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Disorder and the integer quantum Hall plateau-to-plateau transition WANLI LI, D.C. TSUI, Princeton University, J.S. XIA, University of Florida and NHMFL, L.N. PFEIFFER, K.W. WEST, Bell Labs — We have studied the temperature scaling of integer quantum Hall plateau-to-plateau transition in various disordered systems down to 10mK. The samples are $Al_xGa_{1-x}As$-$Al_{0.33}Ga_{0.67}As$ heterostructures with different Al concentration x. Previous work has shown a perfect power law $(dR_{xy}/dB)|_{Bc} \propto T^{-\kappa}$ with κ=0.42 over two decades of temperatures in the sample with x=0.85%. In the sample of x=0, κ=0.58 was observed at high temperatures, while we have now found κ=0.42 restored below a crossover temperature T_c=120mK. T_c increases to 250mK for x=0.21%, and is not observable in the experimental temperature range in the sample of x=0.85%. We propose that the quantum phase coherence length exceeds the disorder correlation length below T_c, shifting the nature of the disorder in the system from long-ranged to short-ranged. On the other end of the sample series with x=4.1%, where alloy clustering is believed to be significant, κ=0.58 is found to persist down to the lowest temperature of the measurement limit, suggesting a different universal class of the transition in long-range disordered systems.

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