

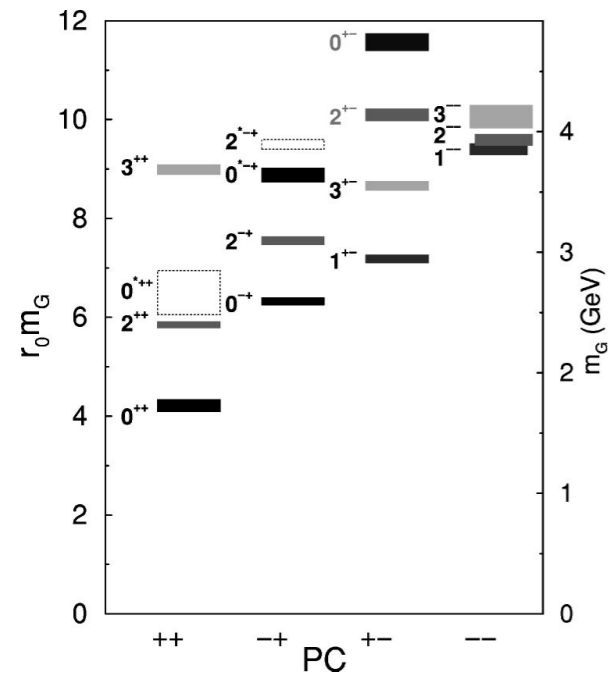
Progress in my glueball study

Keita Sakai, Nuclear theory group

What I want to know

... **Origin of glueball mass**

Glueball ... hadron consisted of gluons only



Lattice QCD predicts its mass

What makes this mass?

C. Morningstar and M. Peardon, Phys. Rev. D60,

Known mass generation mechanism

- Higgs Mechanism
- Quark condensate (Nambu Mechanism)



not the case



New mechanism

Better understanding of hadron masses

Mass measurement in lattice QCD

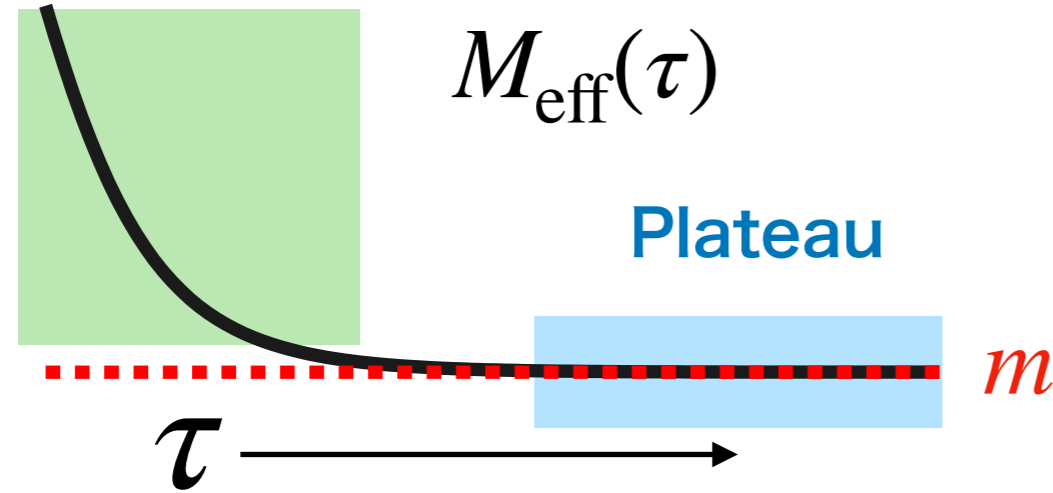
- From asymptotic behavior of 2pt function ← Normal way
- As a expectation value of EMT operator ← Need to do

To do the 2nd way: **“Good” glueball 2pt func.**

$$\langle G(\tau)G^\dagger(0) \rangle \simeq e^{-M_G \tau}, \quad M_{\text{eff}}(\tau) = -\log \frac{G(\tau+1)}{G(\tau)} \quad \text{Effective mass}$$

With large t

Contribution of excited states



“Good” means...

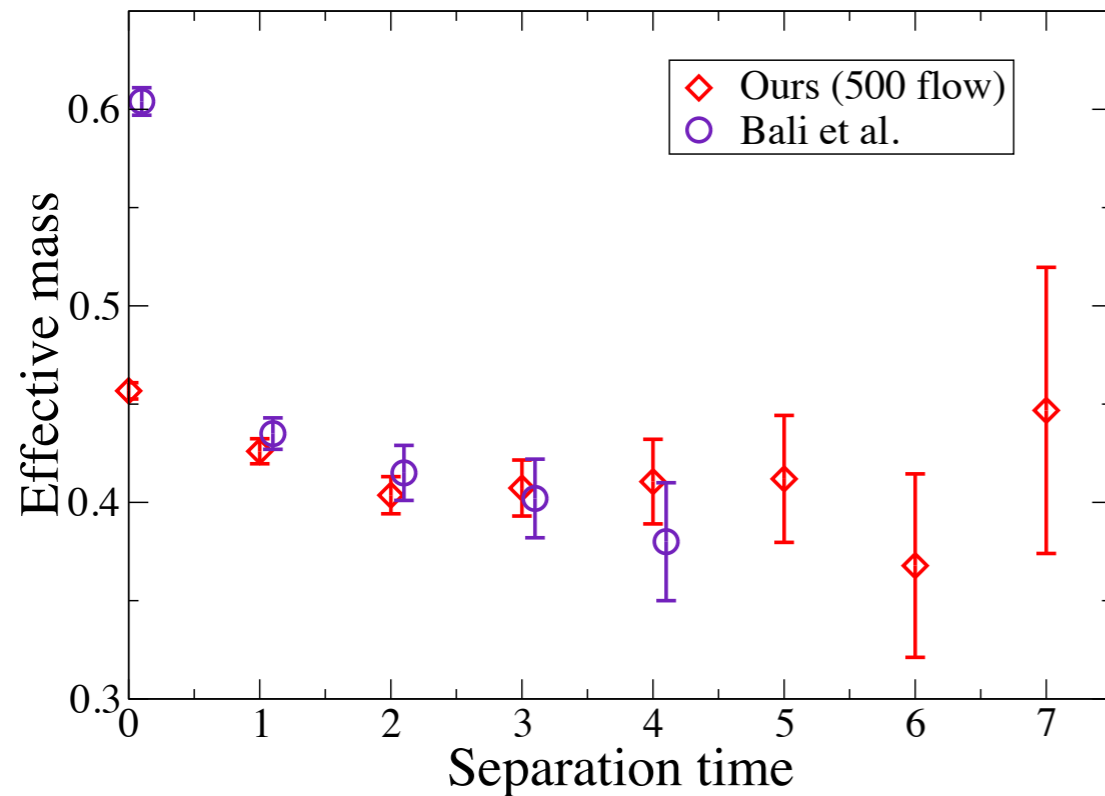
- **Less**
- **Long**

To get good 2pt func.

We proposed a new technique: **“Spatial flow method”**

Result

Effective mass with spatial flow



By using spatial flow,

About 2x
better precision

Long plateau like
behavior

Plans of research in next few years

1. This year and next year

- Study about spatial flow method
- Glueball mass calc. from EMT



almost finishing

2. After that

Full QCD study about glueball mass

Seminar points

GSP:0

GASP:2

Not good...

Overseas studies

Symposium etc.

- The 38th International Symposium on lattice field theory (July 25-31, 2021)
- The 14th Quark Confinement and the Hadron Spectrum (Aug. 2-7, 2021)

Joint research

(As candidates,)

- The University of Stavanger (Norway)
- The University of Adelaide (Australia)
- The University of Kentucky (U.S.)

(I will decide about this more specifically after submitting my paper...)