TITLE: ENHANCED INTERLAYER EXCITON LIFETIME IN ATOMICALLY THIN SEMICONDUCTING VAN DER WAALS HETETROSTRUCTURES

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Interlayer excitons (IXs) in atomically thin transition metal dichalcogenide (TMD) heterostructures are a promising platform for the study of dipolar Bose-Einstein condensates (BECs) in two-dimensional solid-state systems. IXs exhibit tunable emission energies, large binding energies, and long lifetimes, allowing for the manipulation of the exciton energies and spatial position [1]. To successfully generate a BEC, long lifetimes are favorable for the IXs to thermalize with each other and potentially condense. One approach to further extending the excitonic lifetime is to place ultrathin hexagonal boron nitride (h-BN) in between two monolayers of TMDs [2]. At sufficiently high electric fields, we demonstrate the existence of two species of IXs in a system of WSe_2/monolayer h-BN/WSe_2 (Fig. 1a). We can tune their emission owing to their large dipole moments of 0.9 nm for the A-IX, and 0.5 nm for the B-IX. Further, we can use the electric field to tune the lifetime of the A-IX between 75-100 ns (Fig. 1b), a significant improvement over natural bilayer lifetimes. This technique is promising for applying to other indirect exciton systems, such as $MoSe_2$/WSe_2 heterobilayers.

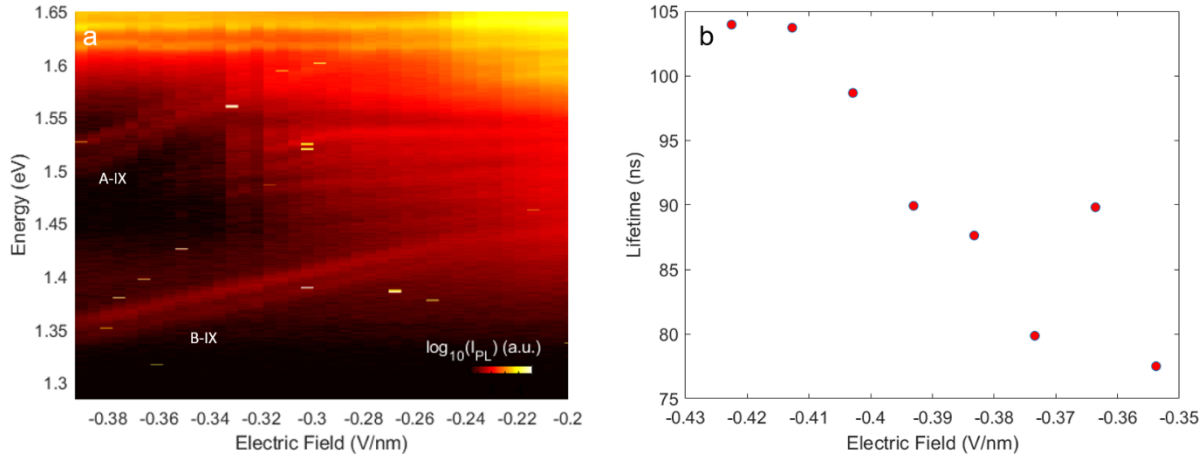

Fig. 1. (a) Electric field dependence of the photoluminescence spectra. We observe two distinct IX species: a higher energy peak starting around -0.34 V/nm labeled A-IX, and a lower energy peak appearing around -0.24 V/nm, labeled B-IX. (b) The lifetime of the A-IX is enhanced with increasing magnitude of the electric field.

References

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