# Metadata Working Group Report

ILDG15, December 4th

T. Yoshie for MDWG

Update of QCDml

Apology for Propagator Sharing

# Update of QCDml

- received a request from BGR (Bern-Graz-Regensburg) Collab. to markup their chirally improved fermion action
- Dirk took leadership to update, with the collab. member Christian Hagen

- Chirally improved action
  - proposed by C. Gattringer in

    Phys.Rev. D63 (2001) 114501, hep-lat/0003005
  - write down a general form of lattice Dirac operator

$$D_{x,y} = \sum_{\alpha=1}^{16} \Gamma_\alpha \sum_{p \in \mathcal{P}^\alpha_{x,y}} c_p^\alpha \prod_{l \in p} U_l \, .$$

– constrain coefficients with symmetry

$$
\begin{aligned}
D \equiv \mathbb{I}\Big[ & s_1 + s_2 \sum_{l_1} < l_1 > + s_3 \sum_{l_2 \neq l_1} < l_1, l_2 > \\
& + s_4 \sum_{l_1} < l_1, l_1 > \ \ldots \Big] \\
+ \sum_{\mu} \gamma_\mu \sum_{l_1 = \pm\mu} s(l_1) \Big[ & v_1 < l_1 > + v_2 \sum_{l_2 \neq \pm\mu} [< l_1, l_2 > \\
& + < l_2, l_1 >] + v_3 < l_1, l_1 > \ \ldots \Big] \\
+ \sum_{\mu<\nu} \gamma_\mu \gamma_\nu \sum_{\substack{l_1=\pm\mu \\ l_2=\pm\nu}} & s(l_1)\, s(l_2) \sum_{i,j=1}^{2} \epsilon_{ij} \Big[ t_1 < l_i, l_j > \ \ldots \Big] \\
+ \sum_{\mu<\nu<\rho} \gamma_\mu \gamma_\nu \gamma_\rho \sum_{\substack{l_1=\pm\mu, l_2=\pm\nu \\ l_3=\pm\rho}} & s(l_1)\, s(l_2)\, s(l_3) \sum_{i,j,k=1}^{3} \epsilon_{ijk} \times \\
& \Big[ a_1 < l_i, l_j, l_k > \ \ldots \Big] \\
+ \gamma_5 \sum_{\substack{l_1=\pm1, l_2=\pm2 \\ l_3=\pm3, l_4=\pm4}} & s(l_1)\, s(l_2)\, s(l_3)\, s(l_4) \sum_{i,j,k,n=1}^{4} \epsilon_{ijkn} \times \\
& \Big[ p_1 < l_i, l_j, l_k, l_n > \ \ldots \Big] . \qquad (4
\end{aligned}
$$

$< l_1, l_2, \ldots >$

a path from a site going to $l_1$ direction first, then to $l_2$ direction, ....

$s_i v_i t_i \ldots$

(real) coefficient for scalar, vector, tensor ... parts

- impose Ginsparg-Wilson condition E=0 with

$$E = -D - \gamma_5 D \gamma_5 + \gamma_5 D \gamma_5 D ,$$

  gives “coupled quadratic equation of coefficients”
- truncate expansion, solve coupled equations numerically, one obtains an approximation to Ginsparg-Wilson Action

- markup action coefficients
  - the action could in principle have infinite number of coefficients
  - consider practical use
  - BGR collab. uses an action with 51 coefficients
  - 19 out of 51 are usually non-zero, while others are zero

- mandate 19 coefficients to be marked up
- regard other coefficients optional, and coefficients which are not present are implicitly assumed to be zero.
- notation for coefficients follows

  C. Gattringer, et.al.,

  Nucl. Phys. B 618 (2001) 205, [hep-lat/0105023]

- use <ciQuarkAction> for the original action and <fatLinkCIQuarkAction> for smeared actions

- QCDmlEnsemble1.4.5 is ready to use

| Clifford generator | Generating path | Name of coefficient |
|---|---|---|
| $\mathbb{I}$ | $<>$ | $s_1$ |
| $\mathbb{I}$ | $<1>$ | $s_2$ |
| $\mathbb{I}$ | $<1,2>$ | $s_3$ |
| $\mathbb{I}$ | $<1,2,3>$ | $s_5$ |
| $\mathbb{I}$ | $<1,1,2>$ | $s_6$ |
| $\mathbb{I}$ | $<1,2,-1>$ | $s_8$ |
| $\mathbb{I}$ | $<1,2,3,4>$ | $s_{10}$ |
| $\mathbb{I}$ | $<1,2,-1,3>$ | $s_{11}$ |
| $\mathbb{I}$ | $<1,2,-1,-2>$ | $s_{13}$ |
| $\gamma_1$ | $<1>$ | $v_1$ |
| $\gamma_1$ | $<1,2>$ | $v_2$ |
| $\gamma_1$ | $<1,2,3>$ | $v_4$ |
| $\gamma_1$ | $<2,1,3>$ | $v_5$ |
| $\gamma_1\gamma_2$ | $<1,2>$ | $t_1$ |
| $\gamma_1\gamma_2$ | $<1,2,3>$ | $t_2$ |
| $\gamma_1\gamma_2$ | $<1,3,2>$ | $t_3$ |
| $\gamma_1\gamma_2$ | $<1,2,-1>$ | $t_5$ |
| $\gamma_1\gamma_2$ | $<1,2,-1,-2>$ | $t_{15}$ |
| $\gamma_5$ | $<1,2,3,4>$ | $p_1$ |

```
<ciQuarkAction>
    ....
   <mass>-0.050</mass>
   <s1>1.481599252</s1>
   <s2>-0.05218251439</s2>
   <s3>-0.01473643847</s3>
   <s5>-0.002186103421</s5>
   <s6>0.002133989696</s6>
   <s8>-0.003997001821</s8>
   <s10>-0.0004951673735</s10>
   <s11>-0.0009836500799</s11>
   <s13>0.007529838581</s13>
   <v1>0.1972229309</v1>
   <v2>0.008252157565</v2>
   <v4>0.005113056314</v4>
   <v5>0.001736609425</v5>
   <t1>-0.08792744664</t1>
   <t2>-0.002553055577</t2>
   <t3>0.002093792069</t3>
   <t5>-0.005567377075</t5>
   <t15>-0.003427310798</t15>
   <p1>-0.008184103136</p1>
</ciQuarkAction>
```

# Apology for Propagator Sharing

- at ILDG14, we summarized status of propagator sharing within collaborations and possible extensions to ILDG
  - file formats exist
    - USQCD SciDAC format
    - ETMC extension
    - we may adopt them as ILDG standards
  - metadata
    - prepare minimal set
- Situation remains unchanged, simply because...
- we plan to restart our work
  - face-to-face kick-off, including people who want propagator format and metadata, will be useful