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**Approaching the insulating state in Ca-doped $Bi_2Se_3$ nanodevices**[1] PENG WEI, ZHIYONG WANG, JING SHI, Department of Physics and Astronomy, University of California at Riverside — We report a systematic tuning of the carrier density in Ca-doped $Bi_2Se_3$ nanodevices. A clear transition from the metallic to insulating state is observed as both the Ca-concentration and the gate voltage are tuned. At high temperatures, the devices behave metallic as indicated by the linear temperature dependence of the electrical resistivity as the devices are initially cooled. As the temperature is lowered, the resistivity shows a minimum then increases. This insulating behavior can be modeled by a thermal activated conductivity, which is taken over by saturation at the lowest temperatures. At 1.5 K, the resistivity undergoes a ∼5-fold increase as a gate voltage is swept from -60 V to 60 V. The field-effect mobility is found to be about ∼ 5000 cm2/Vs. We have also observed a systematic evolution of the magnetoresistance as the chemical potential is tuned via the gate voltage. The combination of the chemical and electronic dopings provides an effective way to access the low carrier density gap states in Bi2Se3 topological insulator nanodevices. This work was supported in part by DOE and NSF.

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Peng Wei
Dept of Physics and Astronomy, University of California at Riverside

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