HMLQCD Application

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Introduction

Lattice QCD - an indispensable tool both for particle and nuclear physics.

HMLQCD Application's goal
Computation of basic properties of matter simulating the theory of strong interactions, Quantum Chromodynamic on the Lattice on massively parallel computers.

Our project aims:

- To test local chiral actions for the calculation of the hadron masses.
- Calculate quark - antiquark potential from Wilson loops.
- On the algorithmic side the project will test new solvers for overlap and domain wall fermions.

Development Plan

Start of alpha stage: *M01. Construction of an algorithm. Creating of the program.*
Start of beta stage: *M6. Parallelization and Debugging of the application.*
Start of testing stage: *M8. Testing on multiprocessor platforms.*
Start of deployment stage: *M10. Performing calculations.*
Start of production stage: *Calculation of quark-antiquark potential and hadron spectroscopy*

Technical Features and HP-SEE Implementation
Primary programming language: *C/C++*
Parallel programming paradigm: *MPI/Open MP*
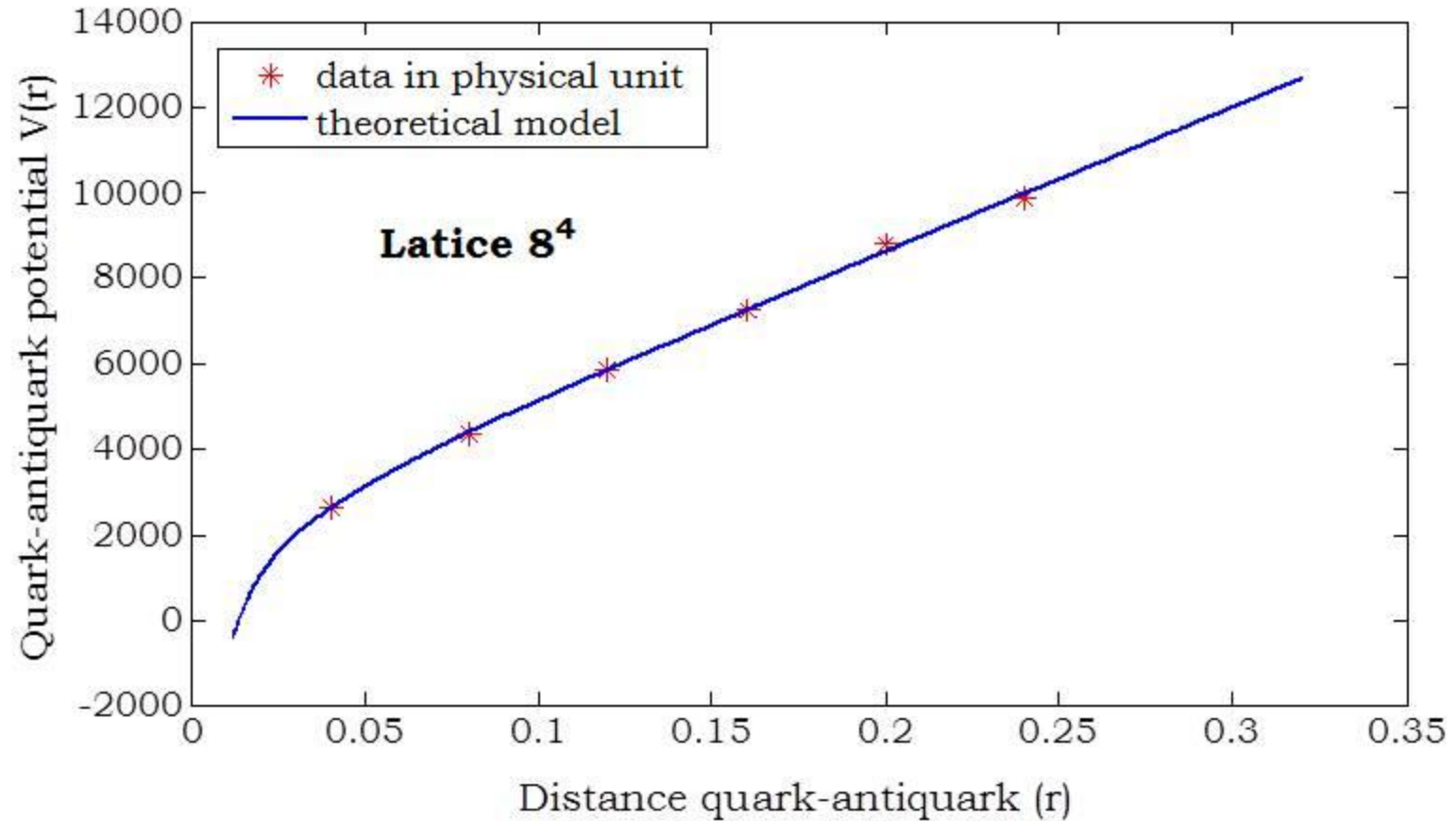Main parallel code: *MPI*
Pre/post processing code: *Own developer*
Application tools and libraries: *FermiQCD, OpenMP*
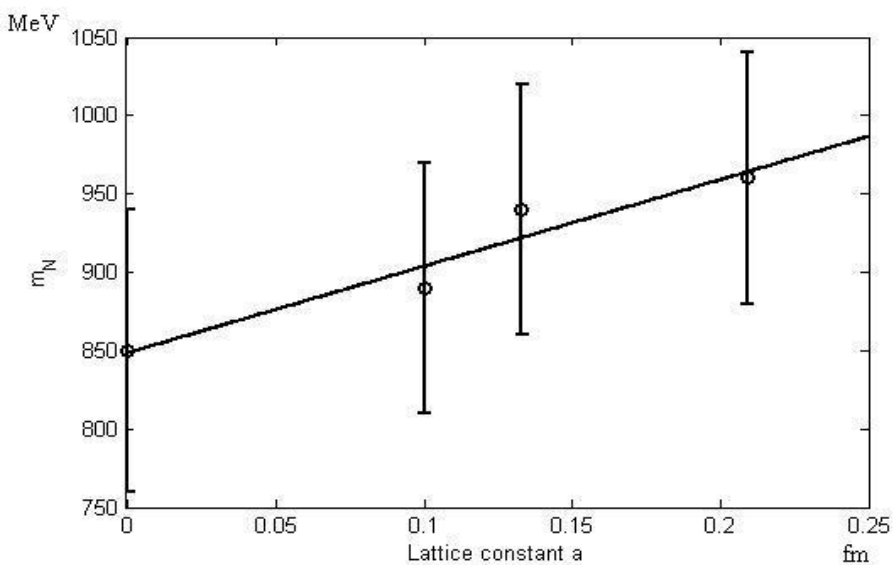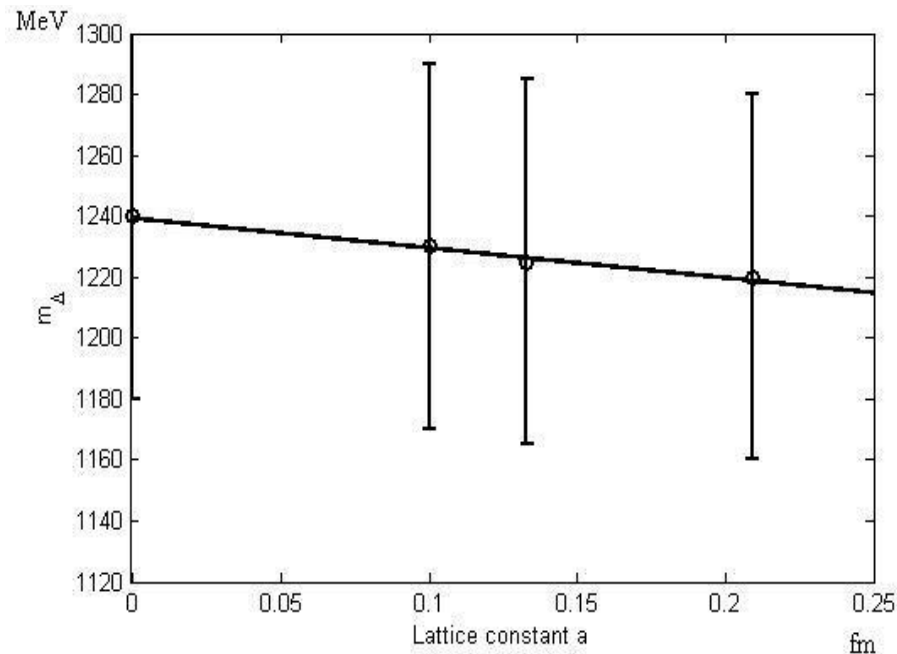Home system: *HPC-Bulgaria*

Results

Results

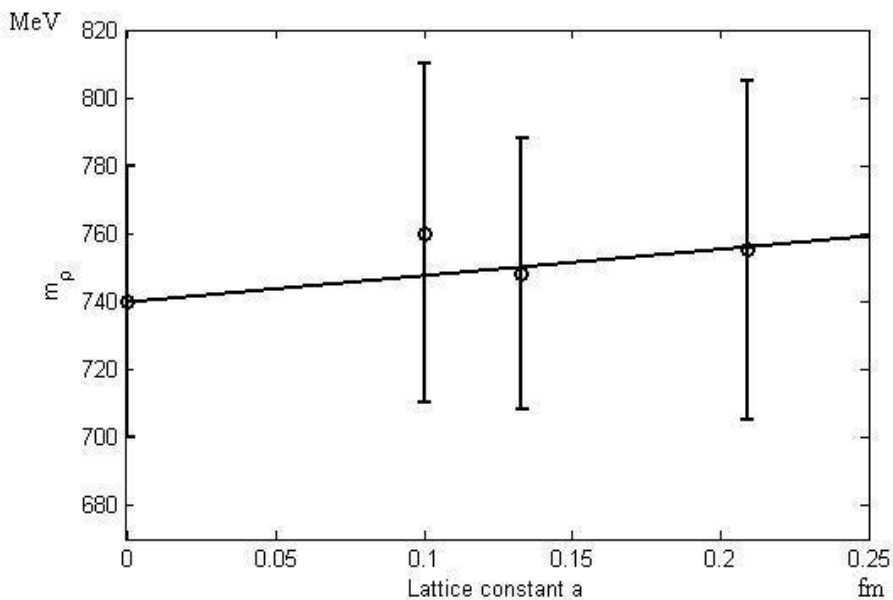| Hadron	Mass (MeV/c²)	Error (MeV/c²)	Exp. Mass (MeV/c²)
Rho - meson	750	± 60	770
Nucleon	855	± 70	938,27
Delta baryon	1240	± 87	1232

Results
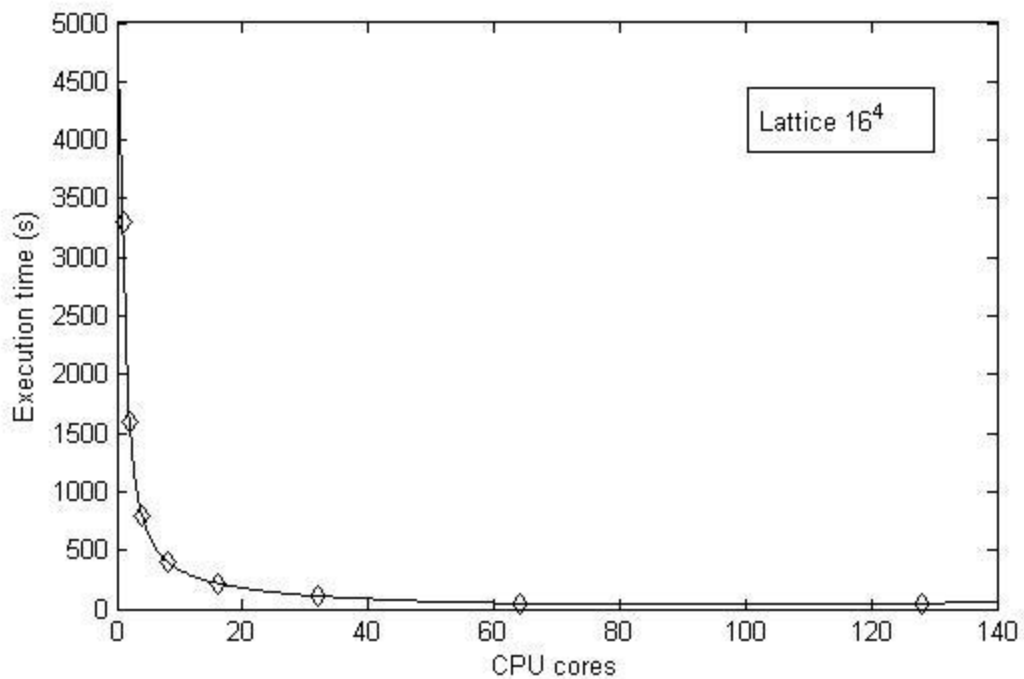
Results
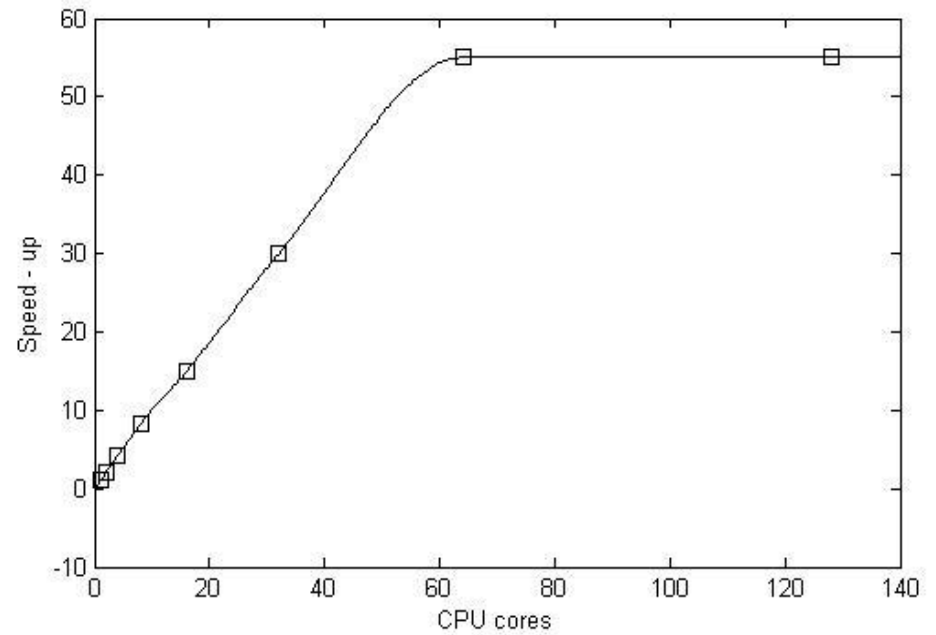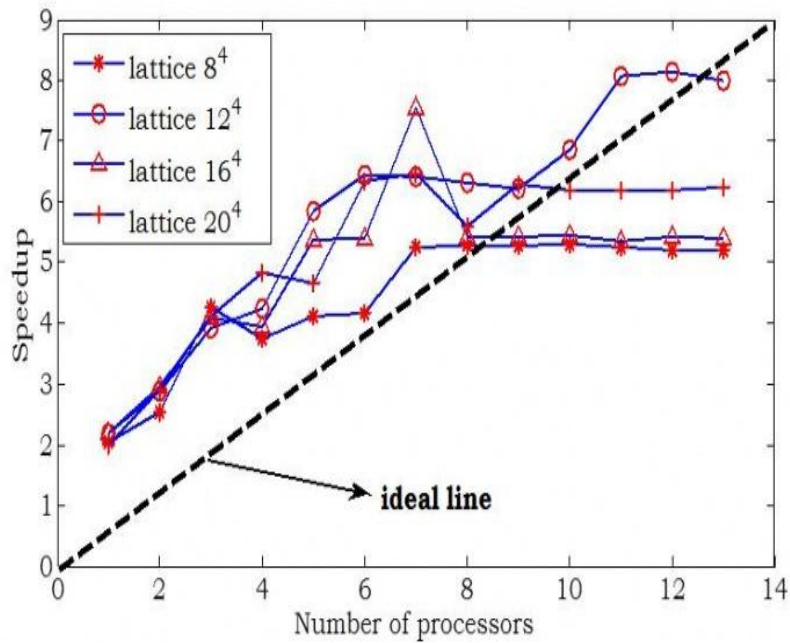
Plans underway

- Restoration of the broken hybercubic symmetry of the Borici – Creutz action
- Test it for the calculation of the hadron masses.
  The codes for the calculation of specific hadrons are already written and tested for Wilson action

-Implementation of the multigrid algorithm in FermiQCD as a solver for overlap and domain wall fermions.

Publications

November 2012 "Fakulteti i Shkencave Natyrore ne 100 vjetorin e pavaresise", Tirane, Albania

1. Zeqirllari, R., Xhako, D., Boriçi, A. "Light hadron spectrum for Wilson action"
2. Xhako, D., Zeqirllari, R., Boriçi, A, "Static quark-antiquark potential calculation"

October 2012 - HP-SEE User Forum 2012, Belgrade, Serbia
1. Zeqirllari, R., Xhako, D., Boriçi, A., "Quenched Hadron Spectroscopy Using FermiQCD",
2. Xhako, D., Zeqirllari, R., Boriçi, A, "Using Parallel Computing to Calculate Static Interquark Potential in LQCD"

Thank you!