Ensembles from JLQCD Colaborations

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(10 slides in total)

Gauge Ensembles

Target Physics

- $T = 0$: B-physics with fine lattices
- $T > 0$:
  - on Line of Constant Physics (LCP) phase structure, thermodynamics
  - fixed-T varying m, reweighting to overlap, $U(1)_A$, topology

Action

- gauge: Tree-level Symansik
- fermion: Möbius Domain Wall (scale factor 2) with a stout smearing

  $T = 0$: 2+1 flavors, 3 flavors

  $T > 0$: 2 flavors, 2+1 flavors, 3 flavors

Gauge Ensembles, cont'd

Algorithm etc.

- algorithm: RHMC for strange
  Hasenbusch for light quarks
  Omelyan integrator
- code sets: GRID with local modification, Iroiro++
- machines: Fugaku (RIKEN), Wisteria-O (U of. Tokyo), Oakforest-PACS (U. of Tokyo and Tsukuba, retired), BG/Q (KEK, retired),...

$T = 0$ ensembles

cf. arXiv:2203.04938

$1/a$ [GeV]	$L^3 \times T \times L_s$	M_π [MeV]	M_K [MeV]	num.
2.453(4)	$32^3 \times 64 \times 12$	226	525	100
		310	486	100
		309	547	100
		397	518	100
		399	577	100
		498	563	100
		499	618	100
3.610(9)	$48^3 \times 96 \times 8$	296	473	50
		300	547	50
		407	413	50
		408	516	50
		499	556	42
		501	629	42
4.96(9)	$64^3 \times 128 \times 8$	314	536	50

every 50–100 MD time

$1/a = 1.45$ GeV, $24^3 \times 48 \times 12$, $M_\pi = 280, 390, 490$ are to come.

cf. Phys. Rev. D 96, 034509 (2017) and `arXiv:2011.01499`

$L^3 \times T \times L_s$	m_l [MeV]	Temp. [MeV]	points × num.
$24^3 \times 8 \times (12–24)$	1.6–16	203	2 × 200
$24^3 \times 8 \times (12–24)$	1.7–16	217	2 × 200
$32^3 \times 8 \times 12$	1.6	203	1 × 210
$32^3 \times 8 \times (12–24)$	1.7–17	217	2 × 150–240
$32^3 \times 12 \times 16$	21	172	1 × 310
$32^3 \times 12 \times 16$	21	179	1 × 340
$32^3 \times 12 \times 16$	22	181	1 × 700
$32^3 \times 12 \times 16$	5.7–23	191	3 × 50–200
$32^3 \times 12 \times 16$	5.9–23	195	3 × 200–250
$24^3 \times 12 \times 16$	2.7–27	220	5 × 310–360
$32^3 \times 14 \times 16$	2.7–13	190	4 × 100–160
$32^3 \times 12 \times 16$	2.7–27	220	5 × 190–310
$40^3 \times 12 \times 16$	13–27	220	2 × 280
$48^3 \times 12 \times 16$	2.7–13	220	4 × 110
$32^3 \times 10 \times 16$	2.7–13	260	4 × 120–290
$32^3 \times 8 \times 16$	2.7–106	330	6 × 50–320
$48^3 \times 8 \times 16$	27–30	330	6 × 90–140

every 100 trajectories (with some exceptions)

LCP

quark mass input, on-going included

$L^3 \times T \times L_s$	m_l	m_s	Temp. [MeV]	points × num.
$24^3 \times 12 \times 12$	$0.1\ m_s$	m_s^{phys}	120-205	10 × 2,000
$24^3 \times 12 \times 12$	m_l^{phys}	m_s^{phys}	120-205	12 × 2,000
$24^3 \times 12 \times 12$	$0.1\ m_s+$	$m_s^{\text{phys}}+$	120-205	10 × 2,000
$24^3 \times 12 \times 12$	$0+$	$m_s^{\text{phys}}+$	120-205	10 × 2,000
$24^3 \times 36 \times 12$	$0.1\ m_s$	m_s^{phys}	130-195	8 × 2,000
$32^3 \times 12 \times 16$	$0.1\ m_s+$	$m_s^{\text{phys}}+$	120-205	10 × 2,000

"+": offset by m_{res}

Fixed-T

larger volumes to come

$L^3 \times T \times L_s$	m_l [MeV]	m_s	Temp. [MeV]	points × num.
$32^3 \times 12 \times 12$	4.9–46	$\simeq m_s^{\text{phys}}$	204	$4 \times 2,000$ +3 × 320–480
$32^3 \times 12 \times 14$	4.9–29	$\simeq m_s^{\text{phys}}$	175	$4 \times 2,000$ +1 × 420
$32^3 \times 12 \times 16$	4.9–29	$\simeq m_s^{\text{phys}}$	153	$4 \times 2,000$

every 10 trajectories

$T > 0$: 3 flavors

$L^3 \times T \times L_s$	am_l	Temp. [MeV]	points × num.
$16^3 \times 8 \times 16$	0–0.2	181	11 × 1,000–1,200
$24^3 \times 8 \times 16$	0–0.14	181	15 × 400–600
$24^3 \times 12 \times 16$	-0.06 –0.14	121	44 × 300–1,000

Also $T = 0$ configurations:

$1/a$ [GeV]	$L^3 \times T \times L_s$	am_l	points × num.
1.45	$12^3 \times 24 \times 16$	0.1–0.3	3 × 700
1.45	$24^3 \times 48 \times 16$	0.02–0.045	6 × 1,000
2.03	$24^3 \times 48 \times 16$	0.015–0.040	6 × 380–560

every 10 traj.

Data management

- Keep them in the machines that generated them
- Then, copy to Japan Lattice Data Grid (JLDG) servers
- Gfarm (same as JLDG) storage system provided by HPCI for (temporal) backup

  HPCI: High Performance Computing Infrastructure. The strorage system is accessible from major supercomputer sites in Japan.

Access Policy

- Request based
  - should be available after publications
- Future: to be public in principle

Suggestions/Future Plan

- the policy of the grant/institute requires to make the related data public
  - but *how* is non-trivial
- JLDG currently plays a crucial role to keep the data in Japan
  - this will continue
- it is very nice that ILDG is coming back