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Weak localization and low temperature transport in MoS_2 flakes

ADAM T. NEAL, HAN LIU, YUCHEN DU, PEIDE YE, Purdue University, Birck Nanotechnology Center — With the recent identification of the indirect to direct bandgap transition for monolayer MoS_2 [1] and the use of MoS_2 in field-effect transistors [2,3], this material has attracted recent interest in the physics and nanotechnology communities. We report studies of transport in MoS_2 at low temperature from 1K up to 70K, characterized by Hall mobility and weak localization. We find that the mobility at T=400mK in this few-layer MoS_2 flake varies from 50cm^2/Vs to 300cm^2/Vs as electron density varies from 6x10^{12} cm^{-2} to 1.2x10^{13} cm^{-2} via the back gate bias. Additionally, we find that the mobility decreases with increasing temperature as a power law with a characteristic exponent of 1.6 at a carrier concentration of 1.2x10^{13} cm^{-2}. Magneto-transport measurements reveal weak localization in this MoS_2 sample up to temperatures as high as 10K. The phase coherence length in MoS_2 is estimated to be about 40nm at 1K for a carrier concentration of 1.2x10^{13} cm^{-2}.

[1] K. F. Mak et al. **PRL**, 105, 136805 (2010)
[2] B. Radisavljevic et al. **Nature Nano**, 6, 147 (2011)
[3] H. Liu et al, **IEEE EDL**, 33, 546 (2012).

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