The relationship between the normal state Fermi liquid scattering rate and the superconducting state

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Fermi liquids (FL) are ubiquitous in physics: helium, neutron matter, cold atoms, metals. In several bad metal superconductors, e.g. A-15, borocarbides, heavy fermions, the FL scattering time τ quadratic temperature dependence, i.e. $\rho = AT^2$, dominates the low temperature electrical resistivity ρ above the superconducting transition temperature T_c. In the first place, we show empirically that there exists a relationship between A and T_c when both vary under an external parameter, such as pressure. The more resistive the compound the higher the T_c. Through the analysis of Landau theory of FL, we find that it is a general feature of FL, due to the fact that the scattering that is the main cause of τ is the same one that bounds the pairs that condensed at T_c. We devise a method that allows the determination of the coupling constant λ, which is validated through application to ^{3}He-'s superfluid transitions and τ's extracted from different properties. This method works for conventional superconductors, but fails with heavy fermions.

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