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Impact of Interface Roughness on the Metallic Transport of Strongly Correlated 2D Holes in GaAs Quantum Wells[1] NICHOLAS GOBLE, Department of Physics, Case Western Reserve University, JOHN WATSON, MICHAEL MANFRA, Department of Physics, Purdue University, XUAN GAO, Department of Physics, Case Western Reserve University — Understanding the non-monotonic behavior in the temperature dependent resistance, $R(T)$, of strongly correlated two-dimensional (2D) carriers in clean semiconductors has been a central issue in the studies of 2D metallic states and metal-insulator transitions. We have studied the transport of high mobility 2D holes in 20nm wide GaAs quantum wells with varying interface roughness by changing the Al fraction x in the $\mathrm{Al_xGa_{1-x}As}$ barrier. Prior to this work, no comprehensive study of the non-monotonic resistance peak against controlled barrier characteristics has been conducted. We show that the shape of the electronic contribution to $R(T)$ is qualitatively unchanged throughout all of our measurements, regardless of the percentage of Al in the barrier. It is observed that increasing x or short range interface roughness suppresses both the strength and characteristic temperature scale of the 2D metallicity, pointing to the distinct role of short range versus long range disorder in the 2D metallic transport in this 2D hole system with interaction parameter $r_s \sim 20$.

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