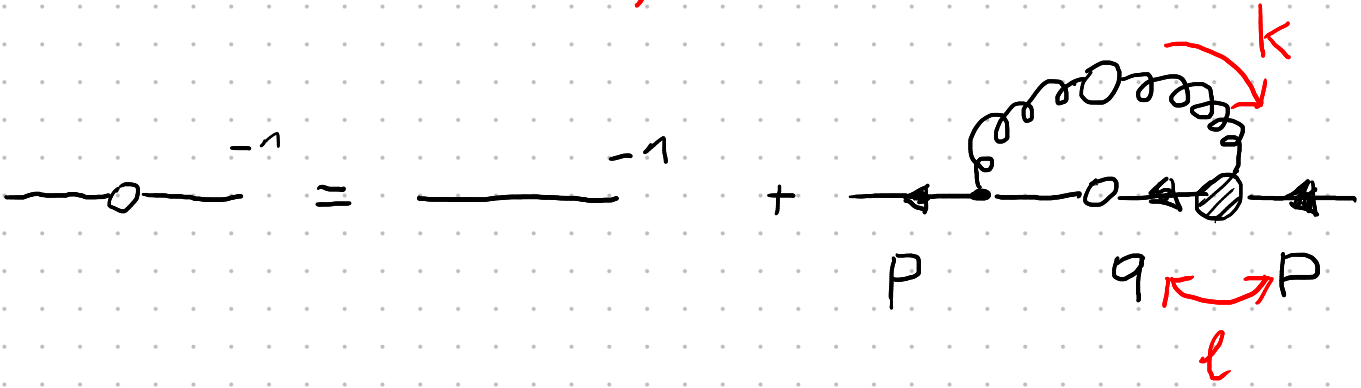
Preliminary Work



[Hadron Physics with functional methods; Project 1: Quark DSE]

on „The Quark Propagator for Timelike Momenta"

Felix Halbwedl

Why Quark Propagators ?

Hadron Properties (mass, Lifetime, scattering form factor)

Quark Properties

Quark Propagator

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Quark DSE

$S(q)$ ... dressed quark propagator

$D^{\mu\nu}(k)$ ... dressed gluon propagator

$g Z_1 i\gamma^\mu$ ... tree-level quark-gluon vertex

$g\Gamma^\mu(l,k)$ ... full quark-gluon vertex

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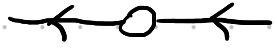
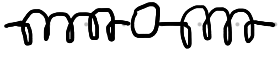
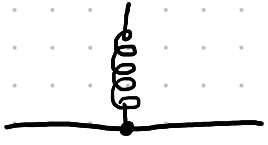
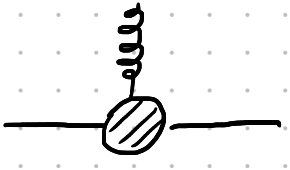
Dressing Functions

	dressing functions	tensor structures
	$\sigma_v(p^2),\ \sigma_s(p^2)$	$-i\not{p}\ ,\ \mathbb{1}$
	$Z(k^2)$	$T^{\mu\nu}_k$
	1	$i\gamma^\mu$
	$f(k^2)$	$i\gamma^\mu$

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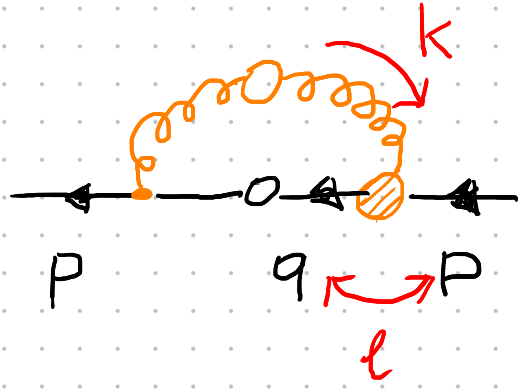
Marys-Tandy Model



$Z(k^2)$ → $\alpha(k^2)$

$f(k^2)$ → $\alpha(k^2)$

$$\alpha(k^2) \sim \underbrace{k^4 e^{-k^2}}_{k << } + \underbrace{\ln(k^4)^{-1}}_{k >>}$$

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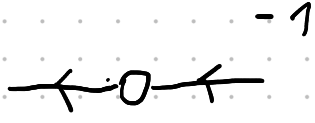
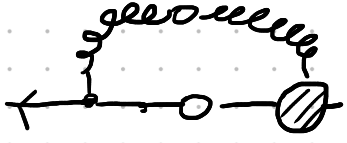
Dressing Functions II

	dressing functions	tensor structures
	$1,\ m$	$i\not{p},\ \mathbb{1}$
	$A(p^2),\ A(p^2)M(p^2)$	$i\not{p},\ \mathbb{1}$
	$\Sigma_a(p^2),\ \Sigma_m(p^2)$	$i\not{p},\ \mathbb{1}$

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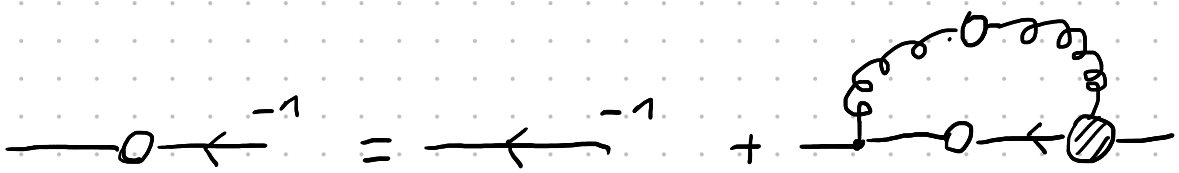
Rewritten Quark DSE



$$A(p^2) = 1 Z_2 + \Sigma_a(p^2)$$

$$A(p^2) M(p^2) = m Z_2 + \Sigma_m(p^2)$$

$$\Longrightarrow \text{renormalize} \quad (A(\mu^2) = 1,\ M(\mu^2) = m)$$

$$A(p^2) = 1 - \Sigma_a(p^2) - \Sigma_a(\mu^2)$$

$$A(p^2) M(p^2) = m + \Sigma_m(p^2) - \Sigma_m(\mu^2)$$

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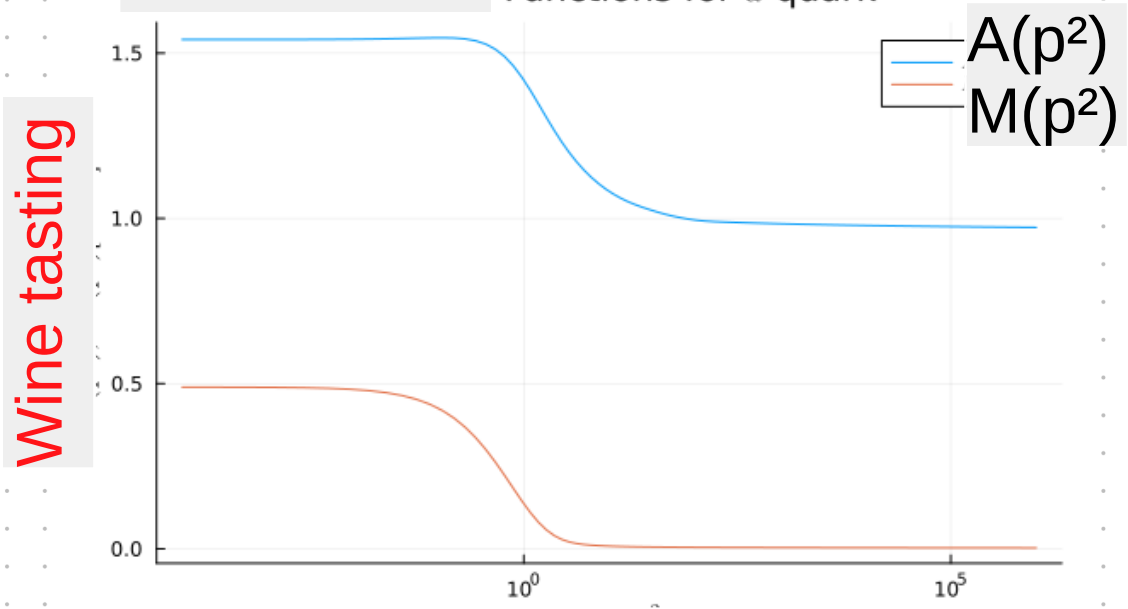
Results

Wine tasting



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