Thin films of magnetically doped topological insulators
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The interplay between the Dirac surface state and ferromagnetic order in topological insulators can lead to a number of very exotic quantum phenomena. To observe the quantum phenomena such as quantized anomalous Hall (QAH) effect in magnetically doped topological insulators, the materials are required to be in the form of thin film with tunable chemical potential and carrier-independent ferromagnetism. In this talk, I will report our recent progress in molecular beam epitaxy growth, chemical potential tuning and electronic properties of the magnetically doped topological insulator thin films. By Cr doping, we have realized both n-type and p-type conductivity in (Bi$_x$Sb$_{1-x}$)$_2$Te$_3$ thin films. Remarkably their ferromagnetism was found independent of the type and concentration of carriers. Moreover, the anomalous Hall effect is significantly enhanced at low carrier concentration regime, with the anomalous Hall angle reaching an unusually large value of 0.2 and the zero field Hall resistance reaching one quarter of the quantum resistance (h/e^2). These findings pave the way to ultimately observing the QAH effect and other quantum effects in magnetic topological insulators.