Progress in my research

Keita Sakai, Nuclear theory group

Goal: to understand the origin of the glueball mass

The only first principle calculation method of QCD we know

…Lattice QCD

Glueball… A hadron which is made of gluons only

For direct calculation of a mass in lattice QCD…

Energy momentum tensor (EMT)$T_{\mu\nu}$ operator

If scale invariance is not broke(classical)… $T_{\mu\mu} = 0$

If scale invariance is broke… $T^R_{\mu\mu} \neq 0$ **Trace anomaly**

To get the exact renormalized EMT operator **Yang-Mills gradient flow**

My plans of research in next few years

Before start to think about glueball…

charmonium(η_c) The ratio of $M_{from\ quarks}$ and $M_{from\ gluons}$ can be calculated

About glueball…

1. This year and next year

Calculation of the mass come from the trace anomaly

2. After that

Investigation of the glueball mass from another(potential) approach

Current status of research

1. Calculate the η_c mass (usual lattice QCD way) — done
2. Calculate the η_c mass created by gluons (gradient flow) — Calculation is running now
3. Create program about glueball — Working on it

GPPU points

Now I have only 4 points　　…Not good. I'll try harder.

Overseas studies

From July 12th to Aug. 4th

Summer school at ECT* in Trento, Italy

"From quarks and gluons to nuclear forces and structure"