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Universal scaling at band-tuned metal-insulator transitions

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We present the theory of a bandstructure-tuned metal-insulator transition (MIT) in $d = 2$ dimensions. Close to the MIT, the conductivity is dominated by disorder, which leads to a universal jump in the conductivity at the transition. Away from the transition, a universal scaling regime appears where the conductivity follows the form $\sigma(EF, T) = \sigma c(T) f(EF/T)$. Notably, at the transition the resistivity diverges as a powerlaw, $Rc(T) \sim 1/T$. As a result, on the metallic side there is a 'fake' insulator regime with $dR/dT < 0$. We show that these features of the band-tuned MIT are universal, even in the presence of strong disorder, magnetic fields, electron-phonon coupling and weak symmetry-breaking interactions. Finally, we compare our theory to the experimentally observed band-tuned MIT in MoTe2/WSe2 and find quantitative agreement.