



### Weekly Seminar

#### Ultrafast Nonlinear Optical Effects in Black Phosphorus Nanomaterials

**Jun He**

*School of Physics and Electronics, Central South University*



**Time: 4:00pm, Nov. 8, 2017 (Wednesday)**

**2017 11 8**

**4:00**

**Venue: Room W563, Physics building, Peking University**

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As a new member of two-dimensional materials, black phosphorus (BP) has attracted unprecedented attention owing to its unique electronic and optoelectronic properties. In this work, a facile liquid exfoliation method was used to prepare BP nanosheets and BP Quantum Dots (QDs) suspended in NMP solvent. The Z-scan and pump-probe measurements indicated that BP nanosheets and QDs exhibit typical broadband saturable absorption properties. For BP nanosheets, an ultrafast recovery time ( $\sim 50$ fs) and slow electron-hole recombination time ( $\sim 1.9$ ps) of BP nanosheets were determined at 1550nm and correlated with intraband relaxation and interband carrier recombination, respectively. For BP QDs, the ultraviolet intraband relaxation time may be too short to be resolved, while the extracted interband relaxation time was 200~300 fs. The carrier diffusion length of 5 nm was obtained based on non-equilibrium carriers diffusion theory, which is consistent with the size of BP QDs. The excellent nonlinear optical characteristics of BP nanosheets and QDs may lead to new applications in lasers and optical switching.

Dr. Jun He is a Professor in School of Physics and Electronics at Central South University, China. He obtained his B.S. and M.S. degrees in physics from Jilin University, China. He undertook his Ph.D. studies at the National University of Singapore, Singapore, and joined the same university as a Research Fellow. From 2006 to 2009, he pursued further postdoctoral work at the City College of the City University of New York, USA, and at the University of Toronto, Canada. Since 2014, he has held the Chair in School of Physics and Electronics at Central South University, China. He also served as Deputy Director at Hunan Key Laboratory of Super-Microstructure and Ultrafast Process, China. He is supported by National Science Foundation for Excellent Young Scientists and Program for New Century Excellent Talents, China. He has authored and co-authored over 90 journal papers and hold several patents. His current research interests include ultrafast nonlinear optics, spintronics, and two-dimensional materials.