# Infrared Magneto-polaritons in $MoTe_2$ Monolayers and Bilayers

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$MoTe_2$ monolayers and bilayers are unique within the family of van der Waals materials since they pave the way toward atomically thin infrared light-matter quantum interfaces, potentially reaching the important telecommunication windows. Here, we report emergent exciton polaritons based on $MoTe_2$ monolayers and bilayers in a low-temperature open microcavity in a joint experiment-theory study [1]. Our experiments clearly evidence both the enhanced oscillator strength and enhanced luminescence of $MoTe_2$ bilayers, signified by a 38% increase of the Rabi splitting and a strongly enhanced relaxation of polaritons to low-energy states. The latter is distinct from polaritons in $MoTe_2$ monolayers, which feature a bottlenecklike relaxation inhibition. Both the polaritonic spin valley locking in monolayers and the spin-layer locking in bilayers are revealed via the Zeeman effect, which we map and control via the light-matter composition of our polaritonic resonances. We further explore a $MoTe_2$-$MoSe_2$ HBL where the moiré exciton-polaritons relax efficiently as in the $MoTe_2$ homobilayer. In a resonant pump-power dependent measurement, we also found that the enhanced optical saturation due to moiré confinement that results in a larger polariton non-linearity as in a type-I heterostructure [2]. Our work paves the way for further research involving cavity-mediated phenomena in $MoTe_2$-based van der Waals heterostructures, including the study of correlated phenomena, Telluride-based dipolaritons, and polariton lasers operated at telecommunication wavelengths.

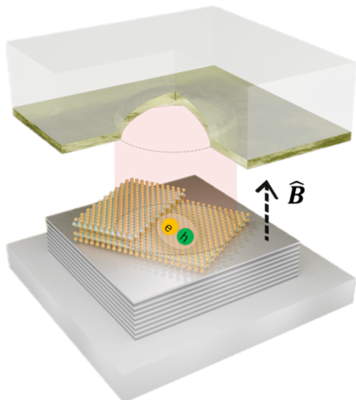


Figure 1: Schematic of the infrared polaritons in a 2D semiconducting material $MoTe_2$ embedded in a cryogenic open optical cavity. The superconducting magnet allows exploration of magnetic properties of the polariton modes.

## Acknowledgments

The project is funded by Deutsche Forschungsgemeinschaft (DFG) Lantern project (funding numbers: Schn1376 11.1). C. S. acknowledges DFG within the initiative for major equipment (Project INST184-220). B. H. acknowledges Alexander von Humboldt-Stiftung for a fellowship grant. M. E. acknowledges funding from the Carl von Ossietzky Universität Oldenburg through a Carl von Ossietzky Young Researchers' Fellowship. F. E. acknowledges support by DFG SFB 1375 (NOA) and BMBF FKZs 16KISQ087K and 13XP5053A. J. F, R. R., and E. M. acknowledge funding from DFG via SFB 1083 and the regular project 524612380. K. W. and T. T. acknowledge support from the JSPS KAKENHI (Grant No. 21H05233 and 23H02052) and World Premier International Research Center Initiative (WPI), MEXT, Japan. M. S. acknowledges funding from Project No. 2019/35/B/ST5/04308 financed by the Polish National Science Center (NCN).

## References

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