

Closing Remark

Hi-Lumi Workshop, JLab, October 5-9, 2026

Jian-ping Chen, Jefferson Lab



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Physics Program with High-Lumi (Precision/Intensity)

- Selected Topics:

- 4 working groups:

Charmonium → window to study proton mass, gluon field,
gravitation FF, scalar radius, **confinement force**

GPDs - 3-D imaging in coordinate space, **mechanical structure**

TMDs - 3-D imaging in momentum space,
tensor charge, orbital motion

BSM - Search for **new physics, discovery potential**

- Excellent talks

Great progresses in both theory and experiments

Planned near-term and upgrade for high-lumi (precision) experiments

Why? Physics is exciting!

Key questions:

Understand QCD in hadrons: confinement, mechanical structure
3-d imaging, orbital motion, QCD dynamics

Quark confinement force

X. Ji

Lorentz forces on quarks

$$\mathcal{F}_q^j \equiv \partial_\mu T_q^{\mu j} = g \bar{\psi} \gamma_\mu F^{\mu j} \psi = \sum_{c=1}^8 g \left(\rho_c \vec{E}_c + \vec{j}_c \times \vec{B}_c \right)^j$$

$$\vec{F}_q(\vec{r}_\perp) \equiv \frac{\vec{\mathcal{F}}_q(\vec{r}_\perp)}{\rho_q(\vec{r}_\perp)} = \frac{(M/4) \vec{V}_\perp G_{s,q}(\vec{r}_\perp)}{3[F_1^p(\vec{r}_\perp) + F_1^n(\vec{r}_\perp)]}$$

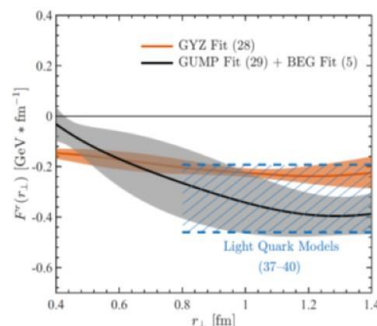
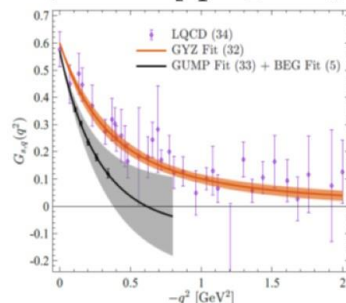


Figure 2: Strong force on quarks in the proton in the transverse plane of the IMF. The forces are obtained using the latest global analyses of the quark momentum current form factors (5, 28, 29). The figure shows the total force from experimental data (black curve and band) and from the fit dominated by LQCD calculations (orange curve and band). The blue hatched band shows the string tensions from several relativistic quark models (37–40).

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Discovery potential: Physics Beyond Standard Model
EW, Dark, and Strong Sector?

Why? Physics is exciting!

- Key questions:
Discovery potential: Physics Beyond Standard Model
EW, Dark Matter, Symmetries...
- How about strong sector?
QCD: “A beautiful theory”
extensive test in high energy limit (pQCD)
The world lives in non-perturbative region (~ 1 fm, ~ 1 GeV)
Great progress in first-principle QCD calculations (LQCD)
Precision measurements encounter precision LQCD
---> potential for surprises and discovery?

What are the “most impactful” physics questions to ask/quantities to measure?

How?

- JLab12: luminosity/Intensity/precision frontier
CEBAF potential: largely not fully exploited
- Budget reality.
- How to maximize science output within the funding boundary?
- Precision → Systematics. Multi-hall program.
Experiment-theory collaboration.
- Creative ideas, Cost-saving, Realistic.
- Cutting edge technology: detector/DAQ R&D/tests, AI/ML
Coordinated collective efforts

Whitepaper

- Proposed structure and timeline:
 - 20-30 pages,
 - Overview/Executive Summary
 - Charmonium, GPDs, TMDs, BSM, each ~ 5 pages
 - Inputs from all speakers and other interested users/community
 - Conveners coordinate the efforts and write/edit into coherent chapters
 - Co-chairs to put all together
- Timeline:
 - 1st draft of each chapter in ~1.5 month (end of November)
 - feedback from participants
 - 1st draft of full report in another months (end of December)
 - feedback from users/community
 - Final version in another months (end of January)
- Guideline, Overleaf, Template

Thanks to

- Everybody attending this workshop meeting
- Speakers for excellent talks
- Support from Tiffany Twine and Sarah Crouse
- Organizers: Working group conveners
Co-chairs: Mark Jones, Stepan Stepanyan
- Funding Support from JLab