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Band nesting and photocarrier relaxation in group 6 transition metal dichalcogenide

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Large absorption coefficient of semiconducting transition metal dichalcogenides in the visible frequencies makes them an attractive material for optoelectronics [1]. However, the origin of strong light-matter interaction in these materials has remained elusive. Recently, Carvalho et al.[2] reported that such giant light-matter interaction is due to band nesting effect. Nesting of the conduction and valence bands in 2D systems leads to a singularity in the joint density of states (JDOS) and corresponding divergence in optical conductivity. Band nesting also implies that photoexcited electron-hole pairs relax with opposite momentum. We demonstrate through photoluminescence excitation spectroscopy (Figure 1) and Monte Carlo simulation that band nesting results in spontaneous formation of indirect excitons when photoexcitation is in resonance with the nesting energy [3].

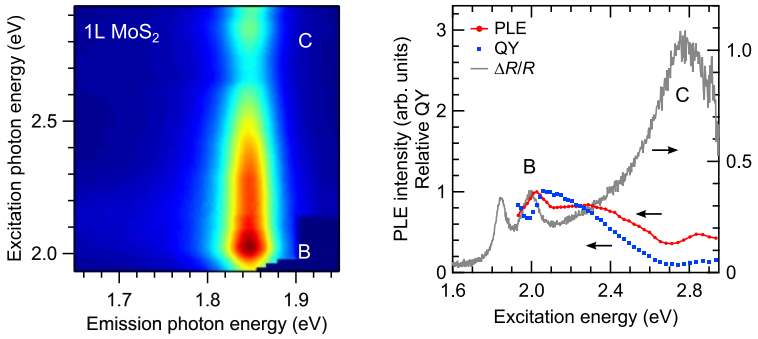

Fig. 1 Photoluminescence excitation and differential reflectance spectrum of mechanically exfoliated MoS_2 monolayer [3].

References

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