Linear confinement and stress-energy tensor around static quark and anti-quark pair - Lattice simulation with Yang-Mills gradient flow -(RY *et al.*, arXiv : 1803.05656 [hep-lat].)

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Physics around $Q\overline{Q}$ in terms of energy and stress



Physics around $Q\overline{Q}$ in terms of energy and stress









Determine absolute values of all components

Interaction





More direct physical quantity : Stress tensor !!

To Do

(1) prepare $Q\bar{Q}$ on the lattice and (2) measure EMT around $Q\bar{Q}$

Measurement of the stress on the Lattice



Measurement of the stress on the Lattice



Setup

- ✓ Quenched SU(3) Yang-Mills gauge theory
- ✓ Wilson gauge action
- ✓ Clover operator
- ✓ Continuum limit
- \checkmark APE smearing for spatial links
- ✓ Multihit improvement in temporal links
- ✓ Simulation using BlueGene/Q @ KEK



β	Lattice spacing	Lattice size	# of statistics
6.304	0.057 fm	48 ⁴	140
6.465	0.046 fm	48^{4}	440
6.513	0.043 fm	48 ⁴	600
6.600	0.038 fm	48 ⁴	1500
6.819	0.029 fm	64 ⁴	1000

Stress distribution in Maxwell theory

$$T_{ij} = \epsilon_0 \left(E_i E_j - \frac{\delta_{ij}}{2} E^2 \right) + \frac{1}{\mu_0} \left(B_i B_j - \frac{\delta_{ij}}{2} B^2 \right)$$







✓ In terms of local interaction

✓ Propagation of force : squeezed vs. spreading











Cylindrical coordinate



Cylindrical coordinate













EMT and confinement potential



EMT and confinement potential



Summary and Outlook



 Outlook ✓ We need to explain the stress distribution using, for example, Abelian-Higgs model (RY+ in progress)
✓ Application : two flux tubes, finite temperature, full QCD...



Ground saturation

