Seebeck measurements on the 2D magnet CrSBr

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The Seebeck effect describes the conversion of heat into electricity and has direct impact on future energy harvesting strategies. However, its intimate coupling to the fundamental electronic properties of a material makes the Seebeck effect also a powerful tool to investigate electronic correlations [1], thermodynamic effects [2], or (quantum)phase transitions with superior precision compared to conventional charge transport measurements. To this end, we implemented few-layer CrSBr into our recently developed cryogenic thermoelectric device architecture [3]. This allowed us to study the magnetic field and temperature dependent thermovoltage in few-layer CrSBr flakes. We observe strong variations of the thermovoltage when magnetic order is changed (PM-AFM, FM-AFM magnetic phase transitions) in the material. Furthermore, we reveal an increase of thermoelectric conversion efficiency by one order of magnitude around 40 Kelvin which we attribute to a spin-entropy change in the material driven by a spin-freezing process.

References

[1] C. Hsu et al., Phys. Rev. Lett. 128 (2022), 147701
[2] E. Pyurbeeva et al., Chem. Phys. Rev. 3 (2022) 041308
[3] P. Gehring et al., Appl. Phys. Lett. 115 (2019) 073103

Figures

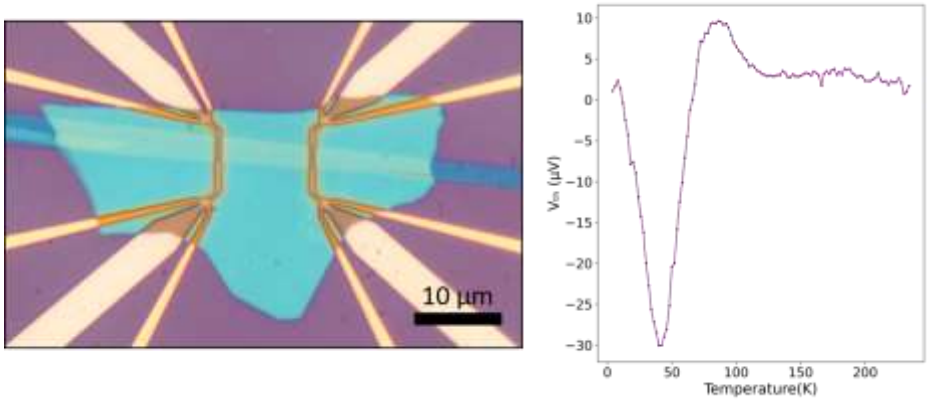

Figure 1: Left: Optical micrograph of a thermoelectric device. A few-layer CrSBr flake is stamped onto gold contacts and encapsulated by a thin hBN flake. Right: Thermovoltage as a function of temperature measured at zero magnetic field.