Theory of Magnetic-Field Dependence of Excitonic Spectra in Atomically Thin Semiconductors

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Atomically thin semiconductors host rich exciton physics in two dimensions. In this contribution, we theoretically study the linear absorption spectrum of TMDC monolayers under the influence of an in-plane magnetic field within an exciton-Bloch-equation approach.

We find, as shown in Figure 1 below, that in-plane magnetic fields induce a hybridization of spin-bright and spin-dark exciton transitions, resulting in a brightening of spin-dark excitons in the linear absorption spectrum with increasing in-plane field-strength. We show analytically, that the spin-dark/bright excitonic energies obey an anti-crossing behaviour, whereas the magnetic-field-induced dephasings show the opposite.

The strength and behaviour of these processes is governed by the combined action of the excitonic dark-bright splitting and the dephasing difference.

In addition, we find analytical expressions for the amplitudes, allowing us to fully characterize the excitonic resonances under influence of an in-plane magnetic field analytically.

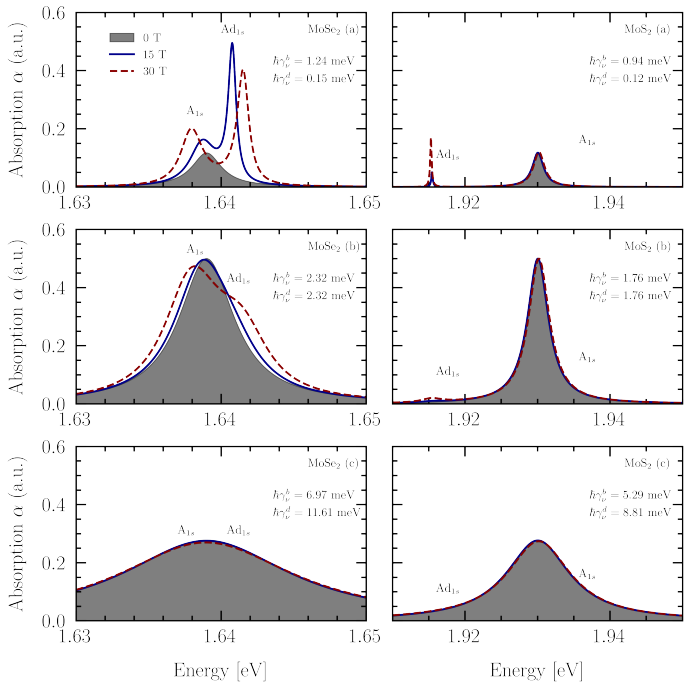

Figure 1: Linear absorption spectrum under influence of an in-plane magnetic field for the materials $MoSe_2/MoS_2$ encapsulated in h-BN with σ_+-polarized light for different dephasings.

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