Pinned Bilayer Wigner Crystals with Pseudospin Magnetism
YONG CHEN, Princeton University and National High Magnetic Field Lab — We study a model of pinned bilayer Wigner crystals (WC) and focus on the effects of interlayer coherence (IC) on pinning. We consider both a pseudospin ferromagnetic WC (FMWC) with IC and a pseudospin antiferromagnetic WC (AFMWC) without IC. Our central finding is that a FMWC can be pinned more strongly due to the presence of IC. One specific mechanism is through the disorder induced interlayer tunneling, which effectively manifests as an extra pinning in a FMWC. We also construct a general “effective disorder” model and effective pinning Hamiltonian for the case of FMWC and AFMWC respectively. Under this framework, pinning in the presence of IC involves interlayer spatial correlation of disorder in addition to intralayer correlation, leading to enhanced pinning in the FMWC. The pinning mode frequency ($\omega_{pk}$) of a FMWC is found to decrease with the effective layer separation, whereas for an AFMWC the opposite behavior is expected. An abrupt drop of $\omega_{pk}$ is predicted at a transition from a FMWC to AFMWC. Possible effects of in-plane magnetic fields and finite temperatures are addressed. Finally we discuss some other possible ramifications of the FMWC as an electronic supersolid-like phase. [1] Yong P. Chen, cond-mat/0507124

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