

Valley Polarization in WS₂/Graphene Heterostructures

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Understanding valley polarization is vital for transferring data in next-generation electronics. Due to spin-orbit coupling, WS₂ is a promising material for valleytronic devices. Here we address the behavior of valley polarization in different WS₂ heterostructures. The results indicate that unlike interaction in WS₂ encapsulated with hBN, the interaction between WS₂ and graphene has an intense impact on the temperature dependence depolarization. Furthermore, intervalley scattering rates under resonant and non-resonant excitation energy are crucial parameters to see the temperature dependence by considering that Fröhlich coupling is calculated. The results show that the scattering rate is almost independent of temperature due to large phonon energy. The results suggest that the major contribution of valley depolarization merges from the change in the radiative lifetime.

REFERENCES

- [1] Paradisanos, Ioannis, Kathleen M. McCreary, Davoud Adinehloo, Leonidas Mouchliadis, Jeremy T. Robinson, Hsun-Jen Chuang, Aubrey T. Hanbicki et al. "Prominent room temperature valley polarization in WS₂/graphene heterostructures grown by chemical vapor deposition." Applied Physics Letters 116, 203102 (2020).

FIGURES

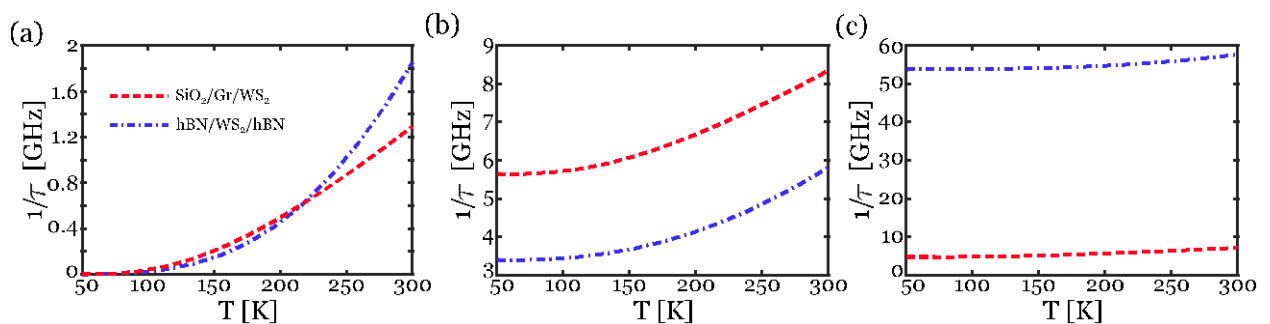


Figure 1: Inter-valley scattering rates of electrons in WS₂ heterostructures. (a) on resonance excitation conditions, (b) 55 meV above resonance excitation, and (c) 200 meV above resonance excitation.