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Giant capacitance of a plane capacitor with a two-dimensional electron gas in a magnetic field BRIAN SKINNER, BORIS SHKLOVSKII, University of Minnesota — If a clean two-dimensional electron gas (2DEG) with small concentration comprises one (or both) electrodes of a plane capacitor, the resulting capacitance can be larger than the "geometric capacitance" defined by the physical separation between electrodes. Such capacitance enhancement is a hallmark of the positional correlations that arise between electrons within the 2DEG at low electron density. Here we show that in the presence of a strong perpendicular magnetic field, such correlations are enhanced, leading to unusually large capacitance even for systems where the effective Bohr radius is large. The effect is perhaps most dramatic for ultrathin graphene-based capacitors, where strongly-correlated electron states appear at small filling factors, even though in the absence of magnetic field such correlated states are normally precluded by graphene's Dirac-like kinetic energy spectrum.

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