FASTSUM: Anisotropic $N_f = 2 + 1$ Wilson-Clover

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On behalf of the FASTSUM Collaboration

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Current ensembles

Details

- Two spatial Volumes $N_s = 24$ and 32
- **Gauge Action:** Symanzik-improved, tree-level tadpole
- **Fermion Action:** Wilson-Clover, stout-links, tree-level tadpole
- $m_\pi \sim 240$, 384 MeV, $\xi \sim 3.5$, $T_c \sim 167$, 181 MeV
- Same zero-temperature parameters as HadSpec Collaboration
- OPENQCD-FASTSUM
  - Code stored on (public) Gitlab https://gitlab.com/fastsum
  - Modified version of openQCD-1.6 with anisotropy and stout link smearing

Data Management

Storage

- Two separate file servers managed by Swansea University
- Separated by $\sim$ 7km
- $\sim$ 80 TB and $\sim$ 230 TB respectively
- All Generation 2 & 2L also on Storj

Findability

- Published DOI on Zenodo

Sharing

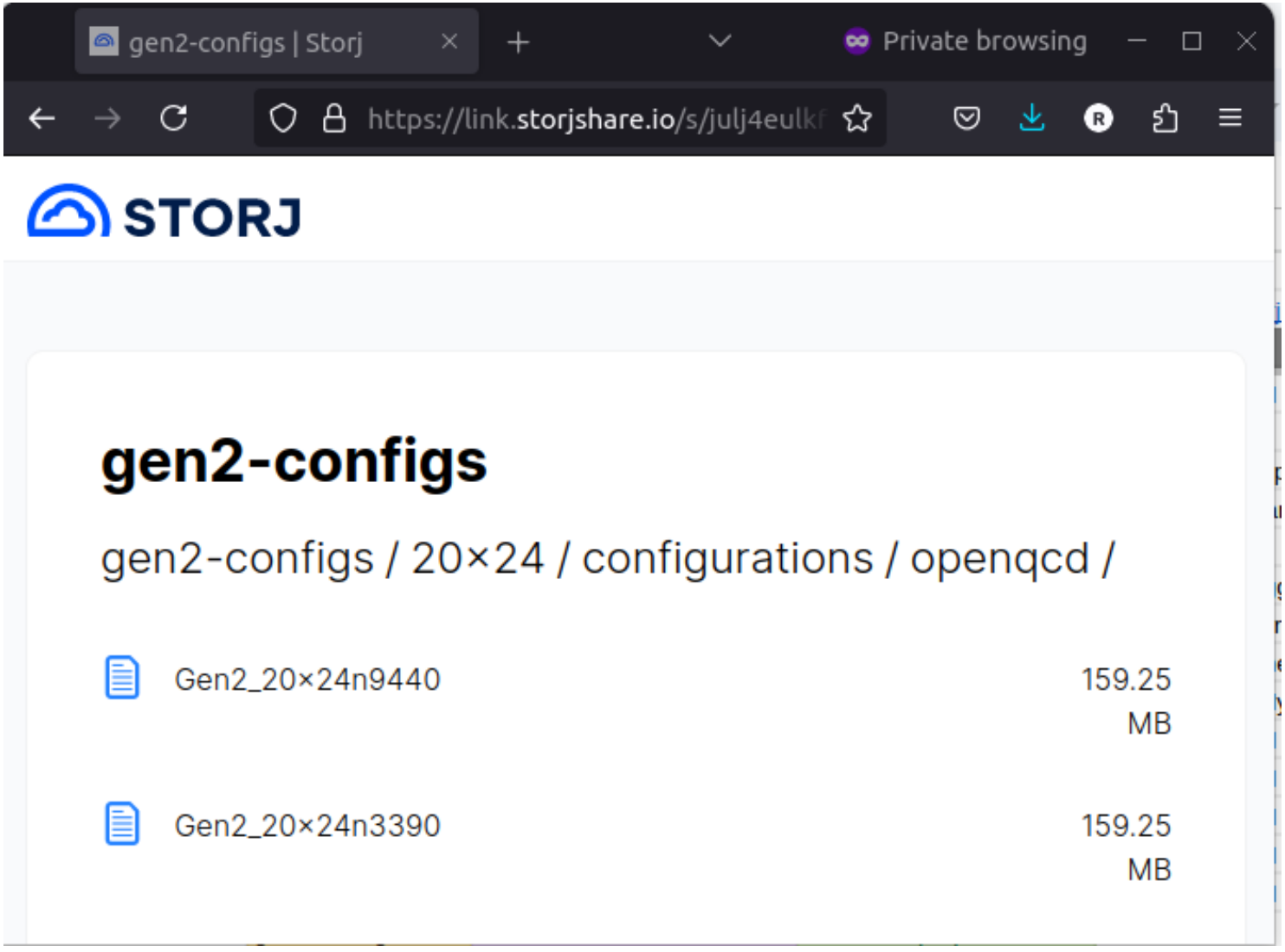
- De-centralised cloud storage service Storj enables easy sharing

Storj

A Decentralized Cloud Storage Network Framework

- Access provided through UK's Distributed Research using Advanced Computing - DiRAC
- Object storage similar to Amazon AWS/etc
- Various levels of access controls
- Easy to share
- S3, i.e. rclone or even web browser
- `https://link.storjshare.io/julj4eulkfnqnd26v36des6wvy3a/gen2-configs`

Storj


gen2-configs | Storj
Private browsing
https://link.storjshare.io/s/julj4eulk
STORJ
gen2-configs
gen2-configs / 20×24 / configurations / openqcd /
Gen2_20×24n9440
159.25 MB
Gen2_20×24n3390
159.25 MB

Zenodo

About

"Zenodo is a general-purpose data repository built on open source software that accepts all forms of research output from data files to presentation files."

- Use for DOI for ensemble sharing
- Human readable description of ensembles
- Tagging system
- **ILDG has a community:**
  `https://zenodo.org/communities/ildg/`
- Several collaborations have lattice data on Zenodo (mostly correlators)

FASTSUM Generation 2 Anisotropic Thermal Lattice QCD Gauge Ensembles

The FASTSUM collaboration [1] Generation 2 Ensembles are lattice Quantum Chromodynamics (QCD) gauge-ensembles used extensively to examine thermal (non-zero temperature) properties of QCD using the first principles methods of lattice QCD. These are anisotropic lattices using the `fixed-scale` approach to thermal ensembles wherein the temperature is changed entirely by changing the number of points in the temporal direction.

These ensembles are freely available (see below). The only requirements of use are that this Zenodo page, and the two papers detailing the ensembles, Electrical conductivity and charge diffusion in thermal QCD from the lattice and Properties of the QCD thermal transition with Nf=2+1 flavors of Wilson quark are appropriately cited.

These ensembles are characterised by

- $N_f = 2 + 1$ flavour
  - Degenerate up and down quarks, physical strange quark
- spatial lattice spacing a_s
  - ~0.12 fm
- temporal lattice spacing a_t
  - ~0.035 fm
- anisotropy $\nu = a_s/a_t$
  - ~3.444
- Number of spatial sites NS
  - NS = 24 or 32
- Number of Temporal sites
  - NT in [16, 48]
- Temperatures
  - 117 MeV to 352 MeV
- Pseudocritical temperature (from renormalised chiral condensate)
  - 181(1) MeV
- Pion mass
  - $m_\pi \sim 384$ MeV
- Psuedoscalar to vector mass ratio
  - $M_\pi/M_\rho \sim 0.446$

Keywords and subjects

QCD | Lattice QCD | Gaugefield | Finite Temperature | Anisotropic | Wilson | Clover

Details

DOI

DOI 10.5281/zenodo.8403827

Resource type

Dataset

Publisher

Zenodo

Languages

English

Rights

Future ensembles

Generation 3

- Newest ensemble with decreased temporal lattice spacing (15.7 attometre!)
- Tuned to otherwise be similar to Generation 2
- $N_s = 32$, $m_\pi \sim 384$ MeV, $\xi \sim 7.0$, $T_c \sim 181$ MeV, $a_s \sim 0.12$ fm
- Beginning production

Generation 2P

- Next step in Generation 2, 2L, to take $m_\pi \to m_\pi^{phys}$

Future Questions

openQCD

- How can we reconcile all the versions floating around the community?

Sharing & Searching

- What role do cloud services play
- Is S3/etc style access doable?
- Can simpler tags ease searching?

FASTSUM Collaboration

Who are we?

- Gert Aarts, Swansea University
- Chris Allton, Swansea University
- Muhammad Anwar, Swansea University
- Ed Bennet, SA^{2}C
- Ryan Bignell, Trinity College Dublin
- Tim Burns, Swansea University
- Shiyang Chen, Swansea University
- Matteo Favoni, Swansea University
- Mackenzie Gibbons, Swansea University
- Simon Hands, University of Liverpool
- Rachel Horohan D'Arcy, Maynooth University
- Benjamin Jäger, Southern Denmark University
- Seyong Kim, Sejong University
- Chris Kirwan, Trinity College Dublin
- Dale Lawlor, Maynooth University
- Maria Paola Lombardo, INFN Sezione di Firenze
- Ben Page, Swansea University
- Sinead Ryan, Trinity College Dublin
- Antonio Smecca, Swansea University
- Jon-Ivar Skullerud, Maynooth University
- Tom Spriggs, Swansea University
- Liang-Kai Wu, Jiangsu University

FASTSUM Collaboration

What do we do?

- Thermal QCD using the fixed-scale (Anisotropic) approach
- Bottom physics using NRQCD
  - **2112.04201**, **1402.6210**, **1310.5467**, **1210.2903**, A. Smecca, R. Horohan D'arcy, R. Bignell Wed 11:15-11:55
- Electrical conductivity of the quark-gluon plasma
  - **2008.12326**, **1412.6411**, **1307.6763**
- light, strange and charm hadron spectroscopy
  - **2308.12207**, **2209.14681**, **2007.04188**, **1812.07393**, **1703.09246**
- and more...
  - **2211.13717**, **2007.04188**

Format & Code & Metadata

Gaugefields

- Gaugefields mostly in openQCD format
  - Header contains dimensions + plaquette value
- Some of Generation 2 in SCIDAC/LIME

Code

- Code stored on (public) Gitlab https://gitlab.com/fastsum
- Modified version of openQCD-1.6 with anisotropy, stout link smearing and additional logging

Metadata

- Shared Google Docs. Spreadsheet
- Input files also on Gitlab