Kai Wu, Ph.D.

Education

Ph.D. Electrical Engineering University of Minnesota-Twin Cities 2013-2017
Advisor: Prof. Jian-Ping Wang
PhD Thesis: Magneto-Nanosensor Platforms for Biosensing Applications
B.S. Electrical Engineering Northwestern Polytechnical University 2009-2013

Research Experience

Assistant Professor, Texas Tech University, U.S. 2022-Present

- Magnetic biosensors for healthcare, such as wearable inks for vital signs monitoring, THz magnetic biosensors to document molecule fingerprints, point-of-care (POC) devices for on field tests, and machine learning assisted healthcare.
- Magnetic imaging such as magnetocardiography (MCG) and small animal tumor imaging.
- Magnetic nanomaterials and nanodevices for both biomedical applications and neuromorphic computing.
- Magnetic neuromodulation and recording for the treatment of brain disorders.

Research Scientist, University of Minnesota, U.S. 2020-2022

- Wrote grant proposals and served as project co-PI or co-I. Received **6** federal, state, and university grants with total award of **$1.707 million** as of Aug 2022.
- Assisted in the establishment of the Minnesota NeuroSpin Initiative Center to connect neurologists, neuroscientists, and engineers to develop novel magnetic nanomaterials and spintronic devices for investigating and understanding the nervous system. *One of the pioneers in applying magnetic and spintronic devices to neural engineering.*
- Assisted in the establishment of Gophters Fighting COVID-19 and connect virologists and engineers to use our portable magnetic particle spectroscopy (MPS) device for on-site SARS-CoV-2 detection. Selected news: EquiManagement, IEEE Spectrum, KSTP. *One of the pioneers in applying magnetic biosensors for SARS-CoV-2 detection from exhaled breath.*
- Assisted in mentoring PhD students through 3 active projects where I served as co-PI, co-I and senior researcher.

Postdoctoral Associate, University of Minnesota, U.S. 2017-2020

- Team leader in developing magnetic particle spectroscopy (MPS) point-of-care device for rapid, inexpensive, wash-free, and highly sensitive disease diagnosis. See team website: MagiCoil**.**
- Designed and fabricated flexible giant magnetoresistive (GMR) biosensors with the ability to adapt to complex biological structures.
- Synthesis and surface functionalize of high magnetic moment (3 times higher than commercial iron oxide nanoparticles) iron nitride nanoparticles for biomedical applications.
- Develop flexible spintronic nanodevice arrays for large-scale, high resolution neural stimulation and recording. Selected news release: The Minnesota Daily.
- Perform micromagnetic simulations of spintronic nanodevices, such as spin Hall channels, magnetic domain wall motion, skyrmions, and magnetic tunnel junctions (MTJ). Predict the magnetic dynamics of spintronic devices when an external magnetic field and charging current are applied.
- Serve as laboratory manager, responsible for laboratory safety, preparing standard operating procedures (SOP), and instructing graduate students.

Research Assistant, University of Minnesota, U.S. 2013-2017

• Developed a GMR point-of-care device that is capable of data processing, display, and wireless communication. Applied it for the detection of influenza A virus and ovarian cancer. Demonstrated a one-step, wash-free GMR bioassay method to simplify the testing protocol with minimal sacrifice of the performance. Selected news release: UMN ECE.

• Conceived and built up a magnetic particle spectroscopy (MPS) bench-top system for bioassays. Demonstrated its feasibility on detecting influenza A virus.

Member, Golden Gopher Magnetic Biosensing Team, University of Minnesota, U.S. 2013-2015

• Designed and fabricated two types of GMR biosensor chips with different nanosensor array layouts for GMR POC device. The startup company Zepto Life Technology (St. Paul, MN) is based on this platform.

• One of five Distinguished Award Winner Teams in Nokia Sensing XCHALLENGE Competition. Selected news release: WCCO, Bring Me The News, HIT Consultant Media, MedCityNews, 21st Century Tech Blog.

Book Chapters

1. **Wu, K.**, Su, D., Saha, R., & Wang, J. P. Chapter 4. Giant Magneto-resistance (GMR) Materials and Devices for Magnetic Sensors. Luo, J., Wang. K., Yang, M. (Ed.). (2022). Spintronics: Materials, Devices, and Applications. John Wiley & Sons Limited.
2. **Wu, K.**, Su, D., Feng, Y., & Wang, J. P. Chapter 13. Magnetic Nanoparticle-based Biosensing. Thanh, N. T. (Ed.). (2018). Clinical Applications of Magnetic Nanoparticles. CRC Press.

Professional Service

1. Guest editor for:

Special issue Advanced Nanomaterial-Based Sensors for Biomedical Applications, Sensors. 2021-2022

Special issue High Sensitivity Electromagnetic Sensors and Their Applications, Journal of Sensors.2019

2. Conference Reviewer for: IEEE sensors (2020), INTERMAG Conference (2018, 2020), The Annual Conference on Magnetism and Magnetic Materials (2016, 2020)
3. Journal Reviewer for 40+ international journals

Teaching

1. ECE2372 Modern Digital System Design — Fall 2022, Texas Tech University
2. EE 5670 Spintronic Devices — Spring 2016, 2020, 2021, University of Minnesota
3. EE 8660 Seminar: Magnetics — Spring 2016, University of Minnesota

Professional Development

1. Serving as editorial board member of the journal Sensors, MDPI.
2. Serving as reviewer for 40+ international journals.
3. Member of American Chemical Society.
4. Writing grant proposals and collaborating with colleagues from TTU and external institutions.
4. Giving academic talks within TTU, at external institutions, at international conferences.