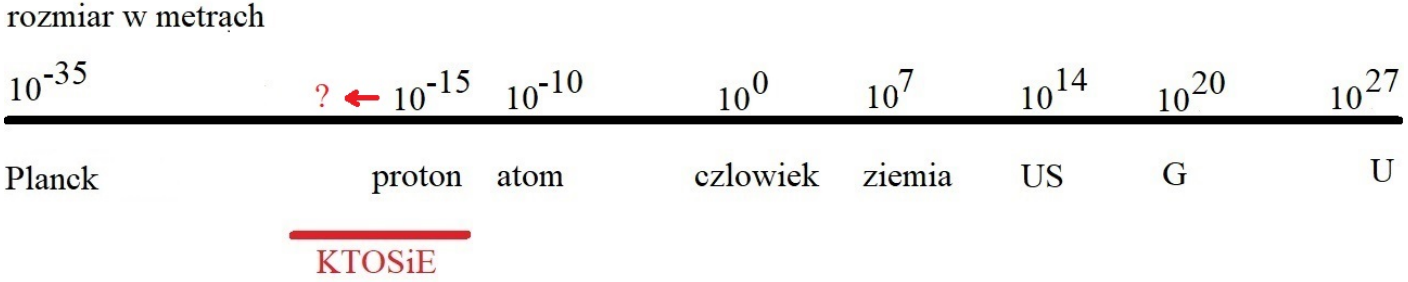
Konstrukcja efektywnej teorii fizycznej

Stanislaw Glazek, IFT



Katedra Teorii Oddzialywan Silnych i Elektroslabych ~ 11 rzedow wielkosci

E. Bartnik, P. Chankowski, J. Kalinowski, M. Misiak, K. Rolbiecki, A. Szymacha

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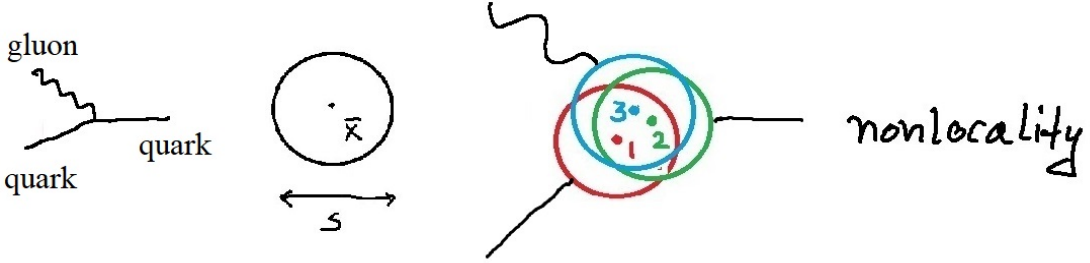
Protony sa zbudowane z kwarkow i gluonow, ale z jak duzych?



Origin of gauge symmetry? **Gluon mass** **Proton mass → curvature?**

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RGPEP **R**enormalization **G**roup **P**rocedure for **E**ffective **P**articles

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punktem wyjscia jest teoria, ktorej autorami sa Glazek i Wilson

K. G. Wilson (Nobel in Physics for critical phenomena) OPE, Lattice QCD

relatywistyczne rownanie definiujace RGPEP

$$H'_s = \Big[[H_f, \tilde{H}_s], H_s\Big]$$

RGPEP ma bardzo szeroki zakres stosowalnosci

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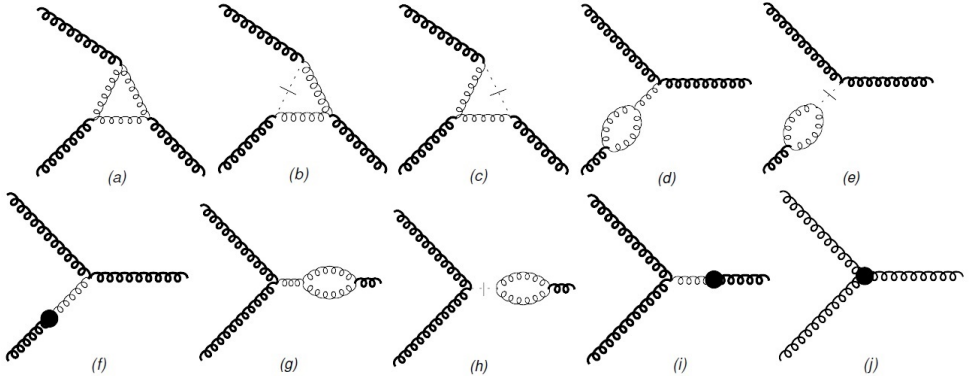
AF w QCD w schemacie RGPEP



Gómez-Rocha's illustration of AF in QCD - these are not Feynman diagrams, see PRD92

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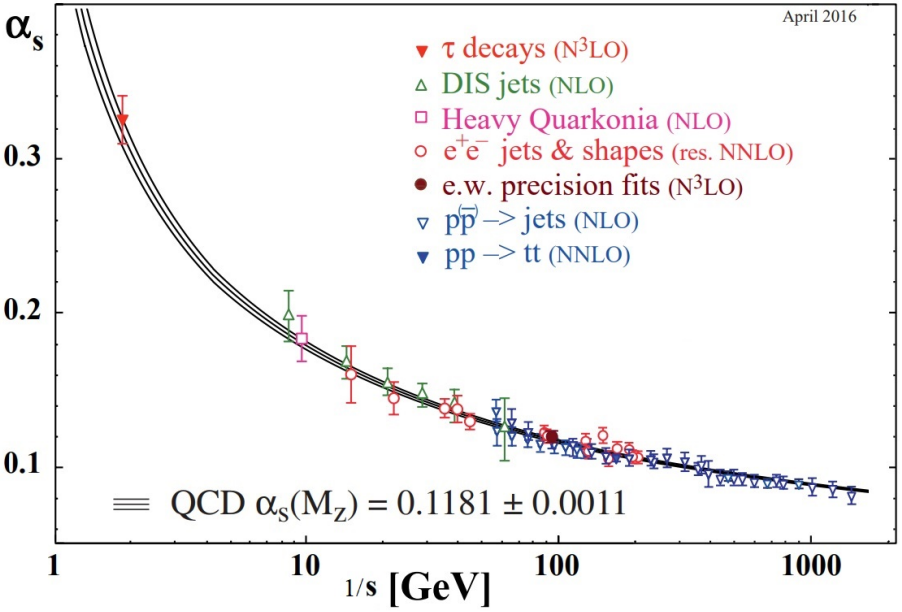
adapted from: pdg.lbl.gov/2017/reviews/rpp2017-rev-qcd.pdf



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Effective-particle scale-dependent picture of nucleons

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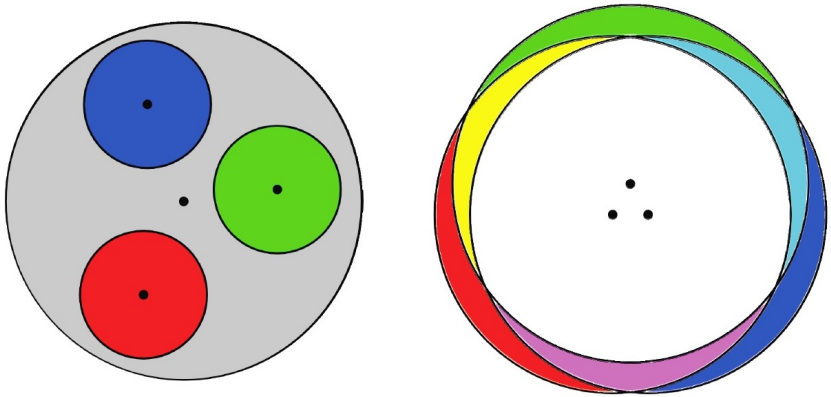

Ridge effect in *pp* **collisions** from 7 TeV to 13 TeV

P. Kubiczek, SDG, Lith. J. Phys. **55**, 155 (2015)

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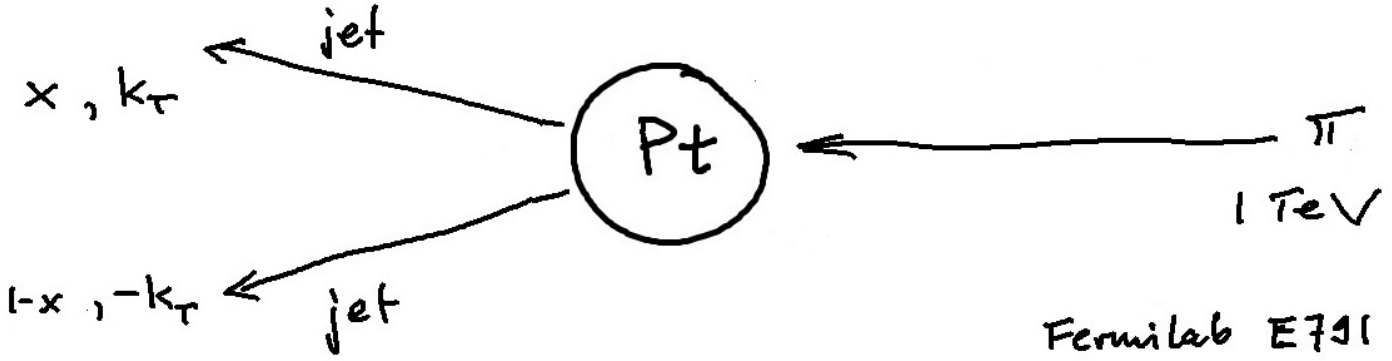
Jet production in pion-nucleus collisions

A. Trawiński: Pion is wedged into two quark jets by gluons in a nucleus.



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Jet counts distribution $\phi(x, k_T)$ A. Trawiński

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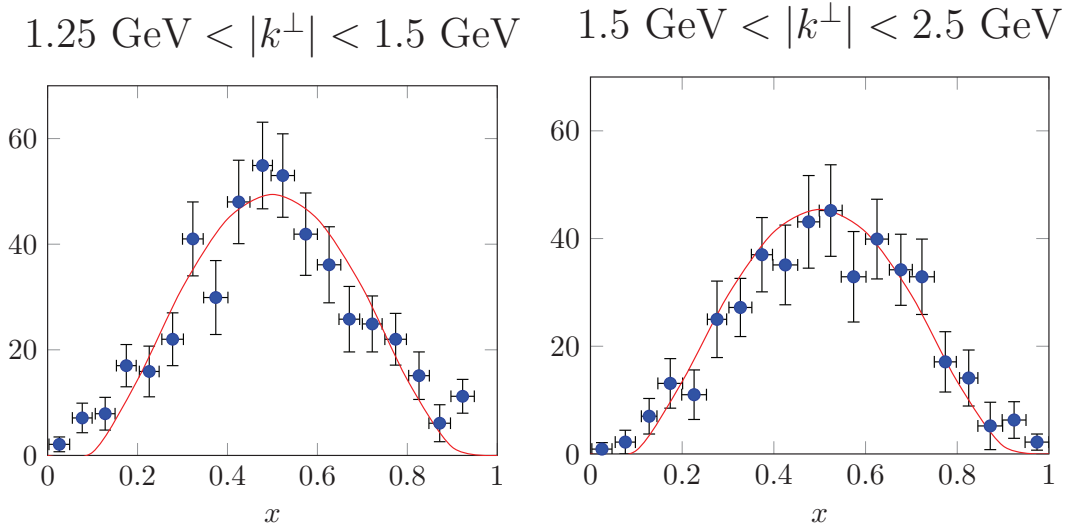

Jet counts distribution $\phi(x, k_T)$, for jets induced by pions impinging on Pt, in two jet-k_T bins.

Data from E791, Phys. Rev. Lett. **86**, 4768 (2001)

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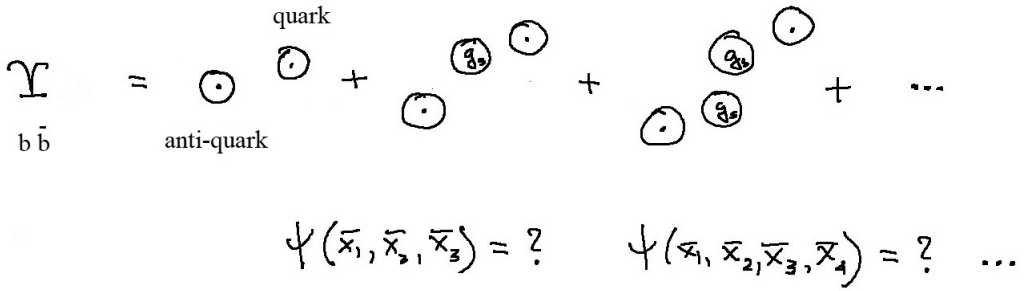
Quark binding Heavy quarkonia including gluon components, lattice operators



M. Gómez-Rocha, K. Serafin, J. More, PL B773 Baryons in preparation

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Heavy mesons np. Υ

$$\left(\frac{\vec{k}^{\,2}}{m} - \frac{1}{2}\,\tilde{\kappa}\,\Delta_{\vec{k}}\right)\psi(\vec{k}\,) + \int \frac{d^3q}{(2\pi)^3} V_{C,\,BF}(\vec{q}\,)\,\psi(\vec{k}-\vec{q}\,) = B\;\psi(\vec{k}\,)$$

$$\boxed{\tilde{\kappa} = m\omega^2/2 = \alpha\;(ms^2)^{-3}/(36\sqrt{2\pi})}$$

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Heavy baryons, przewidywanie:

.

$$
\begin{aligned}
&\left[\frac{\vec{K}_{12}^{\,2}}{2m_{12}} + \frac{\vec{Q}_{3}^{\,2}}{2m_{3(12)}}\right]\,\psi(1,2,3) \\
-\;& w_{12}\left(\frac{\partial}{\partial\vec{K}_{12}}\right)^2\,\psi(1,2,3) + \sum_{\sigma_{1'}\sigma_{2'}}\int\frac{d^3K'_{12}}{(2\pi)^3}\,V^{12}_{C,BF}\,\psi(1',2',3) \\
-\;& w_{23}\left(\frac{\partial}{\partial\vec{K}_{23}}\right)^2\,\psi(1,2,3) + \sum_{\sigma_{2'}\sigma_{3'}}\int\frac{d^3K'_{23}}{(2\pi)^3}\,V^{23}_{C,BF}\,\psi(1,2',3') \\
-\;& w_{31}\left(\frac{\partial}{\partial\vec{K}_{31}}\right)^2\,\psi(1,2,3) + \sum_{\sigma_{3'}\sigma_{1'}}\int\frac{d^3K'_{31}}{(2\pi)^3}\,V^{31}_{C,BF}\,\psi(1',2,3') \\
=\;& B\,\psi(1,2,3)
\end{aligned}
$$

$$\boxed{w_{ij} \;=\; \tfrac{\alpha}{18\sqrt{\pi}}\left(s^2\sqrt{m_i^2+m_j^2}\right)^{-3}}$$

mass spectra

K. Serafin *et al.*, in preparation

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Strings of effective gluons **AdS/QCD**

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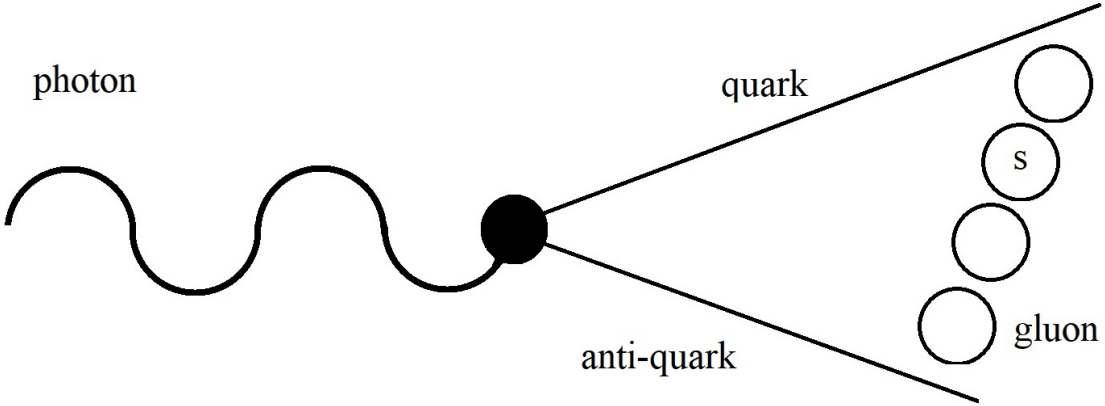

Photon turns into a quark-anti-quark pair connected by a gluon string.

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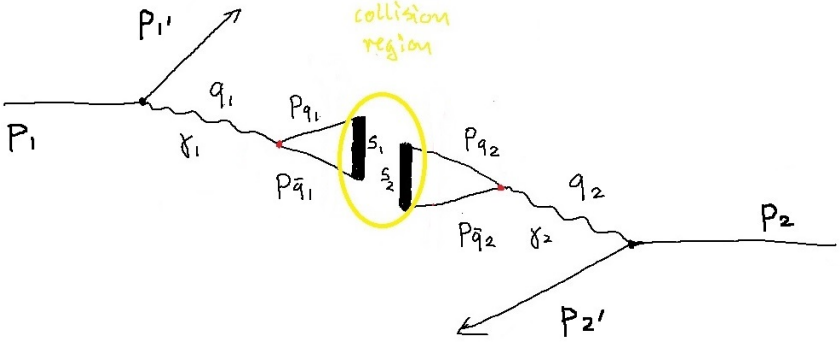
Collision of gluon strings at LHC Brodsky, Glazek, Goldhaber, Brown



The peripheral $p_1 p_2 \to p_{1'} p_{2'} X$ scattering proceeds through collision of gluon strings S_1 and S_2.

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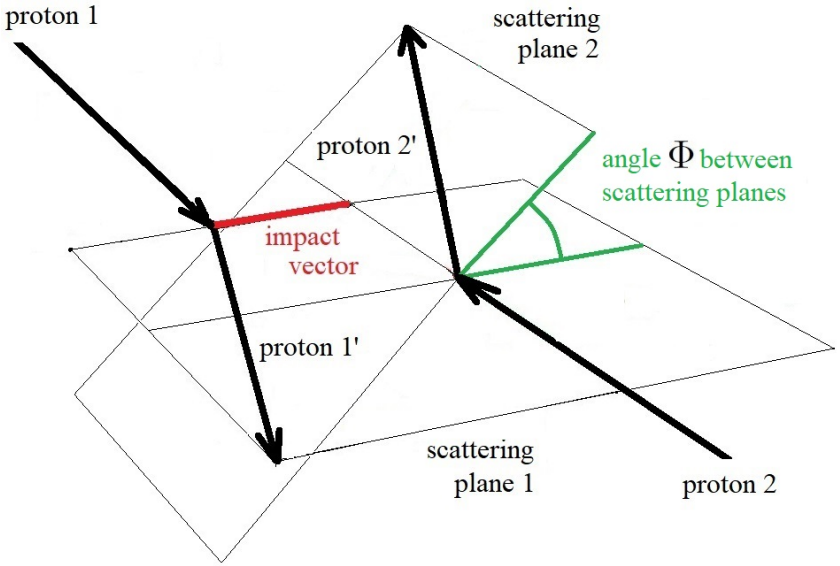

Angle Φ between scattering planes

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Przewidywanie bez precedensu:

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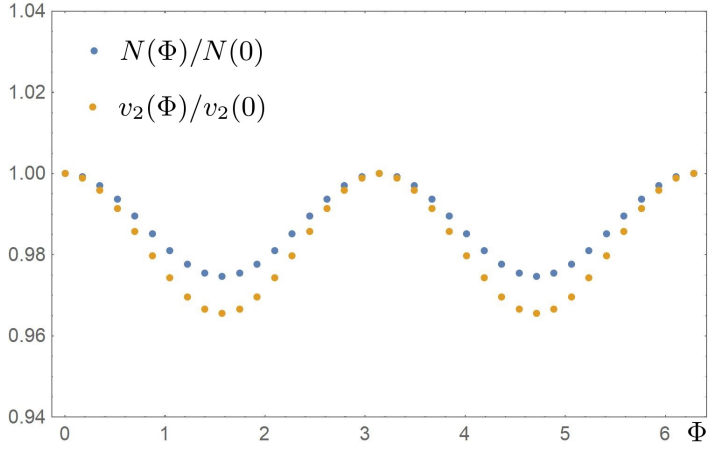

Minimal-bias average ratios of multiplicity, $N(\Phi)/N(0)$, and elliptic flow, $v_2(\Phi)/v_2(0)$

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M. Wieckowski, T. Maslowski, J. Mlynik, J. Narebski, A. Trawinski, P. Kubiczek, S. Dawid, K. Serafin (IFT)

M. Gomez-Rocha (ECT*), J. More (Mumbay), S. Brodsky (Stanford), A. Goldhaber (Stony Brook), R. Brown (Case Western)

Organizacja miedzynarodowa ILCAC, LightCone2018, Jefferson Laboratory

przyklad pracy ze studentami: http://www.fuw.edu.pl/home.html

XII Oboz SKFiz, 9-14 lipca 2018 *Konstrukcja efektytwnej kwantowej teorii pola*, skfiz.fuw.edu.pl

Nasze podejscie otwiera nowe mozliwosci rozwoju teorii i fenomenologii.

ZAPRASZAMY!

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