Notes concerning article

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1 Role of γ and y

1.1 Introduction

μ is the renormalization scale,

$$m_0(\lambda) \equiv m_r(\lambda)\, Z_m(\epsilon, g_r) \tag{1.1}$$

RG equations

$$-\gamma_m \equiv \frac{\partial \log m_r(\lambda)}{\partial \log \mu} = -\frac{\partial \log Z_m}{\partial \log \mu} = \frac{\partial \log Z_m}{\partial \log \mu_0} \tag{1.2}$$

$$m_0(\lambda) = \lambda m_0, \quad \mu_0(\lambda) = \lambda \mu_0$$

We want to find how $m_r(\lambda)$ transforms. Differentiating equation 1.1

$$\frac{\partial m_0(\lambda)}{\partial \log \lambda} = \frac{\partial}{\partial \log \lambda}\left(m_r(\lambda)\, Z_m\right) = Z_m \frac{\partial m_r(\lambda)}{\partial \log \lambda} + m_r(\lambda)\frac{\partial Z_m}{\partial \log \lambda}$$

$$\begin{aligned}\frac{1}{Z_m}\frac{\partial m_0(\lambda)}{\partial \log \lambda} &= \frac{\partial m_r(\lambda)}{\partial \log \lambda} + \frac{m_r(\lambda)}{Z_m}\frac{\partial Z_m}{\partial \mu_0}\frac{\partial \mu_0}{\partial \log \lambda} \\ &= \frac{\partial m_r(\lambda)}{\partial \log \lambda} + \frac{m_r(\lambda)}{Z_m}\frac{\partial Z_m}{\partial \mu_0}\frac{\partial \mu_0}{\partial \lambda}\frac{\partial \lambda}{\partial \log \lambda}\end{aligned}$$