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Wigner crystals and their melting in atomically thin heterostructures

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Abstract: A Wigner crystal, an electron solid, is the first predicted correlated state, and exhibits intriguing quantum and classical phase transitions. Despite decades of research, it has been challenging to realize Wigner crystals in the quantum regime where quantum fluctuations dominate over thermal fluctuations. In this talk, I will introduce how heterostructures of atomically thin semiconductors such as transition metal dichalcogenides form an exciting new materials platform to investigate correlated electronic states. I will then describe how we can use optical spectroscopy to probe the formation of Wigner crystals and determine the phase diagrams of the crystals' classical and quantum melting. Finally, I will discuss how these experiments can open new avenues for simulating quantum many-body states and may form a novel basis for quantum information processing.

Biography: Dr. You Zhou is an Assistant Professor in the Department of Materials Science and Engineering at the University of Maryland, College Park. He received his B.S. in Physics from Peking University. He earned his Ph.D. in Applied Physics from Harvard in 2015, where he worked on metal-insulator transitions in correlated oxides with Prof. Shriram Ramanathan. He was a postdoctoral fellow in Prof. Hongkun Park's group at Harvard University between 2015 and 2020, focusing on excitonic and electronic properties of 2D semiconductors. He is a recent recipient of the NSF CAREER Award.