Excitons, magnons & photons in a van der Waals antiferromagnet

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Magnetic van der Waals materials offer new perspectives on magneto-optic effects, which often seem to be dominated by the interplay of excitons and magnetic order in these materials. Additionally, exciton-magnon coupling manifests in a variety of responses unique to either the weak or the strong exciton-photon coupling regime. In this talk, I will discuss how interactions of excitons, magnons, and photons bring together concepts from semiconductor physics, magnetism, and photonics. The elemental role of strong light-matter coupling and the emergent hybrid light-matter states known as exciton-polaritons will be analyzed in the context of the optical properties of the layered magnetic semiconductor CrSBr [1-4]. In the second part, I will also present our latest experimental and theoretical advances on unraveling the impact of magnons on the propagation of excitons. Highly non-linear exciton transport features, such as propagation enhanced at the antiferromagnet-to-paramagnet phase transition, will be discussed alongside the anomalous observations of exciton cloud contraction and superdiffusive behavior.

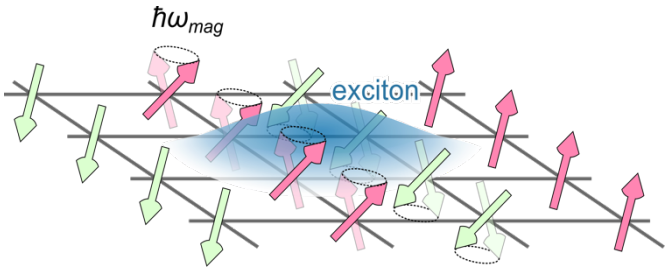

Figure 1: A cloud of excitons surrounded by ordered magnetic moments and magnons precessing at a frequency $\hbar\omega_{mag}$.

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