



Snowmass '21 CPM
Session #124: LGT for HEP
BSM with Lattice Gauge Theory

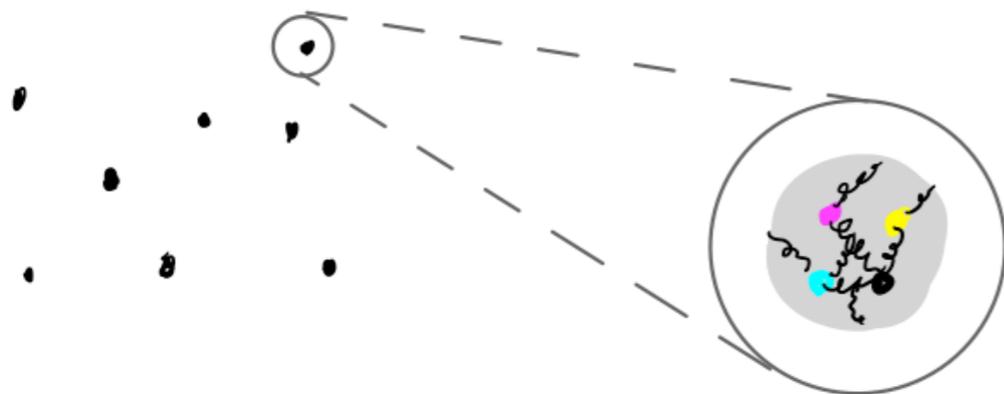
Ethan Neil (U. Colorado)
10/06/20



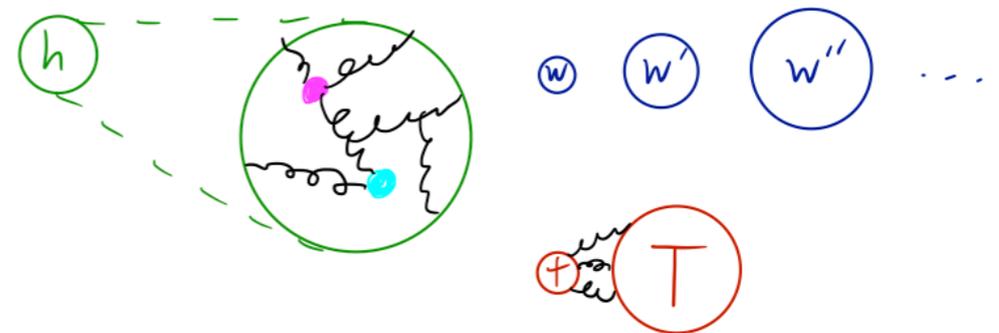
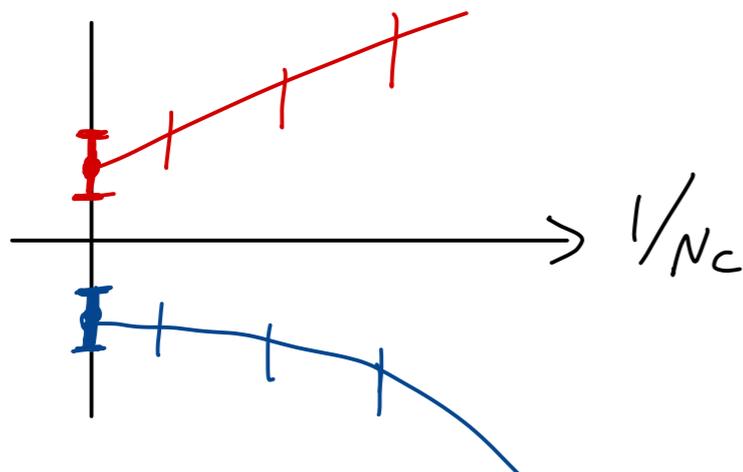
Overview: lattice + BSM

- Many overlaps of LGT with searches for new physics, of course! This talk = lattice study of *theories other than QCD*.
- Broad and exploratory research area: many different physics directions (the “theory space” is large.)
- What kinds of BSM theories are generally studied?

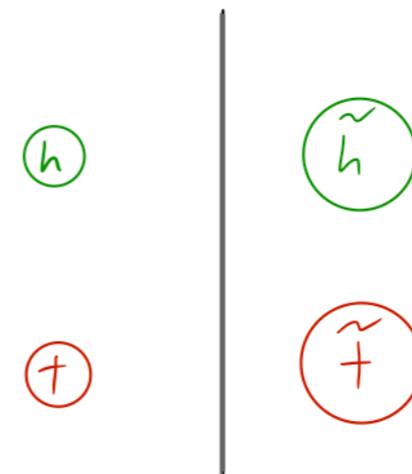
Composite Higgs: new strongly-coupled sector at the electroweak scale; Higgs is a composite bound state.



Supersymmetry (SUSY): hypothetical symmetry relating bosons to fermions. Strong coupling relevant for SUSY breaking.



Composite dark matter: dark “hidden sector” which is strongly coupled. Can appear naturally with composite Higgs or GUT theories.



Formal QFT: we gain insight into strongly-coupled QFT with each numerical lattice study! Learn about large- N_c , conformal field theories, ...

LOIs received

1. SNOWMASS21-EF2_EF8-TF8_TF5-CompF2_CompF0_Pavlos_M._Vranas-188.pdf:
“Composite Higgs from Strong Dynamics on the Lattice”
2. SNOWMASS21-TF8_TF5-087.pdf:
“Novel Directions in Natural Composite Higgs Modeling”
3. SNOWMASS21-TF5_TF1-CompF2_CompF0_Catterall-088.pdf:
“Lattice Supersymmetry: Successes and Opportunities”
4. SNOWMASS21-CF1_CF0-TF5_TF8-CompF2_CompF0_Pavlos_M._Vranas-166.pdf:
“Composite Dark Matter from Strong Dynamics on the Lattice”
5. SNOWMASS21-TF3_TF5-CompF2_CompF0_Witzel_Oliver-060.pdf:
“Lattice field theory for conformal systems and beyond”
6. SNOWMASS21-TF3_TF5_ryttov_shrock-021.pdf:
“Perturbative Calculations of Anomalous Dimensions in Conformal Field Theories”

LOI highlights

- 1,2: **Composite Higgs**: from lattice side, emphasis on progress in dilaton-like Higgs and pNGB Higgs with “mass-split” theories. Connecting UV completions to lattice and pheno is important!
- 3: **Lattice SUSY**: holographic principle tests, insight into string corrections moving away from large- N /infinite 't Hooft coupling.
- 4: **Composite DM**: motivations, progress on DM form factors. Future directions: DM self-interaction, “dark nuclei”, primordial gravity waves
- 5,6: Progress in **conformal/near-conformal systems**, anomalous dimensions. Further collaboration between perturbative, lattice, conformal bootstrap would be useful. Future directions: search for asymptotic safety, lower-dimensional + supersymmetric non-perturbative CFTs.