Magnetization dynamics in the 2d antiferromagnet CrSBr

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The 2d antiferromagnet CrSBr has garnered significant attention in recent years due to the strong coupling of its magnetization state to its optical properties, such as photoluminescence and reflectivity [1,2], as well as non-linear effects like second harmonic generation (SHG) [3]. This easy access allows for measurements of antiferromagnetic dynamics, which are usually elusive in optics due to their insensitivity to techniques such as circular dichroism and Kerr spectroscopy (Fig. 1). For instance, the interlayer AFM order in even-layered CrSBr flakes breaks time- and inversion symmetry and enhances the SHG signal [3]. Our goal is to employ tr-SHG to measure the de- and remagnetization of few-layer CrSBr, as the antiferromagnetic ordering should be melted by a femtosecond laser pulses transiently heating the sample above T_N. By comparing the response of mono- and few-layer CrSBr it could be possible to probe intralayer ferromagnetic and interlayer antiferromagnetic coupling separately. Similarly, we measure antiferromagnetic magnons in tr-reflectivity, whose frequency can be shifted by applied gate voltages (Fig. 2). We use this mechanism to build a magnonic phase shifter.

References

[1] Y. Bae et al., *Nature* 609, 282 (2022)
[2] Diederich et al., *Nature Nanotechnology* 18, 23 (2022)
[3] Lee et al., Nano Letters 21(8), 3511 (2021)

Figures

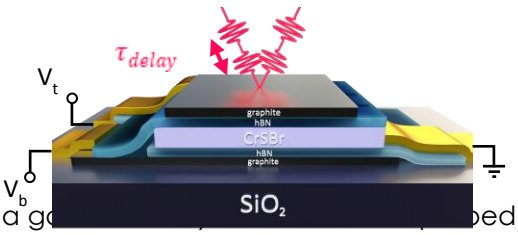

Figure 1: Antiferromagnetism in a g ed by ultrafast spectroscopy methods such as tr-reflectivity and SHG.

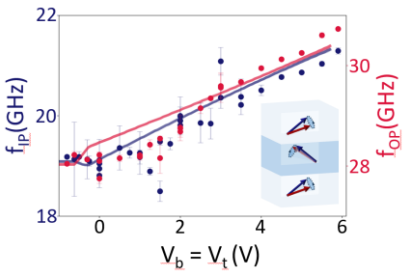

Figure 2: Gate-dependence of magnon frequencies in CrSBr.