toxins using graphene aptasensors.*
   A. T. Charlie Johnson, **Jinglei Ping**, Chengyu Wen, and Steven Vitale

Publications

*Equal contribution

In preparation

1. *Multiplexed detection of toxins in tap water using a graphene aptasensing system.*
   Jinglei Ping, Chengyu Wen, Steven Vitale, A. T. Charlie Johnson.
2. *Graphene-enabled detection of DNA at aM concentrations without amplification.*
   Ramya Vishnubhotla, **Jinglei Ping**, Adithya Sriram, Olivia Dickens, Srinivas Mandyam, Emmeline Adu-Beng, A. T. Charlie Johnson.
3. *Chemical vapor deposition of large-area 2D hexagonal diamond.*
   Ying Liu*, **Jinglei Ping***, John Mcclimon, Joel Lefever, William Parkin, Marija Drndic, Robert Carpick, Wei Tan, A. T. Charlie Johnson.

Submitted/Accepted

4. *All-electronic detection of pM-level opioid-neuropeptides using graphene-based microelectrodes.*
   Jinglei Ping, Jin Xi, Ramya Vishnubhotla, Pedro Ducos, Jeffery G. Saven, Renyu Liu, A. T. Charlie Johnson, accepted by ACS Nano.
5. *Single-crystal bilayer graphene with controlled stacking from Ni-Cu gradient alloy.*
   Zhaoli Gao, Qicheng Zhang, Carl H. Naylor, Youngkuk Kim, Irfan Haider Abidi, **Jinglei Ping**, Pedro Ducos, Jonathan Zauberman, Mengqiang Zhao, Andrew M. Rappe, Ying-Jun Wang, Zhengtang Luo, Li Ren, A. T. Charlie Johnson, under review.
6. *DNA nano-tweezers and 2-D electronics based highly specific and picomolar sensitive SNP detection and their wireless transmission.*
   Michael T. Hwang, Zi Chao Shiah, Zejun Wang, **Jinglei Ping**, Leif Antonschmidt, Joon Lee, Yushuang Liu, Abhijith G. Karkisaval, Deependra Kumar Ban, A. T. Charlie Johnson, Chunhai Fan, Gennadi Glinsky, Ratnesh Lal, under review.

2017

7. *Scalable graphene aptasensors for drug quantification.*
   Ramya Vishnubhotla*, **Jinglei Ping***, Abigail Lee, A. T. Charlie Johnson, AIP Advances 7, 115111 (2017). (Featured article, highlighted by Scilight.)
8. *An aptamer-based biosensor for the azole class of antifungal drugs.*
   Gregory Wiedman, Yunan Zhao, Arkadv Mustaev, **Jinglei Ping**, Ramya Vishnubhotla, A. T. Charlie Johnson, and David Perlin, mSphere 2, e00274-17 (2017).
9. *pH sensing properties of flexible, bias-free graphene microelectrodes in complex fluids: from phosphate buffer solution to human serum.*
   Jinglei Ping, Jacquelyn E. Blum, Ramya Vishnubhotla, Amey Vrudhula, Carl Naylor, Zhaoli Gao, Jeffery, G. Saven, A. T. Charlie Johnson, Small 13, 1700564 (2017).

10. *Structural-functional analysis of engineered protein-nanoparticle assemblies using graphene microelectrode.* (Featured on Chemical Science HOT articles and reported by myScience, Penn News, etc.)
Jinglei Ping, Katherine W. Pulsipher, Ramya Vishnubhotla, Jose A. Villegas, Tacey L. Hicks, Stephanie Honig, Jeffery G. Saven, Ivan J. Dmochowski, A. T. Charlie Johnson, Chemical Science 8, 5329 (2017).

11. *Quantifying the effect of ionic screening with protein-decorated graphene transistors.* (Invited paper)
Jinglei Ping, Jin Xi, Jeffery G. Saven, Renyu Liu and A. T. Charlie Johnson, Biosensors and Bioelectronics 89, 689 (2017).

2016

12. *Scalable production of sensor arrays based on high mobility hybrid graphene field effect transistors.*
Zhaoli Gao, Hojin Kang, Carl Naylor, Frank Streller, Pedro Ducos, Madeline D. Serrano, **Jinglei Ping**, Jonathan Zauberman, Rajesh, Robert Carpick, Ying-Jun Wang, Yung W. Park, Zhengtang Luo, Li Ren, A. T. Charlie Johnson, ACS Applied Materials & Interfaces 8, 27546 (2016).

13. *Scalable production of high-sensitivity, label-free DNA biosensors based on back-gated graphene field-effect transistors.*
Jinglei Ping*, Ramya Vishnubhotla*, Amey Vrudhula, and A. T. Charlie Johnson, ACS Nano 10, 8700 (2016).

14. *Quantifying the intrinsic surface charge density and charge-transfer resistance of the graphene-solution interface through bias-free low-level charge measurement.* (Editor's pick)
Jinglei Ping and A. T. Charlie Johnson, Applied Physics Letters 109, 013103 (2016).

15. *Genetically engineered antibody functionalized platinum nanoparticles modified CVD-graphene nanohybrid transistor for the detection of breast cancer biomarker, HER3.*
Rajesh, Zhaoli Gao, Ramya Vishnubhotla, Madeline D. Serrano, **Jinglei Ping**, M. K. Robinson, and A. T. Charlie Johnson, Advanced Materials Interface 3, 1600124 (2016).

16. *Monolayer single-crystal 1T'-$MoTe_2$ grown by chemical vapor deposition exhibits weak antilocalization effect.*
Carl H. Naylor, William Parkin, **Jinglei Ping**, Zhaoli Gao, Yu Ren Zhou, Youngkuk Kim, Frank Streller, Robert Carpick, Andrew M. Rappe, Marija Drndic, James M. Kikkawa, and A. T. Charlie Johnson, Nano Letters 16, 4297 (2016).

Previous to 2016

17. *Seeded growth of highly crystalline mobybdenum disulphide monolayers at controlled locations.*
Gang H. Han, Nicholas J. Kybert, Carl H. Naylor, Bum S. Lee, **Jinglei Ping**, Joo H. Park, Jisoo Kang, Si Y. Lee, Young H. Lee, Ritesh Agarwal and A. T. Charlie Johnson, Nature Communications 6, 6128 (2014).

18. *Disorder induced magnetoresistance in a two dimensional electron system.* (Editor's suggestion)
Jinglei Ping, Indra Yudhistira, Navneeth Ramakrishnan, Sungjae Cho, Shaffique Adam, and Michael S. Fuhrer, Physics Review Letters 113, 047206 (2014).

19. *Carbon impurities on graphene synthesized by chemical vapor deposition on platinum.*
Jinglei Ping and Michael S. Fuhrer, Journal of Applied Physics. 116, 044303 (2014).

20. *Measuring the thickness of few-layer graphene by laser scanning microscopy.*
Behnood Ghamsari, Jacob Tosado, A. Zhuravel, Mahito Yamamoto, Daniel Lenski, **Jinglei Ping**, Michael Fuhrer, and Steven Anlage, IEEE Xplore, doi:10.1109/CPEM.2012.6251000 (2012).

21. *Layer number and stacking sequence imaging of few-layer graphene by transmission electron microscopy.* (Top 20 most downloaded paper of the month)
Jinglei Ping and Michael S. Fuhrer, Nano Letters 12, 4635 (2012).

22. *Surface localized state enhanced field emission.*
Jinglei Ping, Z. Li and N. Xu, IEEE Xplore, doi:10.1109/IVNC.2006.3354661 (2006).

Invited Presentations

1. *Electrical 2D Biosensors.*
Southern University of Science and Technology, Guangzhou, GD, China, 2018

2. *Electrical Biosensing Devices and Systems Based on 2D Materials.*
McMaster University, Hamilton, ON, Canada, 2017

3. *Electrical Biosensors Based on 2D Materials.*
Boston College, Boston, MA, 2017

4. *Electrical Biosensors Based on Two Dimensional Nanomaterials.*
BioDirection, Inc., Santa Fe, NM, 2017

5. *Electrical Biosensing Science and Technology Based on Two Dimensional Nanomaterials.*
University of Delaware, Newark, DE, 2017

6. *Biosensors and bioelectronics based on two-dimensional nanomaterials.*
APS March Meeting, Baltimore, MD, 2016

7. *Graphene chemical-vapor-deposited on platinum: the glamour of imperfection.*
Penn State University, University Park, PA, 2013

Contributed Presentations

1. *Non-perturbative quantification of ionic charge transfer through nm-scale protein pores using graphene microelectrodes.*
APS March Meeting, New Orleans, LA, 2017

2. *Graphene decorated with mu-opioid receptor: the ionic screening effect and detection of enkephalin.*
APS March Meeting, San Antonio, TX, 2015

3. *Magnetoresistance induced by inhomogeneity in graphene.*
APS March Meeting, Denver, CO, 2014

4. *Magnetoresistance of graphene in contact with inhomogeneous disordered graphitic carbon.*
APS March Meeting, Baltimore, MD, 2013

5. *Layer-number and stacking-order imaging of graphene by transmission electron microscopy.*
Windsor Summer School, London, UK, 2012

6. *Layer number and stacking sequence identification of few-layer graphene by transmission electron microscopy.*
APS Meeting, Boston, MA, 2012

7. *Characterization of graphene by TEM.*
CNAM Seminar, University of Maryland, College Park, MD, 2012

8. *Graphene by chemical vapor deposition.*
Chemical Physics Seminar, University of Maryland, College Park, MD, 2011

9. *Field emission patterns from localized states.*
   Conference of condensed Matter Physics and Statistical Physics, Guangzhou, Guangdong, 2006

Posters and Co-Authored Presentations (Selected)

1. *Scalable production of biosensors based on aptamer-functionalized graphene for detection of the HIV drug tenofovir.*
   APS Meeting, New Orleans, LA, 2017
2. *Biosensors based on DNA-functionalized graphene.*
   APS Meeting, Baltimore, MD, 2016
3. *Seeded growth of highly crystalline molybdenum disulphide monolayers at controlled locations.*
   APS Meeting, San Antonio, TX, 2015
4. *Theoretical study of disorder induced magnetoresistance in graphene.*
   APS Meeting, Denver, CO, 2014
5. *Laser scanning microscopy for quantitative measurement of the local microwave-photonic properties of advanced materials and devices.*
   APS Meeting, Boston, MA, 2012
6. Poster given at CFAR Symposium, University of Pennsylvania, Philadelphia, PA, 2017
7. Poster given at NanoDay@Penn, University of Pennsylvania, Philadelphia, PA, 2015
8. Poster given at Gordon Research Conference, Biddeford, MN, 2014
9. Poster given at Windsor Summer School, London, UK, 2012

Teaching Assistant Experience

University of Maryland–College Park

1. Experimental Physics II: Electricity and Magnetism (PHYS276), 2009, with Prof. Hassan Jawahery and Dr. Richard Ellis.
   Lectured, assisted on experiments in real time, run discussion sessions, held office-hours, and graded.
2. Intermediate Electricity and Magnetism (PHYS411, ENEE680), 2008, with Prof. Edward Ott.
   Lectured, run discussion sessions, held office-hours, and graded.

Sun Yat-sen University

3. Biophysics, 2005, with Prof. Paul Erdös.
   Lectured, held office-hours, and graded.

Research Mentorship

Graduate

1. Chengyu Wen, Department of Materials Science and Engineering, University of Pennsylvania. Fabrication of transparent graphene field-effect transistors, 2017.
2. Ying Liu, School of Chemical Engineering in Tianjing University. Growth of two dimensional diamond-structure materials, 2017.

3. Camilla Schneier, Department of Physics and Astronomy in University of Pennsylvania. Scalable DNA biosensors based on graphene field-effect transistors, 2016. Schneier was co-author on an article for contributing in this project.
4. Ram Gona, School of Engineering in University of Pennsylvania. Fabrication of graphene nanoelectrodes, 2016.
5. Ramya Vishnubhotla, Department of Physics and Astronomy in University of Pennsylvania. Scalable DNA biosensors based on graphene field-effect transistors, 2015. Vishnubhotla was co-author on an article in ACS Nano for contributing in this project.
6. Xue Fei, Baylor College of Medicine in University of Maryland. Imaging and diffraction of protein by field-emission electron transmission microscopy, 2013.
7. Rian You, Department of Physics in University of Maryland. Imaging and diffraction of carbon particles by field-emission electron transmission microscopy, 2012.
8. Behnood G. Ghamsari. Department of Physics in University of Maryland. Preparation of graphene by chemical vapor deposition and mechanical exfoliation, 2011.

Undergraduate

1. Abigail Lee, Department of Physics and Astronomy in University of Pennsylvania. Fabrication and electron transport properties of graphene field-effect transistors, 2016. Lee was co-author on an article for contributing in this project.
2. Olivia Saouaf, Department of Materials Science & Engineering in MIT. Fabrication and functionalization of graphene/MoS_2-based transistors, 2016. Saouaf was co-author on an article for contributing in this project.
3. Amey Vrudhula, Department of Bioengineering in University of Pennsylvania. Fabrication and analysis of electron transport properties of graphene field-effect transistors, 2015. Vrudhula was co-author on an article in ACS Nano for contributing in this project.
4. Ryu-Sung Weinmann, Department of Physics in University of Maryland. Controllable growth of impurity-decorated graphene on platinum, 2012.
5. Gary Chen, Department of Physics in University of Maryland. Synthesis of graphene by chemical vapor deposition on copper, 2011.

High-school

1. Thomas McKenzie-Smith, Harriton High School. Gas-sensing based on DNA-decorated carbon-nanotube field-effect transistors, 2016.

Professional Service

- Reviewer for journals including IEEE Sensors, Nano Letters, ACS Advanced Materials Interfaces, Applied Physics Letters, Chinese Physics Letters
- Membership: American Physics Society, American Chemistry Society, Materials Research Society
- Chairing & Organizing
  - Chair of Session P33 (focused session) of APS March Meeting 2017, New Orleans, LA
  - Chair of Session J1 (focused session) and Y26 of APS March Meeting 2015, San Antonio, TX
  - Chapter Member of EPS Young Minds–Section Maryland 2012
  - Organizer and chair of Chemical Physics Seminar, 2009-2010, University of Maryland, MD