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The Structure of Perturbative Renormalization Group Functions

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RG functions are used in QFT to evolve theories between energy scales and are frequently used in both phenomenology and theory. As we push to ever higher loop-order beta functions in generic gauge-Yukawa-quartic theories, we have observed and utilized an underlying structure to obtain results at 4-3-2 loop order: the beta functions satisfy what is known as the Weyl Consistency Conditions. Going to these high orders in perturbation theory, we also found that the usual MS-bar definition of the beta functions is ambiguous and can even exhibit poles in the dimensional regulator. I will clarify how this is linked to flavor symmetries and how we can recover unambiguous, finite functions.

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