Collective depinning and sliding of a quantum Wigner crystal in a two-dimensional electron system

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I will report the observation of two-threshold voltage-current characteristics accompanied by a peak of broadband noise between the two threshold voltages in the insulating state at low electron densities in two-dimensional electron systems in silicon metal-oxide-semiconductor field-effect transistors and ultrahigh mobility SiGe/Si/SiGe heterostructures. The two-threshold V I characteristics reported in my talk are strikingly similar to the two-threshold I V characteristics known for the collective depinning of the vortex lattice in type-II superconductors, with voltage and current axes interchanged. The observed results can be described by a phenomenological theory of the collective depinning of elastic structures, which naturally generates a peak in broadband current noise between the dynamic and static thresholds and changes to the crystal's sliding over a pinning barrier above the static threshold. This provides compelling evidence for the formation of a Wigner crystal in these structures and demonstrates the generality of the effect across different classes of strongly correlated two-dimensional electron systems.