Electroluminescence from multi-particle exciton complexes in monolayer WSe_2

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Light emission from higher-order correlated excitonic states has been recently reported in hBN-encapsulated monolayer WSe_2 upon optical excitation[1-4]. These exciton complexes are found to be bound states of excitons residing in opposite valleys in momentum space, a promising feature that could be employed in applications such as quantum optoelectronics. However, electrically-driven light emission from such excitons species is still lacking. Here we report electroluminescence from bright and dark excitons, negatively charged trions and neutral and negatively charged biexcitons, generated by a pulsed gate voltage, in hexagonal boron nitride encapsulated monolayer WSe_2 with graphene as electrode. We observe that the relative intensity of the different exciton complexes strongly depends on the pulse parameters. We find the electroluminescence from charged biexcitons and dark excitons to be as narrow as 2.8 meV.

References

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Figures

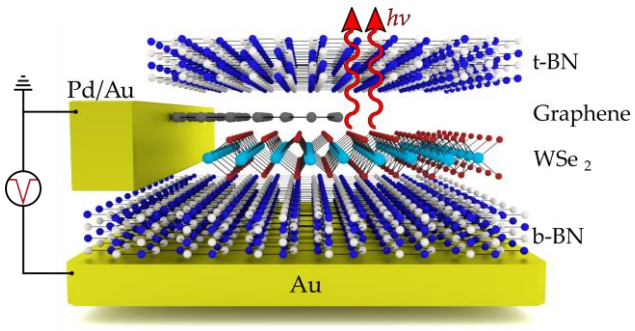

Figure 1: Schematic drawing of the sample. Monolayer WSe_2 and graphene are sandwiched between two multilayer hBN flakes.

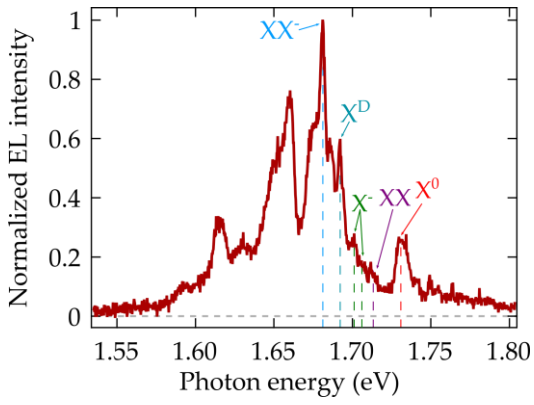

Figure 2: Electroluminescence spectrum from WSe_2.