# Exciton and Valley Dynamics in $MoS_2$, $MoSe_2$ and $WSe_2$ monolayers

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In Transition Metal Dichalcogenide (TMDC) monolayer, inversion symmetry breaking together with the large spin-orbit interaction leads to a coupling of carrier spin and k-space valley physics, *i.e.*, the circular polarization (σ+ or σ–) of the absorbed or emitted photon can be directly associated with selective carrier excitation in one of the two non-equivalent K valleys (K+ or K–, respectively).
We have investigated the exciton and valley properties in TMDC monolayers $MoS_2$, $MoSe_2$, $MoTe_2$ and $WSe_2$ with cw and time-resolved polarized photoluminescence spectroscopy.
We present linear and non-linear optical spectroscopy experiments which evidence the giant exciton binding energy (~500 meV) and its consequences on ultrafast intrinsic radiative lifetime at low temperature [1,2]. Recent results obtained on monolayer (ML) $WSe_2$ encapsulated in hexagonal boron nitride (hBN) will be discussed and compared with the ones measured on ML $WSe_2$ exfoliated directly onto $SiO_2$.
The key role played by exciton exchange interaction will also be presented. It has a dramatic impact on both the luminescence yield through the interplay between bright and dark excitons [3,4] and on the spin/valley depolarization mechanism [5].
We also demonstrate the control of the exciton 'valley coherence' by tuning the applied magnetic field perpendicular to the monolayer plane [6,7].

References

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