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Microwave Spectroscopic Observation of Multiple Phase Transitions of Bilayer Electron Solids in a Wide Quantum Well LLOYD ENGEL, ANTHONY HATKE, National High Magnetic Field Laboratory, YANG LIU, MANSOUR SHAYEGAN, LOREN PFEIFFER, KEN WEST, KIRK BALDWIN, Princeton University — For a single-layer two dimensional electron system, the fractional quantum Hall effect (FQHE) series terminates to form an insulating phase (IP) for Landau filling factor $\nu < 1/5$. In a wide quantum well the charge distribution can separate into two layers as density increases resulting in a modification of the IP onset to $\nu < 1/2$ [1]. The IP is understood as an electron solid pinned by residual disorder. The solid exhibits a microwave pinning mode resonance, which is due to pieces of the solid oscillating within the disorder potential. We have previously observed that the microwave pinning mode spectra reveal phase transitions between different types of solid within the terminating IP [2]. In this talk we extend our studies of microwave spectroscopic measurements of a wide quantum well by investigating these phase transitions in the presence of an in-plane magnetic field. Applying an in-plane field forces the system to be more bilayer-like and for small tilt angles we find that the transitions move to higher ν. However, at sufficiently high angles the resonance onset extends above $\nu = 1/2$ and the ν of the transitions saturate. [1] Manoharan et al., Phys. Rev. Lett. 77, 1813 (1996). [2] A. T. Hatke et al., Nature Commun. 6, 7071 (2015).

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