Valley current polarization and disorder probing in gated MoS$_2$ nanoribbons

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The growing interest in single-layer transition metal dichalcogenides is driven mostly by their promising applications in novel electronics that exploits spin and valley properties of charge carriers [1]. By the means of tight-binding [2] transport calculation we investigate the valley properties of a single-layer MoS$_2$ nanoribbon. We characterize the dispersion relation of the ribbon and explain valley polarization of the current carrying modes that belong to K, K', and Q valleys. We show that due to band mixing in a side-gated ribbon a valley polarization of the current can be achieved. Finally we explain how the current flowing through a nanoribbon is affected by disorder and how the disorder itself can be mapped out by Scanning Gate Microscopy.

References
