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Phase transitions in the two-dimensional electron-hole gas ROMAN KEZERASHVILI, OLEG BERMAN, New York City College of Technology, City University of New York, KLAUS ZIEGLER, Institut fur Physik, Universitat Augsburg — For a gas of spatially separated electrons and holes with tunable Coulomb interaction and variable density a first order phase transition between a Bardeen-Cooper-Schrieffer (BCS) phase and an insulating Mott phase is predicted. The phase diagram is obtained in the framework of a BCS-like mean-field approach and a Landau expansion in terms of the pairing order parameter. This phase diagram indicates several phases and phase transitions, including an electron-hole plasma at low density and weak interaction, an intermediate BCS phase with Cooper pairs and an electron-hole plasma at high density and weak interaction. The insulating Mott phase appears for the strong interaction and low temperatures. The possibilities to realize these phases in realistic systems such as coupled quantum wells and graphene double layers are discussed.

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