Mechanical control of valley magnetization and Berry curvature dipole in monolayer MoS_2

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Atomically thin honeycomb crystals have recently emerged as promising platforms to investigate electron's valley degree of freedom for the development of functional valley-based devices. Electron control by valley index has been demonstrated using electrical, optical and magnetic means, owing to the opposite signs of the Berry curvature between two valley centers. Here we report a different kind of valley-based electron control that is based on the Berry curvature dipole. We demonstrate the generation of net valley magnetization under an in-plane electric field, regulated by the strain-induced modification of the Berry curvature distribution, which produces the Berry curvature dipole [1]. The generation of valley magnetization is optically detected by using the Kerr rotation microscopy on monolayer MoS_2 embedded in flexible van der Waals heterostructures as functions of tunable strain. The measured valley magnetization is well explained by the calculated values of the strain-induced Berry curvature dipole. Our work demonstrates strain as a new functionality for potential novel flexomagnetic and valley information processing devices using monolayer TMD materials.

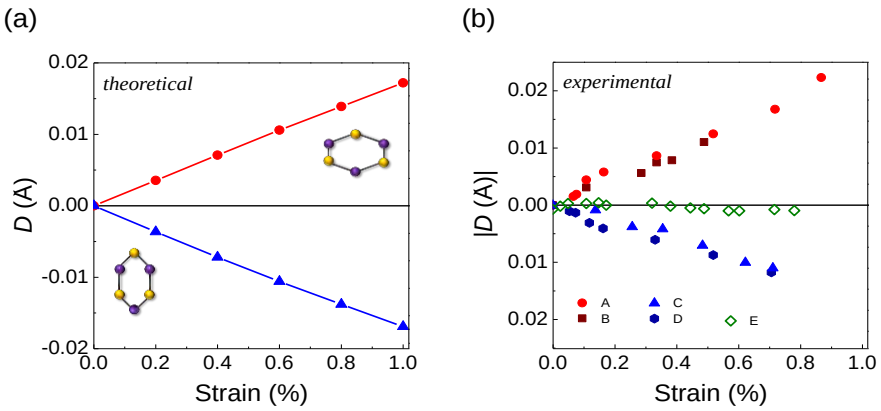

Figure 1. (a) Theoretically calculated and (b) experimentally measured Berry curvature dipole as a function of strain for two different strain directions.

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