Revealing in-plane g factors in few-layer in WSe2 via time-resolved Faraday measurements

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With the increasing interest of two-dimensional heterostructures, the question arises how far the layer-intrinsic properties are imparted to multilayer van der Waals structures. While the effects of external magnetic fields on transition metal dicalcogenides monolayers have been studied intensively during the last years, the interaction of multiple layers remained largely disregarded.
We demonstrate a non-zero effective g factor for in-plane magnetic fields in few-layer WSe2 making use of time-resolved Faraday rotation experiments. The found values commensurate to the established out-of-plane effective g factors. This indicates an isotropic effective in-plane g factor for multilayer WSe2, which stands in contrast to monolayer samples. Up to now, no standard theoretical approach can model a non-zero in-plane g factor.

References

[1] Aurora et al.," Excitonic resonances in thin films of WSe2: from monolayer to bulk material", Nanoscale, 7 (2015), 10421
[2] Aurora et al.," Valley-contrasting optics of interlayer excitons in Mo- and W-based bulk transition metal dichalcogenides"Nanoscale, 10 (2018), 15571-15577
[3] Katsch et al., "Theory of the Coherent Response of Magneto-Excitons and Magneto-Biexcitons in Monolayer Transition Metal Dichalcogenides", Phys. Rev. B 102 (2020), 115420

Figures

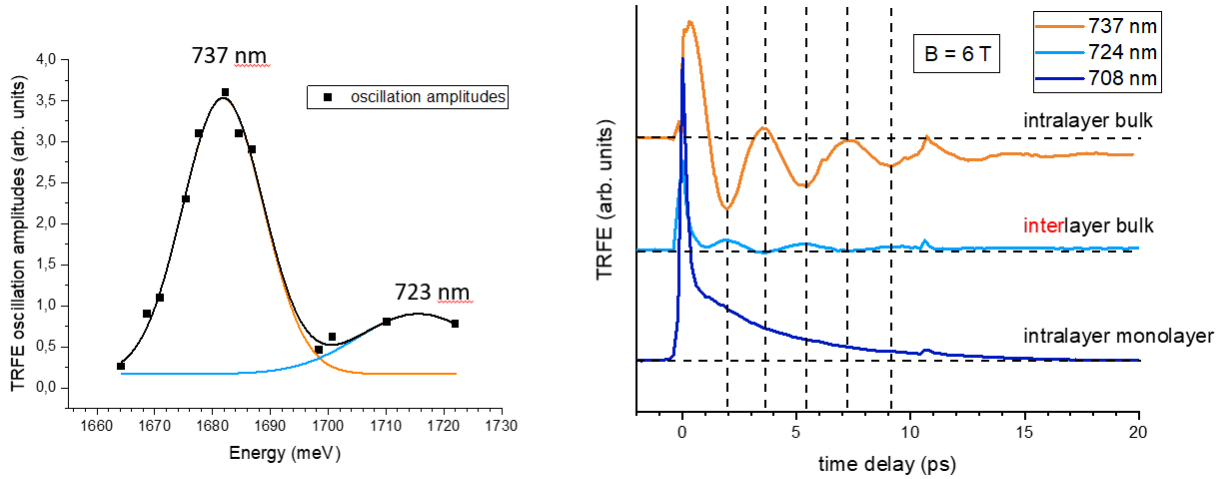

Figure 1: Found optical transitions in few-layer WSe2 and oscillating Faraday ellipticity traces for in-plane magnetic fields allowing a precise determination of an effective g-factor.