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Ballistic superconductivity in high mobility two dimensional electron gas in GaAs heterostructures ZHONG WAN, ALEKSANDR KAZAKOV, MICHAEL MANFRA, Purdue univ, LOREN PFEIFFER, KEN WEST, Princeton Univ, LEONID ROKHINSON, Purdue.edu — Introduction of a Josephson field effect transistor (JoFET) concept sparked active research on proximity effects in semiconductors. Induced superconductivity and electrostatic control of critical current has been demonstrated in two-dimensional gases in InAs, graphene and topological insulators, and in one-dimensional systems including quantum spin Hall edges. Recently, interest in superconductor-semiconductor interfaces was renewed by the search for non-Abelian states when fractional quantum Hall edge states interface with superconductivity. However, the highest mobility 2D gases in GaAs, where variety of strongly correlated states including fractional quantum Hall effect can be observed, are notoriously absent from the list of materials where superconductivity have been induced. We report formation of transparent superconducting contacts to the high mobility 2DEG in GaAs and demonstrate induced superconductivity across several microns. Ballistic supercurrent has been observed across 0.6 μm of 2DEG, a regime essential to the formation of well separated non-Abelian states. High critical fields ($>$ 16 Tesla) in NbN contacts enables investigation of a regime of an interplay between superconductivity and strongly correlated states in a 2DEG at high magnetic fields.

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