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The $\nu = 5/2$ Fractional Quantum Hall State in presence of Alloy Disorder NIANPEI DENG, GEOFFREY GARDNER, SUMIT MONDAL, ETHAN KLEINBAUM, MICHAEL MANFRA, GABOR CSATHY, Purdue University — Disorder plays a prominent role in the formation and the strength of all fractional quantum Hall states, including the one forming at filling factor $\nu = 5/2$. Many aspects of the disorder are, however, poorly understood. At the root of this lack of understanding one often finds our inability to control and characterize disorder. We have investigated the effect of a specific type of disorder, alloy disorder, on the $\nu = 5/2$ state. The alloy disorder is controllably introduced into the electron channel by growing a series of $Al_{0.24}Ga_{0.76}As/Al_xGa_{1-x}As/Al_{0.24}Ga_{0.76}As$ quantum well samples with different aluminum molar fraction x using Molecular Beam Epitaxy techniques. We find a suppression of the energy gap of $\nu = 5/2$ state with increasing x. To our surprise, we observe a fully quantized $\nu = 5/2$ state in an extremely low mobility regime in which, based on existing data, we did not expect the $\nu = 5/2$ state to develop. Such a result indicates that $\nu = 5/2$ state is unusually robust to the short-ranged alloy disorder. This work was supported by the DOE BES contract no. DE-SC0006671.

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