# Observation of spatially dependent nonequilibrium bulk and edge spin accumulation in two dimensional $MoTe_2$

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Two-dimensional (2D) topological materials such as $MoTe_2$ host various efficient charge-to-spin conversion (CSC) mechanisms that reveal promising applications for field-free switching in perpendicular anisotropy magnets, essential for advanced spintronic devices [1]. However, the nature of the various CSC mechanisms and their correlation with underlying crystal symmetries remain unsettled. I will discuss on results on using spin-sensitive electrochemical potential measurements to directly probe the spatially dependent nonequilibrium spin accumulation in $MoTe_2$ across various sample locations and thicknesses. We can clearly distinguish the contributions originating from the spin Hall and Rashba-Edelstein effects and uncover spin accumulation from a conventional spin Hall effect that persists for all thicknesses as well as distinct bulk and edge spin accumulation from a combination of conventional and unconventional CSC effects that gradually appear as the thickness is lowered. [2,3]. By comparison with *ab initio* calculations, we establish a unified understanding of all the observed CSC components in relation to the material dimensionality and stacking order. Our findings not only elucidate previous CSC and spin-orbit torque results on $MoTe_2$, but also paves the way for the design of future spintronic devices utilizing this 2D material.

References

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