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Interacting fermions in two dimensions: singularities in the perturbation theory and the role of collective modes. SUHAS GANGADHARAIAH, University of Utah, DMITRII GUTMAN, University of Florida, DMITRII MASLOV, University of Florida — We consider a system of interacting fermions in two dimensions. It is shown that even for an infinitesimally weak interaction a straight-forward perturbation theory is ill defined near the mass shell. Starting from the second order, the perturbative expansion for the self-energy is singular at the mass shell. We show that this singularity is a manifestation of a non- perturbative effect: the interaction of fermions with the collective mode. The singularities in the perturbation series for the self-energy is treated by resumming the most divergent diagrams. A threshold for emission of zero-sound waves leads to a non-monotonic variation of the self-energy. Consequently, the spectral function acquires a non-Lorentzian kink-like feature. This feature is reminiscent to spin-charge separation in 1D, as the kink is absent in a spin-polarized system. We examine the possibility of detecting the kink in momentum-conserving tunneling between two parallel layers of a 2D electron gas.

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