RHMC Code Documentation

Liam Keegan

October 24, 2017

1 Introduction

A simple RHMC code to simulate n_f flavors of unimproved staggered fermions with the Wilson SU(3) gauge action.

2 QCD formulation

2.1 Gauge Action

Wilson SU(3) plaquette lattice gauge action,

$$S_g[U] = -\frac{\beta}{3}\sum_x \sum_{\mu<\nu} Re\mathrm{Tr}\left[U_\mu(x)U_\nu(x+\hat{\mu})U_\mu^\dagger(x+\hat{\nu})U_\nu^\dagger(x)\right] \tag{2.1}$$

where $U_\mu(x)$ is a 3x3 complex matrix at the site x in the direction μ.

2.2 Fermion Action

$$S_f[U] = \phi^\dagger(DD^\dagger)^{-2}\phi \tag{2.2}$$

where D is the staggered lattice Dirac operator

$$D_{nm} = \sum_\mu \eta_\mu(x)\left(U_\mu(x)\delta_{nm}\right) \tag{2.3}$$

and $\eta_\mu(x)$ are the space-dependent staggered equivalent of Dirac γ-matrices,

$$\eta_0(x) = 1, etc \tag{2.4}$$

3 HMC

The action simulated by the HMC is