

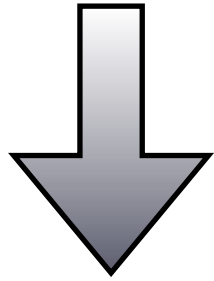
# **Lattice QCD analysis for confinement from Faddeev-Popov and Dirac eigenmodes**

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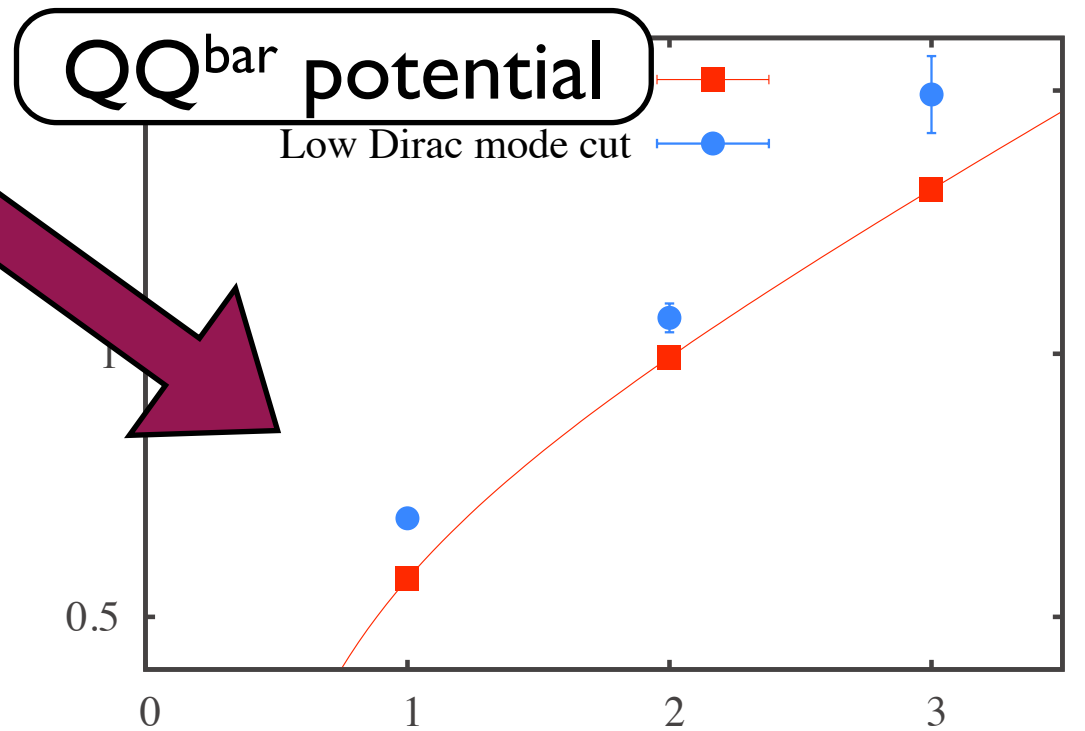
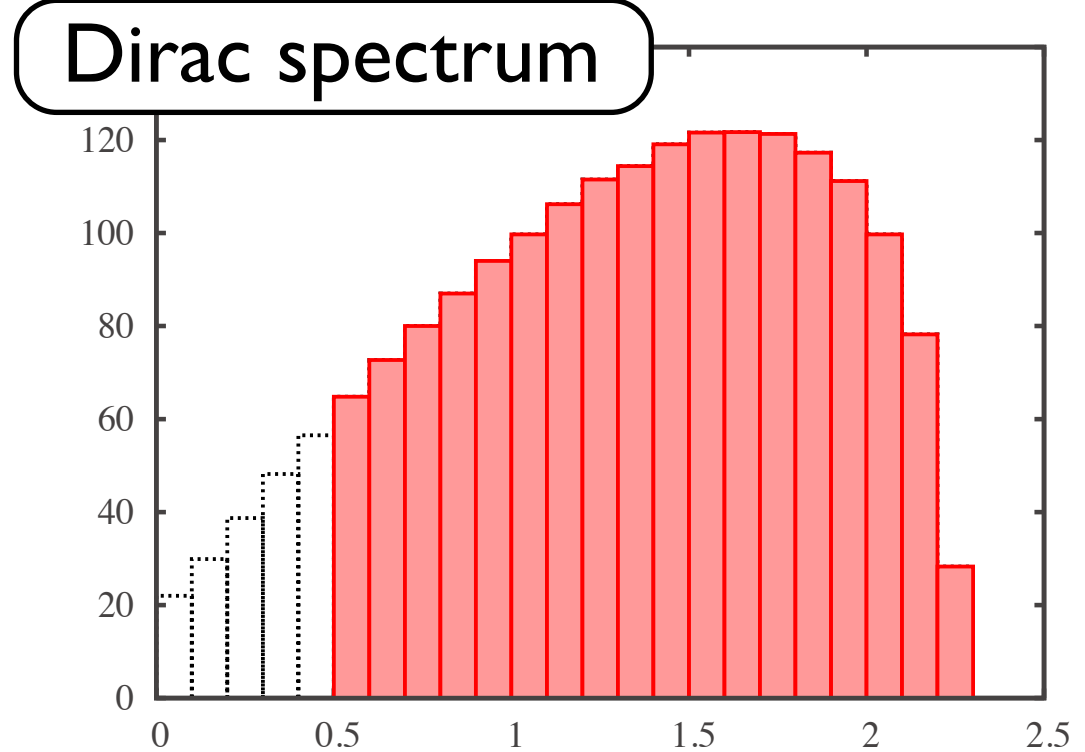
# Cut low Dirac eigenmode

$$D = \gamma_\mu D_\mu$$



- confinement potential is **UNCHANGED!**

**WHAT MODES** are relevant for confinement?



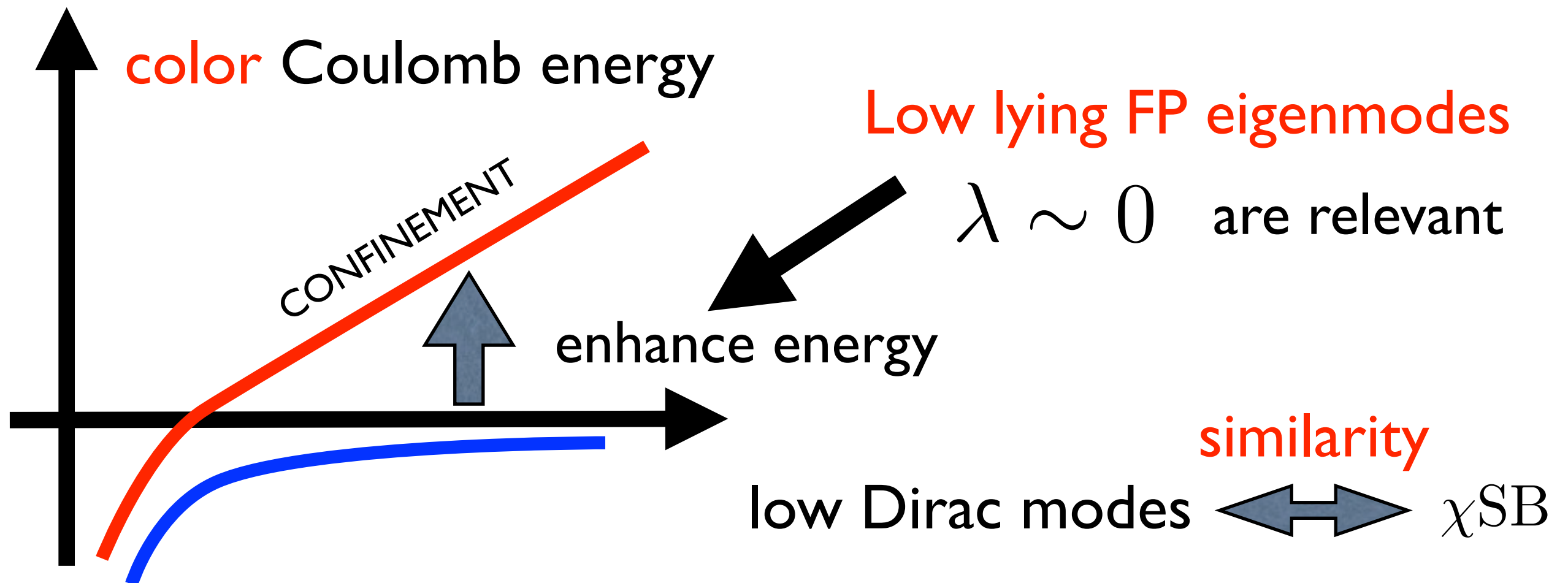
Candidate : **Faddeev-Popov** Eigenmode

$$M^{ac} = -\partial_i \left( \partial_i \delta^{ac} + g f^{acb} A_i^b \right)$$

# Coulomb gauge confinement and Faddeev-Popov eigenmode

- QCD Hamiltonian in the Coulomb gauge

$$H_{\text{QCD}} = \frac{1}{2} \int d^3x \left( \vec{E}^2 + \vec{B}^2 \right) + \frac{1}{2} \int d^3x d^3y \rho(x) \left[ M_{\text{FP}}^{-1} (-\nabla^2) M_{\text{FP}}^{-1} \right] \rho(y)$$



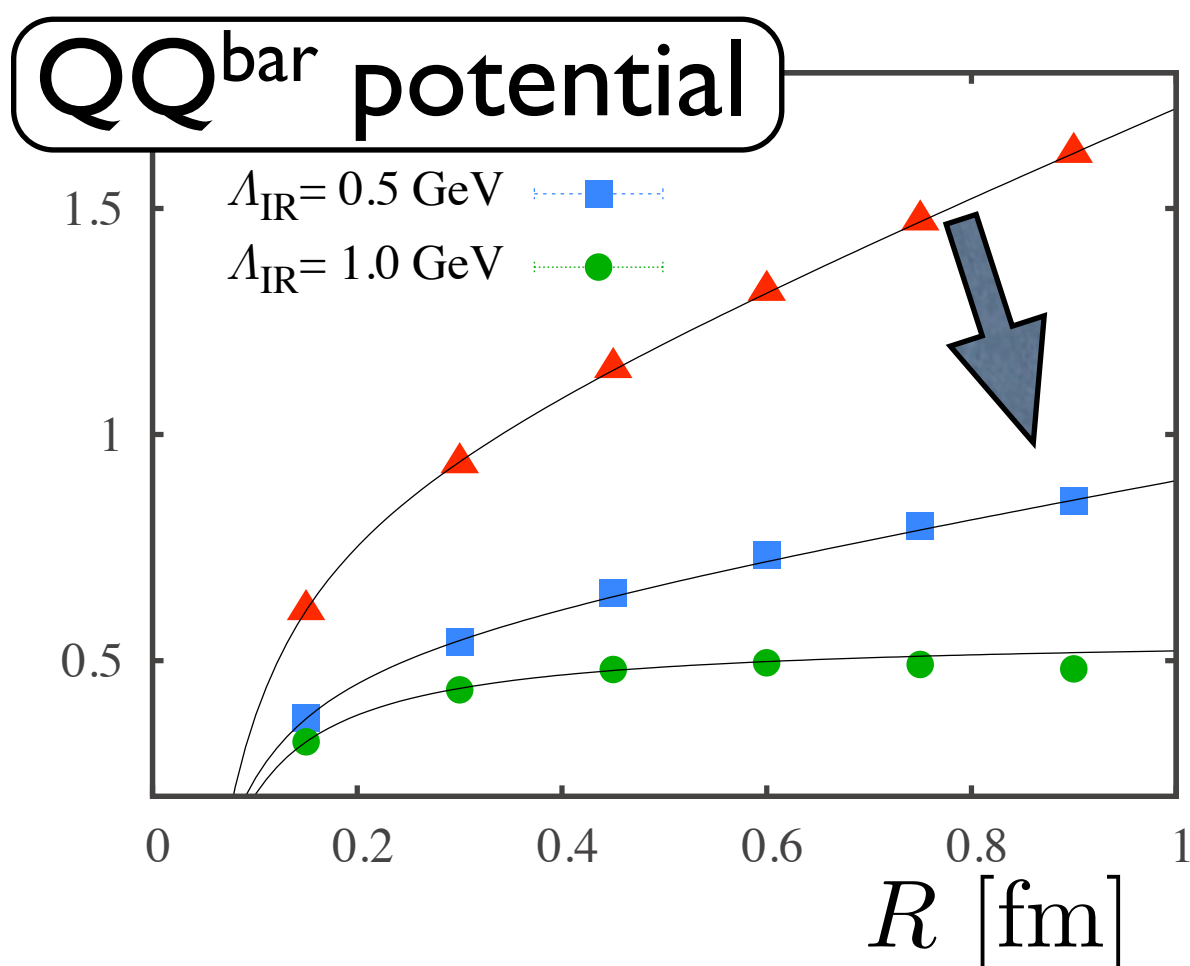
Q : What about FP modes, **without confinement** ?

# Faddeev-Popov eigenmode without Low Momentum Gluon

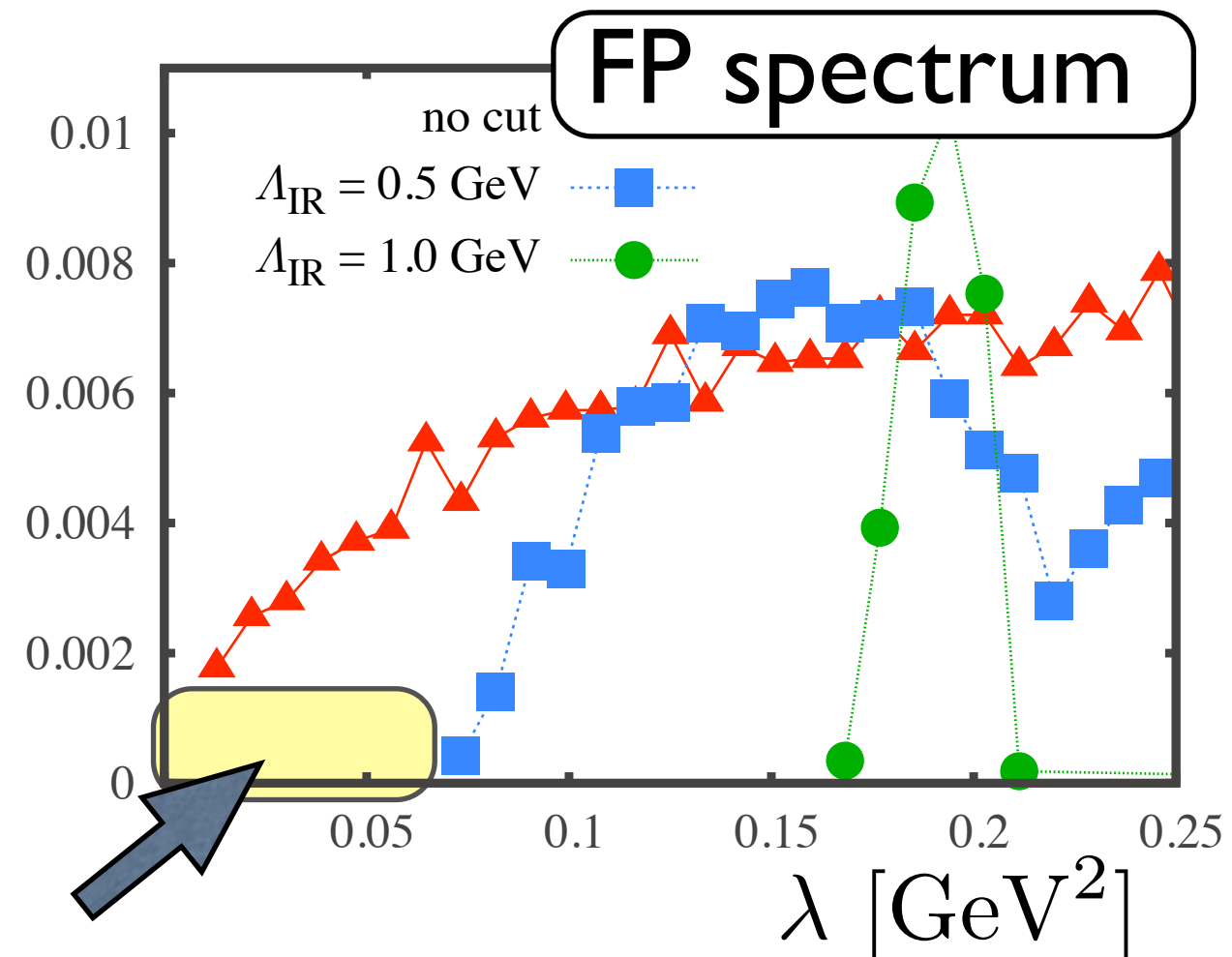
remove low momentum gluon on lattice QCD

A.Yamamoto and H.Suganuma ('08,'09)

## No Confinement



## Low FP modes Vanish



Low FP modes correlate to nonperturbative properties

In Progress: FP eigenmodes projection like Dirac eigenmodes

# Summary

- We analyze the relation between **confinement** and **Faddeev-Popov (FP) eigenmodes**.
- Removing **low momentum gluonic components**, both **confinement** and **low FP modes** vanish.
- We plan to **FP mode projection** like Dirac eigenmode projection.