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$\nu = 1$ quantum Hall state in a lateral periodic quantum anti-dot array W. PAN, J.L. RENO, J.A. SIMMONS, Sandia National Labs, Albuquerque, NM, D. LI, S.R.J. BRUECK, University of New Mexico, Albuquerque, NM — The quantum Hall ferromagnetism (QHF) at the Landau level filling ν=1 in 2DES has been extensively studied over the years. Due to strong Columbic interaction, at ν=1, all the electron spins align with the external magnetic, giving rise to a ferromagnetic order. Consequently, the energy gap (Eg) of the ν=1 state is much larger than that of bare Zeeman splitting (Ez). Previous experimental studies focused mostly on the clean limit of sample quality where the electron-electron interaction is strong. On the other hand, theories have shown that a phase transition from the QHF state to a quantum Hall spin glass state can occur as sample disorder increases. To study this phase transition, we used a lateral quantum anti-dot array, where the electronic potential modulation can be viewed as a special form of sample disorder. More importantly, this disorder can be continuously tuned by varying electron density. We observed that for small potential modulation Eg at ν=1 is much larger than Ez, indicating a ferromagnetic order. As the modulation strength increases, Eg first decreases slowly and after a critical value of modulation, the decrease rate accelerates and Eg approaches the Ez limit, signaling a possible transition from a ferromagnetic state to a spin glass state. Tilting magnetic field results will also be discussed.

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