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Transport theory of superconductors with singular interaction corrections[1] ALEX LEVCHENKO, Argonne National Laboratory — We study nonlinear transport properties of superconductors near the classical critical point T_c where fluctuation effects play the dominant role. In this regime conductivity is set by the interplay of two competing effects. The first is that strong electron-electron interactions in the Cooper channel increase the life time of fluctuation Cooper pairs and thus enhance conductivity. On the other hand, dynamic pair breaking effects tend to suppress superconductivity. An interplay between these processes defines the new transport regime $Gi \ll \frac{T-T_c}{T_c} \ll \sqrt{Gi}$ where fluctuation induced conductivity becomes more singular, here Gi is the Ginzburg number. The crossover temperature $T_c\sqrt{Gi}$ is generated as the result of scattering on dynamic fluctuations of the order parameter. The most singular contributions to conductivity stem from the dynamic Aslamazov-Larkin term, and novel Maki-Thompson and interference corrections. We suggest that the natural way to probe nonlinear fluctuation regime in superconductors is by magnetoconductivity measurements in the perpendicular field.

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Alex Levchenko
Argonne National Laboratory

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