Addendum to triviality discussion

How would we see triviality in ctm, renormalized P.T. ?

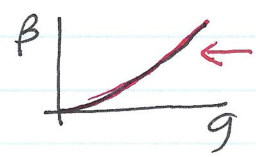
Naively, we can calculate all quantities order by order in $g(\mu)$ ($\overline{MS}$ scale) – why can't $g(\mu_{ref})$ take any value we want?

Here we are thinking of $g(\mu)$ as being close to a physical on-shell scattering amplitude for $|\vec{p}| = \mu$.

Well, we must have $\frac{g(\mu_{ref})}{16\pi^2} \ll 1$ for the PT expressions to be valid.

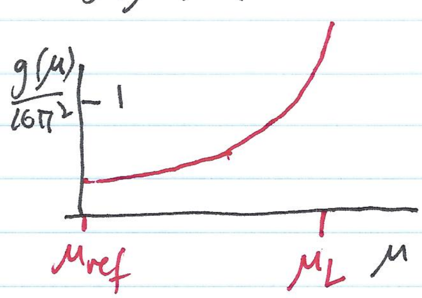
Now we calculate $g(\mu)$ for $\mu > \mu_{ref}$ using

$$\frac{d\, g(\mu)}{d \ln \mu} = \beta(g(\mu)) =$$



← same fcn as before up to 2 loops

$\Rightarrow g(\mu) \uparrow$ when $\mu \uparrow$



At leading order (see 9-9)

$$g(\mu) = \frac{1}{\frac{1}{g(\mu_{ref})} - \beta_1 \ln \mu/\mu_{ref}}$$

"Landau pole" at $\mu_L = \mu_{ref}\, e^{\frac{1}{\beta_1 g_{ref}}}$

Thus PT breaks down when μ approaches μ_L & does not provide a description of the theory for all scales.

Need non-perturbative method in the UV – lattice – to find out what really happens.