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Electronic transport and scanning tunneling microscopy study of bismuth quantum films SHENGYONG QIN, TAE-HWAN KIM, THOMAS Z. WARD, AN-PING LI, Oak Ridge National Laboratory — Semimetal films, such as bismuth films, have attracted great interest due to their unique electronic properties around the Fermi level. Bulk Bi has three conduction band minima at L points about 40mV lower than the single valance band maximum at T point. However, with decreasing Bi layer thickness, an energy gap is expected to open when the size confinement becomes sufficient to raise the lowest electron subband above the highest hole subband. We have utilized quantum growth method to fabricate atomically flat Bi thin films with thickness controllable down to single atomic layer. The quantum films are then studied in situ with a cryogenic four-probe STM to examine the correlation of the electronic and transport properties. An oscillatory resistivity change is observed as function of film thickness, which is discussed in comparison with the local density of states.

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