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$^{-2}$.