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Single-particle and optical self-energies of a Fermi liquid revisited DMITRII MASLOV, University of Florida, ANDREY CHUBUKOV, University of Wisconsin — We discuss the conditions under which the imaginary part of the single-particle self-energy at the Fermi surface $\Sigma(\omega, T)$ and the optical scattering rate $1/\tau(\Omega, T)$ have particular simple scaling forms $\mathrm{Im}\Sigma(\omega, \mathrm{T}) \propto \omega^2 + \pi^2\mathrm{T}^2$ and $1/\tau(\Omega, T) \propto \Omega^2 + 4\pi^2 T^2$. We show that these relations follow from particular analytic properties of the effective fermion-fermion interaction and are only satisfied when the single-particle and optical self-energies are analytic functions of the frequency. When they are not, the scaling forms are more complex even if the system remains a Fermi liquid. We also address recently observed violation of the $\Omega^2 + 4\pi^2 T^2$ form of $1/\tau$ in URu_2Si_2 and discuss possible mechanisms of this violation.

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