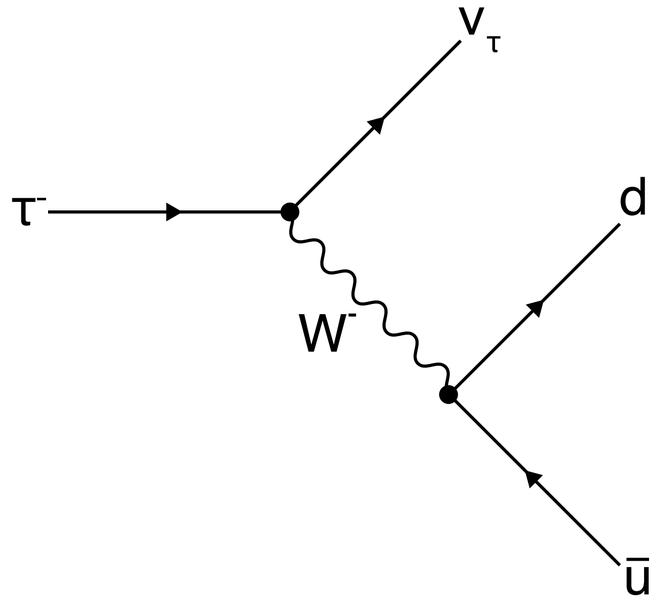
Determination of the QCD Coupling from ALEPH τ Decay Data

Dirk Hornung



Exclusive

Hadronic τ-Decay

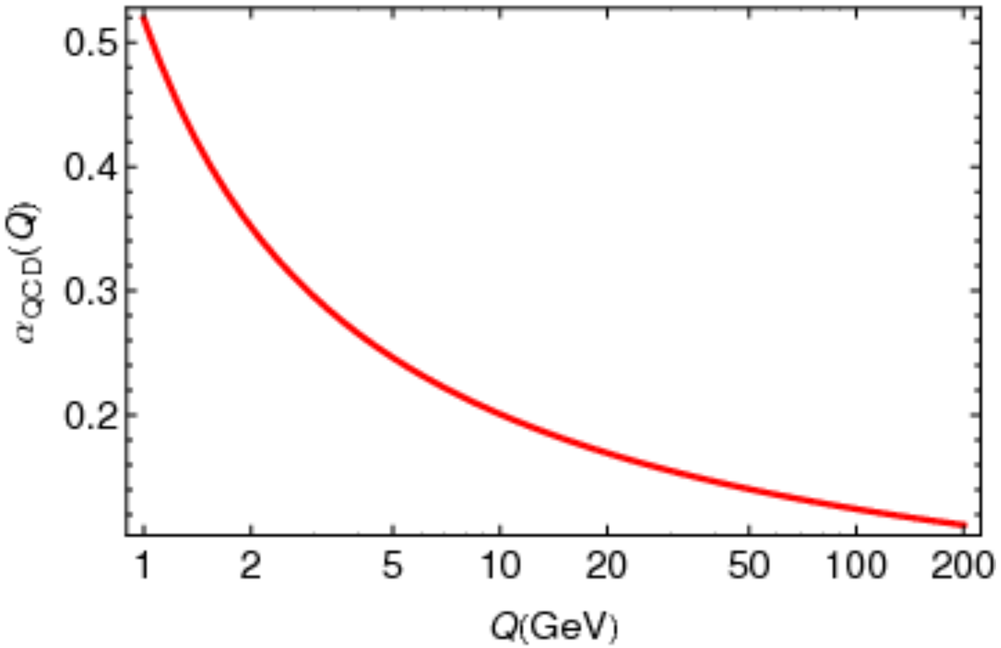
$$R_\tau = \frac{\Gamma[\tau^- \to \nu_\tau \text{hadrons}]}{\Gamma[\tau^- \to \nu_\tau e^- \bar{\nu}_e]}$$

Running of the

Strong Coupling α_s

Entrepreneurial activities differ substantially

depending on the type of organization



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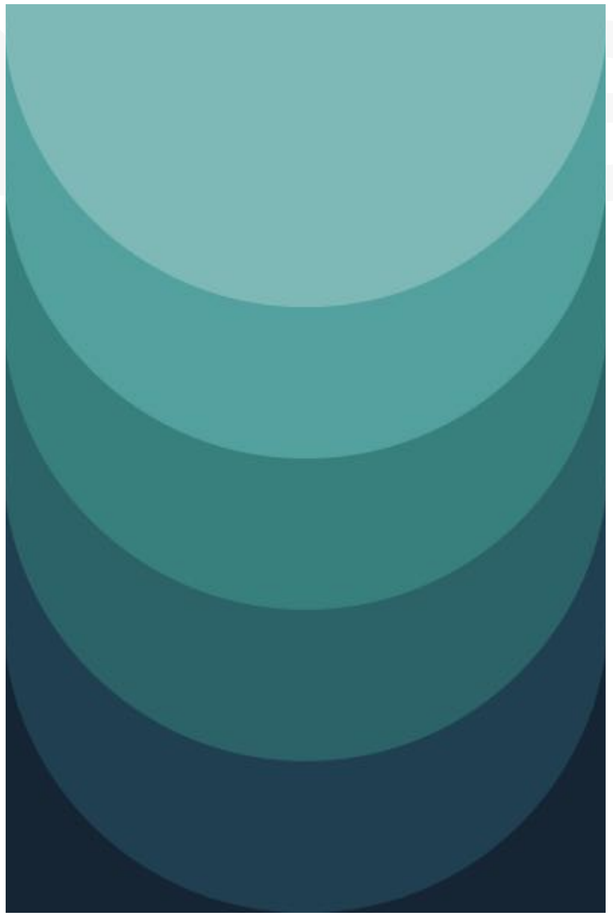


Framework

Theory

Inclusive Ratio

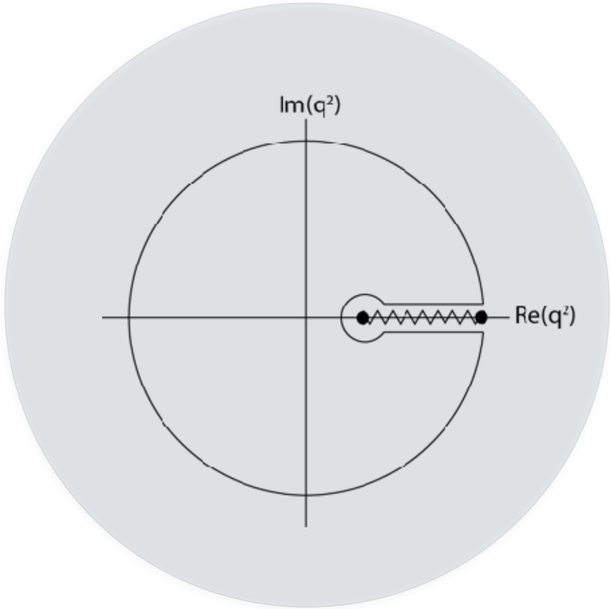
$$R_\tau = 12\pi S_{EW} \int_0^{m_\tau} \frac{\mathrm{d}s}{m_\tau^2}\left(1-\frac{s}{m_\tau^2}\right)\left[\left(1+2\frac{s}{m_\tau^2}\right)\mathrm{Im}\,\Pi^{(1)}(s)+\mathrm{Im}\,\Pi^{(0)}(s)\right]$$

$$\Pi^{(J)}(s) \equiv \left|V_{uq}\right|^2\left(\Pi^{(J)}_{ud,V}+\Pi^{(J)}_{ud,A}(s)\right)$$

Two-Point Correlation Function

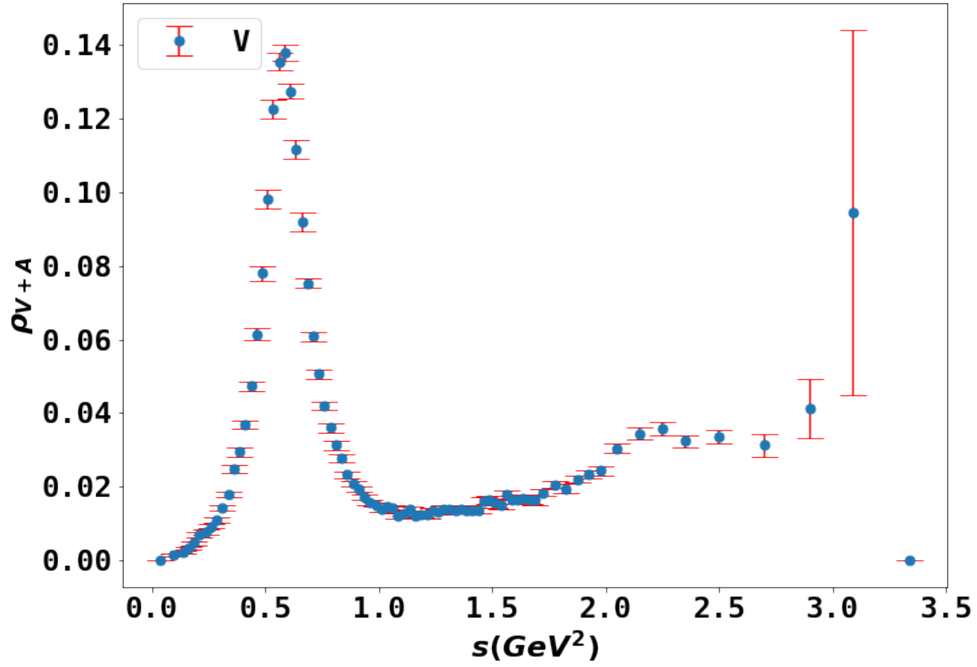
$$\begin{aligned}\Pi_{\mu\nu}(q) &= i\int \mathrm{d}^4\,x e^{iqx}\langle 0|T\left\{\mathcal{J}^\mu_{ij}(x)\mathcal{J}^{\nu\dagger}_{ij}(0)\right\}\rangle \\ &= \left(q_\mu q_\nu = q^2 g_{\mu\nu}\right)\Pi^{(1)}_{ij,\mathcal{J}}(q^2)+q^\mu q^\nu \Pi^{(0)}_{ij,\mathcal{J}}(q^2) \\ &= \left(q_\mu q_\nu - q^2 g_{\mu\nu}\right)\Pi^{(1+0)}(q^2)+q^2 g_{\mu\nu}\Pi^{(0)}(q^2)\end{aligned}$$

$$(I,j=u,d;\mathcal{J}=V,A)\quad V^\mu_{ij}=\bar{q}_j\gamma^\mu q_i \quad A^\mu_{ij}=\bar{q}_j\gamma^\mu\gamma_5 q_i$$



$$\int_{s_{th}}^{s_0}\frac{\mathrm{d}s}{s_0}\omega(s)\,\mathrm{Im}\,\Pi_{V/A}(s) = \frac{i}{2}\oint_{|s|=s_0}\frac{\mathrm{d}s}{s_0}\omega(s)\Pi_{V/A}(s)$$

Experiment Theory



ALEPH

Data

Entrepreneurial activities differ substantially depending on the type of organization

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