

Abstract Submitted
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Lifetime of 2D electrons in $\text{Al}_x\text{Ga}_{1-x}\text{As}-\text{Al}_{0.32}\text{Ga}_{0.68}\text{As}$ Heterostructures WANLI LI, DANIEL TSUI, Princeton University, LOREN PFEIFFER, KEN WEST, Bell Labs — We have investigated the transport lifetime and the quantum lifetime of 2D electrons confined to the $\text{Al}_x\text{Ga}_{1-x}\text{As}-\text{Al}_{0.32}\text{Ga}_{0.68}\text{As}$ heterostructures over the range of x from 0 to 0.85%. The transport lifetime is obtained from the mobility measurement, while the quantum lifetime is determined by fitting the temperature and magnetic field dependences of the Shubnikov-de Hass oscillations to the Dingle formula. With x increases from 0 to 0.85%, the transport lifetime is found to decrease from 160ps to 30ps. However the quantum lifetime only changes from 1.71ps to 1.64ps. Since the quantum lifetime is given by the total scattering rate over all directions while the transport lifetime is only affected by the large-angle backscattering rate, our results show that the alloy scattering centers contribute mainly to the short-ranged large-angle scattering. These results demonstrate a powerful way to manipulate the nature of disorder in 2D electron systems and show consistency with the recent scaling experiment of IQHE plateau-to-plateau transitions in $\text{Al}_x\text{Ga}_{1-x}\text{As}$ alloy systems with different x .

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