Adiabatic Orbital Pumping in 2d materials

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In this work, we theoretically investigate the coupled spin, charge and orbital dynamics induced by a precessing magnetization in a planar bilayer heterostructure. To do so, we developed a theory of adiabatic pumping using Keldysh formalism and Wigner expansion to the first order in magnetization dynamics. This approach enables us to model the pumping mechanism beyond the weak spin-orbit coupling limit. We carry out simulations using a model system to determine the parameters that control the pumping of spin and orbital moments into adjacent non-magnetic metals and show that in principle orbital pumping can be as large as spin pumping. We then extend our study to realistic bilayers considering topological insulators and transition metal dichalcogenides. We show the differences between spin and orbital relaxation in the nonmagnetic 2d material.

References

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