Integration of optoelectronic response in 2D materials into Si photonics

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By using optical platforms instead of metallic interconnects, photonic devices can achieve both high speed and low power consumption suitable for next generation information processing. Although the state-of-the-art silicon (Si) photonic chips are outstanding optical platforms for light propagation, it requires external active optical components such as light sources and photodetectors. A potential solution comes in the form of atomically thin two-dimensional (2D) materials. Their remarkable optoelectronic properties are widely tunable by doping, strain, and external fields, owing to their atomic thickness and unique characteristics. Moreover, their two-dimensional planar structure is suitable for integration into a planar photonic platform.
In this talk, I will discuss my current endeavors of novel photonics and optoelectronics functions using 2D materials integrated Si photonic, including light generation/detection and phase modulations[1,2]. I will discuss the challenges and opportunities of integrating 2D materials with Si photonic devices, and present experimental results that demonstrate their potential for enhancing device performance. Furthermore, I will demonstrate how these advancements can be leveraged to enable novel information processing techniques that can outperform conventional computers.

References

[1] I. Datta et al., Nature Photonics, 14 (2020) 256–262
[2] I. Datta et al., arXiv preprint arXiv:2209.08332 (2022)

Figures

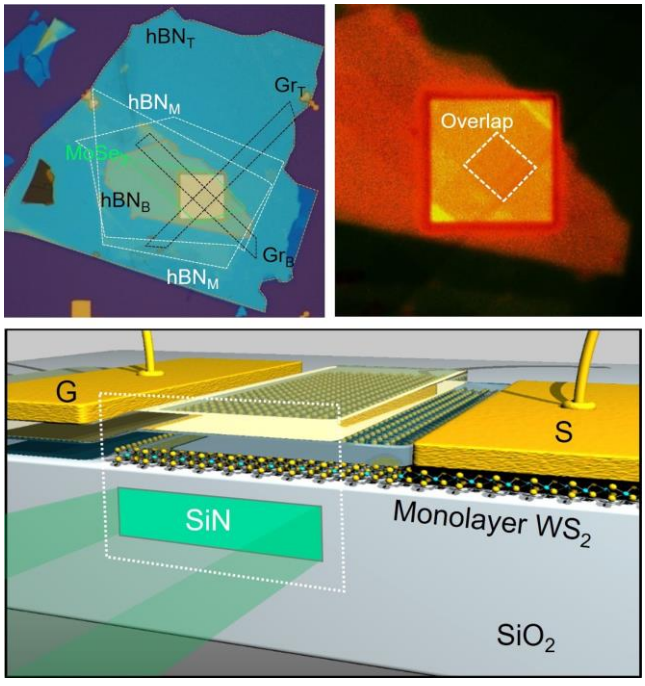

Figure 1: 2D materials-based optoelectronic devices and those integration into Si photonics platform. Light emitting device using MoSe2 (top) and WS2-SiN hybrid photonics for low-loss modulation (bottom).