

The Mueller Lecture

Thursday, August 27, 2026

10:30AM in BRWN 4102

Reception 10:00AM in BRWN 4102



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“Seeing Electrons in Two Dimensions using Light”

Abstract: Layered van-der-Waals crystals can be thinned down to produce stable two-dimensional monolayers. The first widely studied material in this class was graphene, a single layer of carbon atoms, with its semi-metallic character. Subsequently monolayers with insulating and semiconducting 2D materials have been identified, as have been materials with ferromagnetic, ferroelectric, and even superconducting properties. These monolayers can, moreover, be stacked in an arbitrary manner, thus allowing for the combination of different classes of materials in precisely controlled heterostructures that exhibit new properties not present in the individual layers.

In this lecture, we will describe how light interacts with such 2D layers and how optical spectroscopy can be used to reveal the properties of electrons in 2D materials. In the 2D semiconductors, optically excited electrons and holes bind together as atom-like excitonic excited states. These states exhibit features that differ both from the excited states of isolated atoms and from excited states of three-dimensional crystals. The possibility to tune and modify the excited states by electric fields, strain, dielectric environment, and adjacent 2D materials will be discussed. Such studies provide fundamental understanding of the properties of electrons and their excited states in reduced dimensional systems and also reveal potential applications of 2D semiconductors in optoelectronics and quantum information science.

Heinz Bio

Tony Heinz received a BS degree in Physics from Stanford University and a PhD degree, also in Physics, from UC Berkeley. In 1995, after working in the IBM Research Division, he became a professor of Physics and Electrical Engineering at Columbia University. In 2012, he served as the President of Optica. Heinz joined Stanford University as a Professor of Applied Physics, with a concurrent appointment at SLAC National Accelerator Laboratory as a Professor of Photon Science in 2015. He has served in various leadership positions, including as President of the Optical Society of America (Optica) and as the Associate Laboratory Director for Energy Sciences at SLAC. Heinz's research on surfaces, interfaces, and 2D materials has exploited diverse spectroscopic techniques to elucidate the fascinating properties emerging in the world of reduced-dimensional materials. Heinz's research accomplishments have been recognized by the Schawlow Prizes of the American Physical Society, by the Ives Award of Optica, and the Louis Brus award for nanoscience of the ACS, among other distinctions.