Universal and non-universal renormalizations in the Fermi-liquid theory\footnote{This work was supported by NSF-DMR-0908029 (D. L. M.) and NSF-DMR-0906953 (A. V. Ch.)} DMITRII MASLOV, University of Florida, ANDREY CHUBUKOV, University of Wisconsin-Madison — We discuss the interplay between the Landau Fermi liquid theory and a direct perturbative approach to a Fermi liquid. In a Fermi liquid theory for Galilean-invariant systems, mass renormalization $m^*/m$ comes exclusively from fermions at the Fermi surface. We show that in the perturbation theory the same $m^*/m$ comes partly from fermions at the Fermi surface and partly from fermions far away from the Fermi surface. We show that there exists a particular relation between the self-energy contributions from high- and low-energy fermions which allows one to reconcile diagrammatics with a Fermi-liquid theory. We argue that extra care has to be exercised in the renormalization group approach to a Fermi liquid in order not to miss high-energy contributions to $m^*/m$. We present the results for $m^*/m$ and the quasiparticle residue $Z$ for a 2D Fermi gas with short-range interaction and discuss the extension of an $SU(2)$ theory to $SU(N)$. 

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