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Valley Polarization in WS_2 Heterostructures: Experiment and Theory

We investigate the temperature dependence of valley polarization in WS_2 heterostructures. WS_2 layer is considered as an optically active material. The influence of heterostructures of different materials on the degree of valley polarization is depicted. 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 as the crucial parameters to see the temperature dependence by considering Fröhlich coupling are calculated. The results show the scattering rate is almost independent of temperature due to large phonon energy. Subsequently, the major contribution of observed valley depolarization should come from the change in the radiative lifetime.

Reference

[1] Paradisanos, I., McCreary, K.M., Adinehloo, D., Mouchliadis, L., Robinson, J.T., Chuang, H.J., Hanbicki, A.T., Perebeinos, V., Jonker, B.T., Stratakis, E. and Kioseoglou, G., arXiv preprint,1910.05320 (2019)

Figures

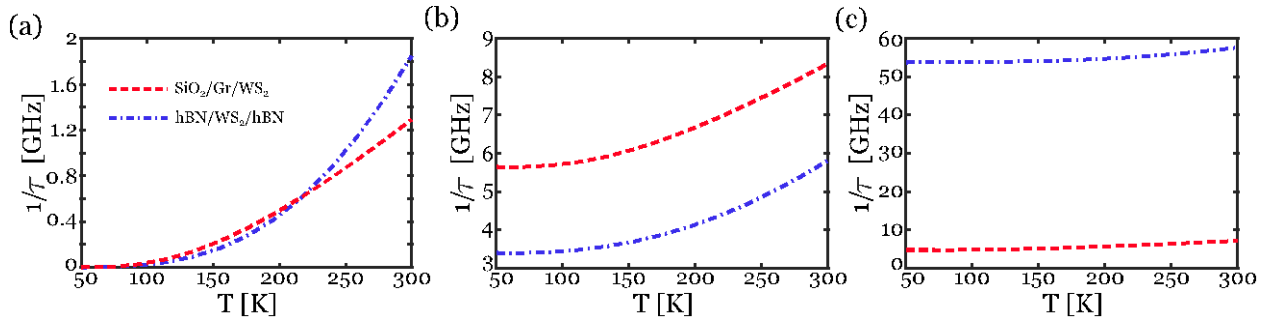

Figure 1: Inter-valley scattering rates of electrons in WS2 heterostructures. (a) ε_k=0 meV, (b) ε_k=55 meV, and (c) ε_k=200 meV.