Transport studies on 2D ferromagnetic $Mn(Bi,Sb)_6Te_{10}$/BN/graphite tunneling junction and 2D antiferromagnetic $MnPS_3$/graphene QH heterostructures

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Two-dimensional van der Waals magnets hosting novel quantum states are fundamentally interesting and potentially useful in low-power electronics. In this poster, we report on the studies of ferromagnetic $Mn(Bi,Sb)_6Te_{10}$ using tunneling spectroscopy and magnon transport in antiferromagnetic $MnPS_3$ using non-local transport techniques. Transport measurements of exfoliated $Mn(Bi_{0.88},Sb_{0.12})_6Te_{10}$ sheets show a Curie temperature of ~11 K and a coercive field of ~ 0.02 T at 2 K, in agreement with bulk measurements. We build vertical tunnel junctions using graphite electrode and thin h-BN barrier to probe the surface density of states of $Mn(Bi_{0.88},Sb_{0.12})_6Te_{10}$ and observed a suppressed differential tunneling conductance in a small range of biases (~15 mV) near $V_{dc}=0$ at low temperatures. This observation is consistent with a magnetic exchange gap. We developed a new non-local transport method to study magnon transmission through $MnPS_3$, which utilizes the quantum Hall edge states of bilayer graphene as injector and detector. We study both linear response and thermally generated magnons systematically as a function of temperature and magnetic field and relate the findings to the magnetic properties of $MnPS_3$. This method can potentially be used to probe the magnetic order and excitations of other van der Waals magnets.