**2D Semiconductor Optoelectronics: *Advances, Challenges and Opportunities***

Ali Javey1,2\*

*1 Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA*

*2 Materials Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA*

\*Email: ajavey@berkeley.edu

In this talk, I will present recent advancements on understanding and controlling the radiative and non-radiative recombination rates in various 2D semiconductor systems. I will discuss the mechanisms by which non-radiative recombination can be fully suppressed in TMDC monolayers, resulting in near-unity photoluminescence quantum yield at room temperature despite the presence of large defect densities. I will discuss an AC carrier injection mechanism to enable bright light emitting devices using monolayers, overcoming the problem of Schottky contacts. Finally, I will discuss potential applications for black phosphorous (BP) thin films for midwave-IR photo detection and emission. Specifically, the BP based devices are shown to exhibit higher detectivity and luminescence efficiencies over state-of-the-art III-V and II-VI devices in mid-IR, owing to the lower Auger recombination rates and unusually low surface recombination velocity.