



Seminar

Nanoscale Devices based on Two-dimensional Materials

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Time: 10:00am, May 31, 2017 (Wednesday)

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10:00

Venue: Room W563, Physics building, Peking University

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Abstract

Two-dimensional (2D) materials are layered crystals with strong in-plane covalent bonds and weak interlayer van der Waals bonds. These materials have many unique chemical, mechanical, optical and electrical properties, which not only provide a platform to investigate fundamental physical phenomena but also may provide solutions to some of today's most pressing technological challenges. In this talk, I will present our work on understanding the electrical properties of graphene, transition metal dichalcogenides, black phosphorus, group IV chalcogenides, and their heterostructures.¹⁻³ I will also present our work on the nano-scale electronic devices (logic devices and radio frequency devices) and photonic devices (plasmonic devices and photo-detectors) based on these 2D materials.^{4,5}

1. Zhu, W. J., Low, T., Lee, Y. H., Wang, H., Farmer, D. B., Kong, J., Xia, F. N. & Avouris, P. "Electronic transport and device prospects of monolayer molybdenum disulphide grown by chemical vapour deposition". *Nature Communications*, **5**, (2014).
2. Zhu, W. J., Low, T., Perebeinos, V., Bol, A. A., Zhu, Y., Yan, H. G., Tersoff, J. & Avouris, P. "Structure and Electronic Transport in Graphene Wrinkles". *Nano Letters*, **12**, 3431-3436, (2012).
3. Lu, S. C., Mohamed, M. & Zhu, W. J. "Novel vertical hetero- and homo-junction tunnel field-effect transistors based on multi-layer 2D crystals". *2D Materials*, **3**, (2016).
4. Freitag, M., Low, T., Zhu, W. J., Yan, H. G., Xia, F. N. & Avouris, P. "Photocurrent in graphene harnessed by tunable intrinsic plasmons". *Nature Communications*, **4**, (2013).
5. Yan, H. G., Low, T., Zhu, W. J., Wu, Y. Q., Freitag, M., Li, X. S., Guinea, F., Avouris, P. & Xia, F. N. "Damping pathways of mid-infrared plasmons in graphene nanostructures". *Nature Photonics*, **7**, 394-399, (2013).

About the speaker

Wenjuan Zhu is an assistant professor in Department of Electrical and Computer Engineering at University of Illinois at Urbana-Champaign. Wenjuan Zhu received her Ph.D. degree in the Department of Electrical Engineering at Yale University in 2003. After graduation, she joined IBM Semiconductor Research and Development Center. She made key contributions to the 65nm and 32nm CMOS technology nodes. In 2008, she joined the IBM T. J. Watson Research Center and worked on 2D materials including graphene and layered transition metal dichalcogenides. In 2014, she joined the faculty at the University of Illinois and established a research group focusing on two-dimensional (2D) materials and nanoscale devices. Her research in the past has resulted in more than 80 publications in journals/conferences and 24 patents issued/pending. Prof. Zhu received National Science Foundation CAREER award in 2017, IBM Research's Pat Goldberg Memorial Best Paper Award in 2013, Outstanding Technical Achievement Award in IBM in 2008, more than ten Invention Achievement Award in IBM, Henry Prentiss Becton Graduate Prize for exceptional achievement in research in Engineering and Applied Science at Yale University in 2003.