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Weak Localization in Disordered Two-dimensional Crystals with Half-Filled Band

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Abstract: Effect of substitutional impurities on electron localization in two dimensional (2D) lattice near the middle of the band is studied. Calculation of density of the electronic states, $\rho(\nu\text{arepsilonpsilon})$, increases logarithmically in the middle of the band. This singularity in the density of states of noninteracting electron gas on lattice gives rise to anomalous dependencies of thermodynamic quantities on the temperature. The quantum correction to the conductivity of a noninteracting electron gas due to Umklapp electron-impurity scattering is calculated. This correction to the conductivity is shown to compete with that from the localization correction for a Normal scattering process. As a result the conductivity has a finite value at the middle of the band. With a small offset from the middle of the band all states again become localized.

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