PDF Moments From DSE

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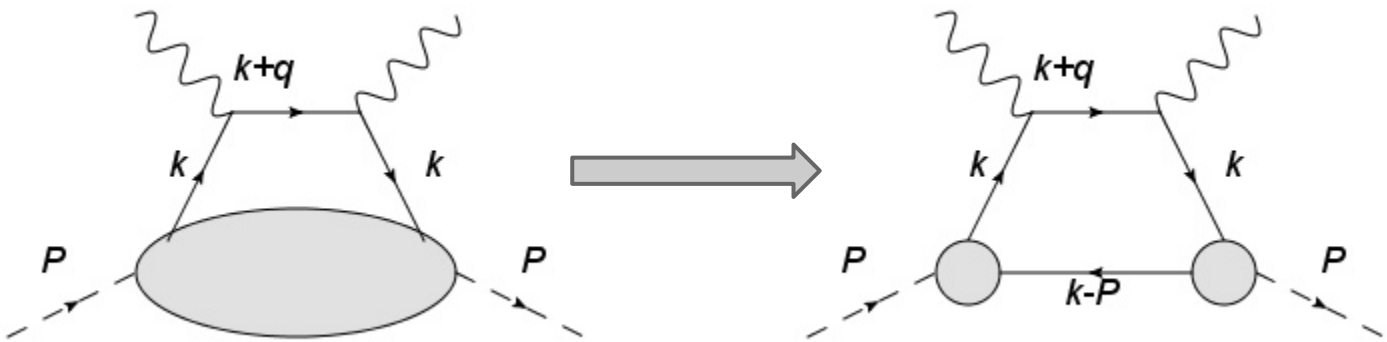
HUGS 2012

Parton Distribution Function



$$W^{\mu\nu} = e^2 \int \frac{d^4k}{(2\pi)^4} Tr\left[\bar{\Gamma}_\pi(-P, k-\frac{P}{2}) S(k) \gamma^\mu (\not{k}+\not{q}) \gamma^\nu S(k) \Gamma_\pi(P, k-\frac{P}{2}) S(k-P)\right] \delta\Big((k+q)^2\Big)$$

$$e^2 x f(x) = \nu n_\mu n_{nu} W^{\mu\nu}$$

$$f(x) = \int \frac{d^4k}{(2\pi)^4} Tr\left[\Gamma_\pi(P, k-\frac{P}{2}) S(k) \not{n} S(k) \Gamma_\pi(P, k-\frac{P}{2}) S(k-P)\right] \delta(x - x_{Bj})$$

DSE

$$S(p)^{-1} = i\not{p} + m + \int \frac{d^4k}{(2\pi)^4}\, g^2\, D_{\mu\nu}(p-q)\, \frac{\lambda^a}{2}\, \gamma_\mu S(q)\, \frac{\lambda^a}{2}\, \Gamma_\nu(q,p)$$

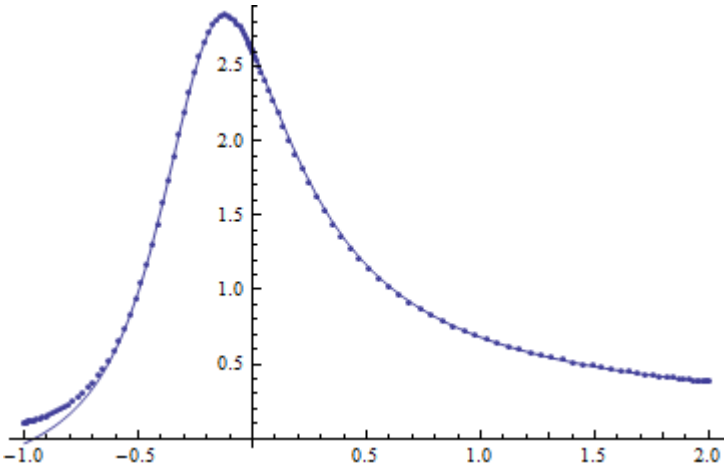
$$A(p^2) i\not{p} + B(p^2) = i\not{p} + m + \int \frac{d^4k}{(2\pi)^4}\, \frac{1}{(p-q)^2} \left(\eta^{\mu\nu} - \frac{(p^\mu - q^\mu)(p^\nu - q^\nu)}{(p-q)^2} \right) D(p-q)\, \frac{\lambda^a}{2}\, \gamma_\mu\, \frac{1}{A(q^2) i\not{q} + B(q^2)}\, \frac{\lambda^a}{2}\, \gamma_\nu$$

$$A(\mu^2) = 1$$

$$B(\mu^2) = m_q(\mu^2)$$

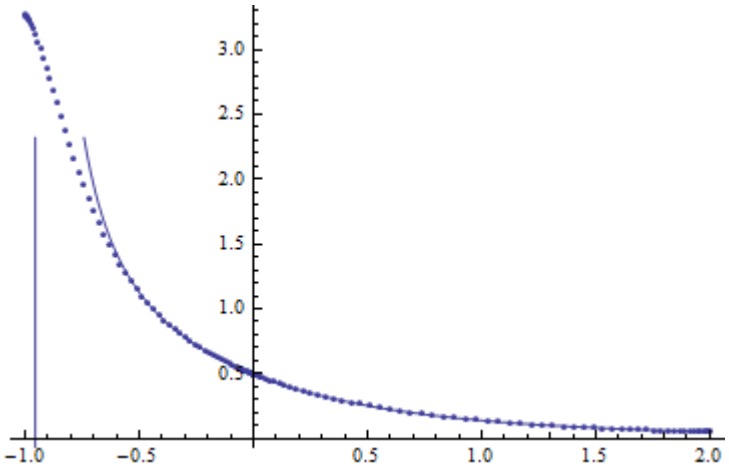
DSE

$A(q^2)/(q^2A^2(q^2)+B^2(q^2))$



$q^2(GeV^2)$

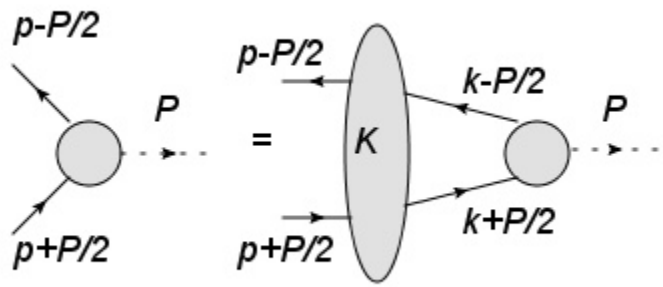
$m(q^2)$



$q^2(GeV^2)$

$$S(p^2) = \sum_i \left(\frac{z_i}{i\not{p} + m_i} + \frac{z_i^*}{i\not{p} + m_i^*} \right)$$

BSE

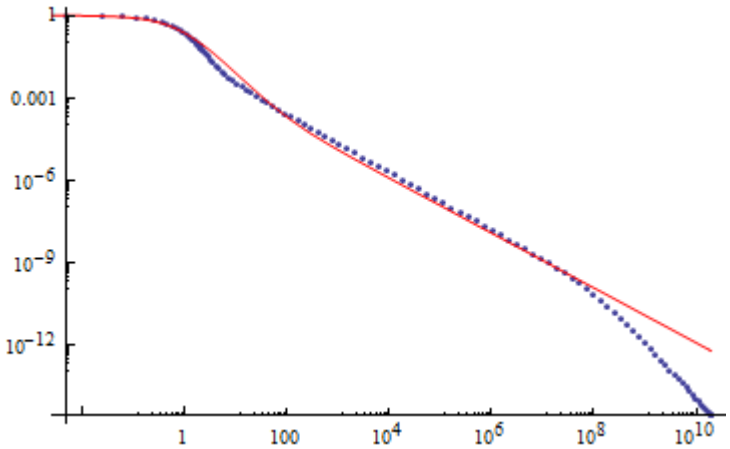


$$\Gamma(P,p) = \int \frac{d^4k}{(2\pi)^2} K(P,p,k) S(k - \frac{P}{2}) \Gamma(P,k) S(k + \frac{P}{2})$$

$$\Gamma(P,k) = \gamma_5 \big(iE(P,k) + \not{P} F(P,k) + \not{k} G(P,k) + \sigma^{\mu\nu} P_\mu k_\nu H(P,k) \big)$$

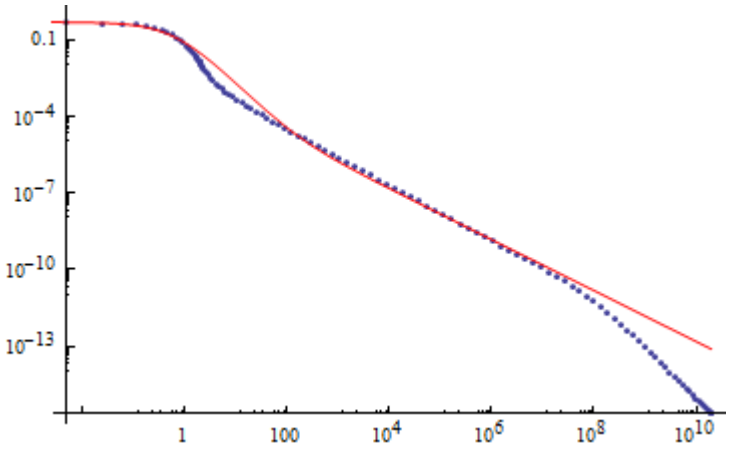
BSE

E(q²)



q²(GeV²)

F(q²)



q²(GeV²)

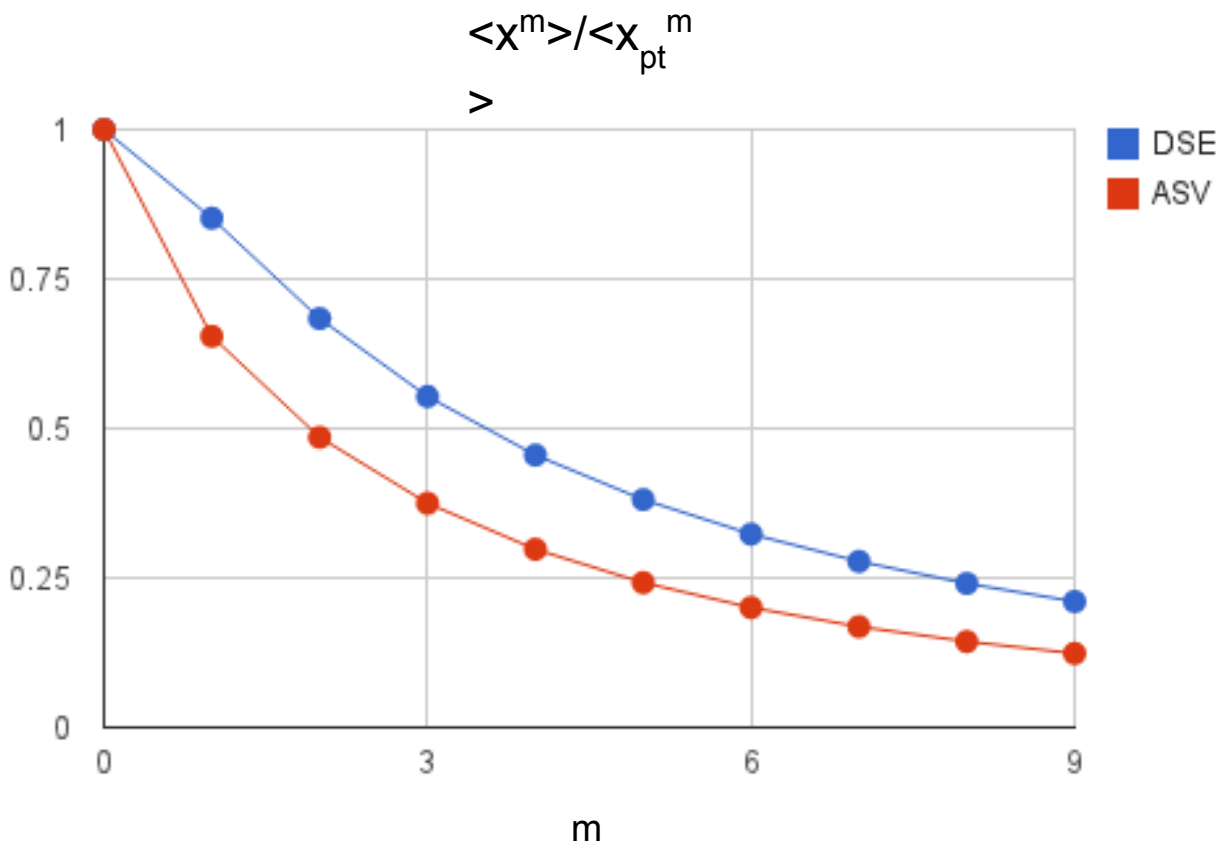
$$E(q^2) = A\left(\frac{(1+\beta q^2)}{(q^2+\alpha q\cdot P+\Lambda^2)^2} + \frac{(1+\beta q^2)}{(q^2-\alpha q\cdot P+\Lambda^2)^2}\right)$$

PDF Moments

$$< x^m >= \int_0^1 dx x^m f(x) =$$

$$= \int \frac{d^4k}{(2\pi)^4} \frac{(k\cdot n)^m}{(P\cdot n)^{m+1}} Tr\left[\Gamma_\pi(P, k - \frac{P}{2}) S(k) \not{n} S(k) \Gamma_\pi(P, k - \frac{P}{2}) S(k-P)\right]$$

$$\prod_{i=1}^{n} \frac{1}{A_i} = \int_0^1 \prod_{i=1}^{n} dx_i \delta\left(\sum_{i=1}^{n} x_i - 1\right) \frac{(n-1)!}{\left(\sum_{i=1}^{n} x_i A_i\right)^n}$$

$$< x^m >= \int_0^1 \prod_{i=1}^{5} dx_i \delta\left(\sum_{i=1}^{5} x_i - 1\right) \int \frac{d^4\tilde{k}}{(2\pi)^4} \frac{P(\tilde{k})}{\left(\tilde{k}^2 + \Delta\right)^5}$$

PDF Moments