LatticeYangMills

Generated by Doxygen 1.8.11

Contents

Chapter 1

LatticeYangMills

Suite for generating field configurations in pure YM SU(3) theory and compute basic observables on them.

Chapter 2

Hierarchical Index

2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 3

Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

Chapter 4

File Index

4.1 File List

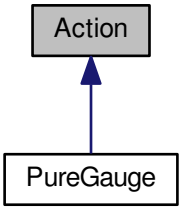
Here is a list of all documented files with brief descriptions:

Chapter 5

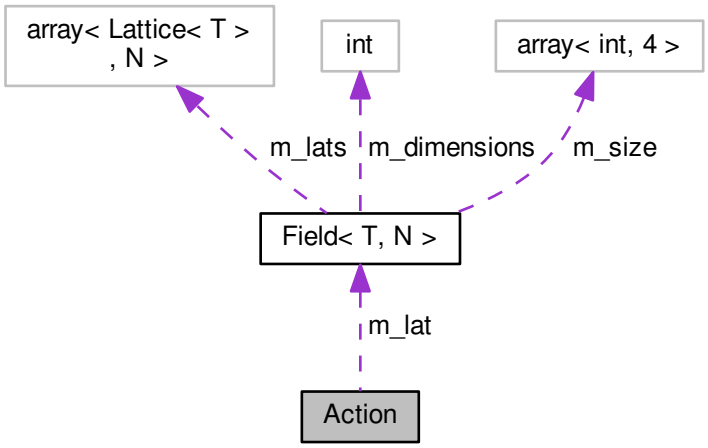
Class Documentation

5.1 Action Class Reference

Inheritance diagram for Action:



Collaboration diagram for Action:



Public Member Functions

- virtual double **compute** (int x, int y, int z, int t, int mu, SU3 &newLink)=0
- virtual void **computeStaples** (int mu)=0
- virtual Lattice< SU3 > **computeDerivative** (int mu)=0
- virtual void **computeStaplez** (GluonField *lattice)=0
- void initAction (GluonField *field)

  Links an action object to a GluonField object.

Protected Attributes

- GluonField * **m_lat** = nullptr

5.1.1 Member Function Documentation

5.1.1.1 void Action::initAction (GluonField * *lattice*)

Links an action object to a GluonField object.

Parameters

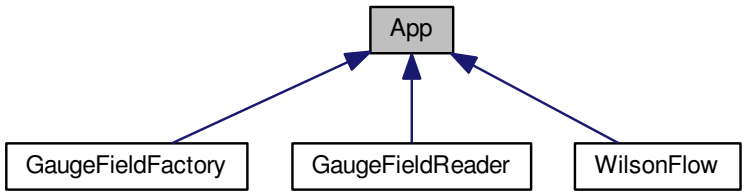
lattice	The gluonfield to link to the action instance.

The documentation for this class was generated from the following files:

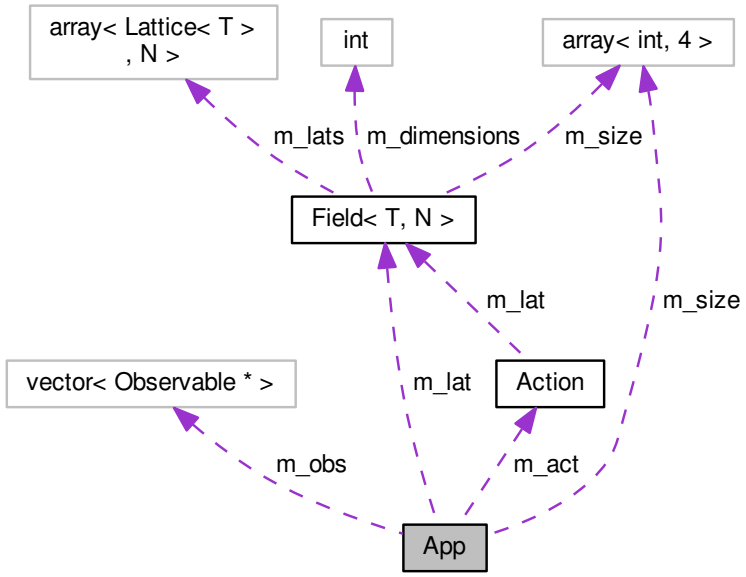
- action.h
- action.cpp

5.2 App Class Reference

Inheritance diagram for App:



Collaboration diagram for App:



Public Member Functions

- void **setAction** (Action ∗action)
- virtual void **createLattice** (std::array< int, 4 > latticeSize)
- void **addObservable** (Observable ∗observable)
- virtual void **execute** ()=0

Protected Attributes

- Action * **m_act** = nullptr
- GluonField * **m_lat** = nullptr
- std::array< int, 4 > **m_size**
- std::vector< Observable * > **m_obs**

The documentation for this class was generated from the following files:

- app.h
- app.cpp

5.3 complex Struct Reference

Collaboration diagram for complex:

Public Member Functions

- void **printComplex** ()
- double **norm** ()

Public Attributes

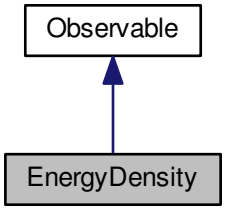
- double **real**
- double **imag**

The documentation for this struct was generated from the following files:

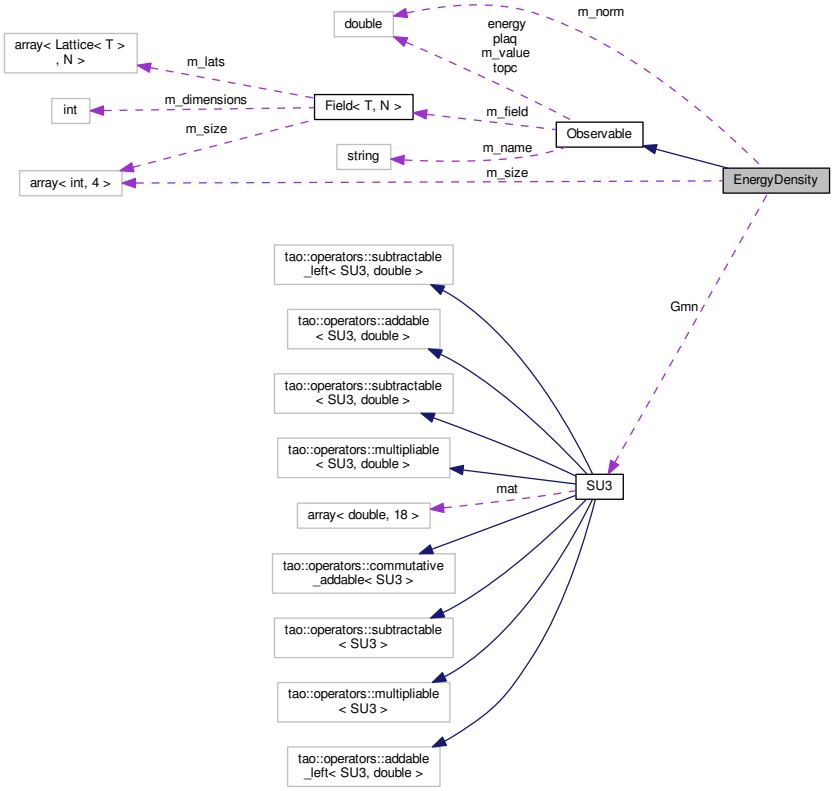
- complex.h
- complex.cpp

5.4 EnergyDensity Class Reference

Inheritance diagram for EnergyDensity:



Collaboration diagram for EnergyDensity:



Public Member Functions

- void **initObservable** (GluonField ∗lattice)
- void **compute** ()

Private Attributes

- std::array< int, 4 > **m_size**
- double **m_norm**
- SU3 **Gmn**

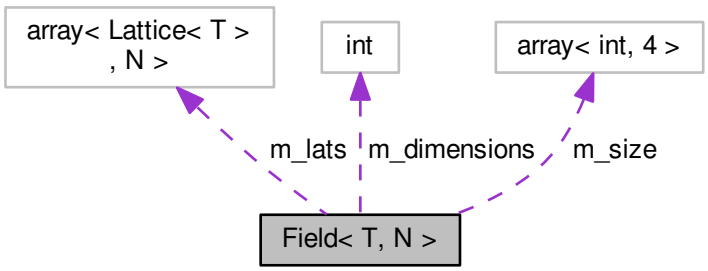
Additional Inherited Members

The documentation for this class was generated from the following files:

- energydensity.h
- energydensity.cpp

5.5 Field< T, N > Class Template Reference

Collaboration diagram for Field< T, N >:



Public Member Functions

- **Field** (std::array< int, 4 > size)
- Lattice< T > & **operator[ ]** (int mu)

Public Attributes

- int **m_dimensions**
- std::array< int, 4 > **m_size**

Private Attributes

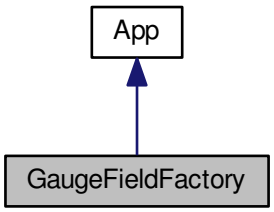
- std::array< Lattice< T >, N > **m_lats**

The documentation for this class was generated from the following file:

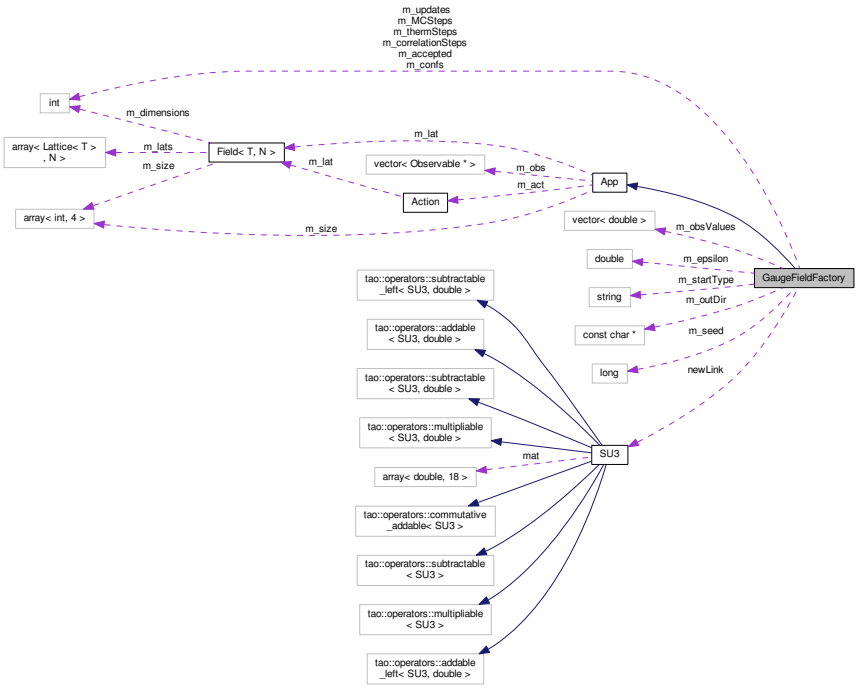
- field.h

5.6 GaugeFieldFactory Class Reference

Inheritance diagram for GaugeFieldFactory:



Collaboration diagram for GaugeFieldFactory:



Public Member Functions

- **GaugeFieldFactory** (int MCSteps, int thermSteps, int NConf, double epsilon, std::string startType)
- void **generateConfigurations** ()
- std::vector< double > & **getObsValues** ()
- void **execute** ()

Private Member Functions

- void **initialize** ()
- void **MCUpdate** ()
- void **updateLink** (int x, int y, int z, int t, int mu)
- void **computeObservables** ()
- void **thermalize** ()
- void **sampleConf** ()
- void **thermalizeTime** ()
- void **sampleConfTime** ()

Private Attributes

- std::vector< double > **m_obsValues**
- int **m_MCSteps**
- int **m_correlationSteps**
- int **m_thermSteps**
- int **m_confs**
- std::string **m_startType**
- double **m_epsilon**
- long int **m_accepted** = 0
- long int **m_updates** = 0
- long **m_seed**
- const char * **m_outDir**
- SU3 **newLink**

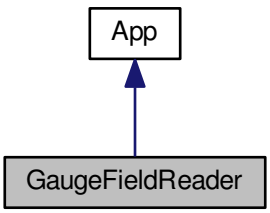
Additional Inherited Members

The documentation for this class was generated from the following files:

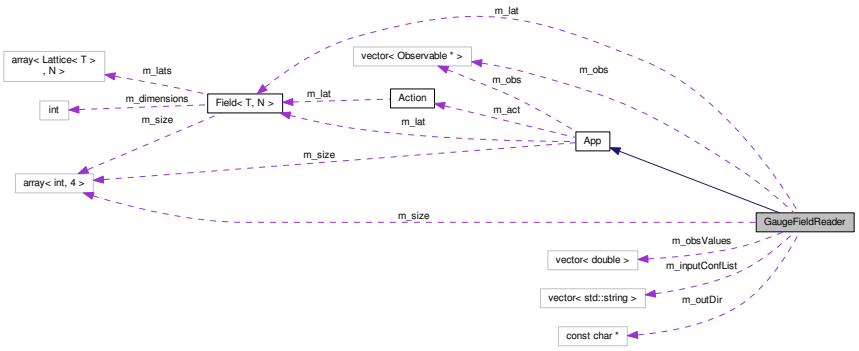
- gaugefieldfactory.h
- gaugefieldfactory.cpp

5.7 GaugeFieldReader Class Reference

Inheritance diagram for GaugeFieldReader:



Collaboration diagram for GaugeFieldReader:



Public Member Functions

- void **initGFR** ()
- void **sampleConfigurations** ()
- void **addObservable** (Observable ∗observable)
- const char ∗ **getOutDir** ()
- std::array< int, 4 > & **getSize** ()
- std::vector< double > & **getObsValues** ()
- std::vector< Observable ∗ > & **getObs** ()
- void **execute** ()

Private Attributes

- GluonField ∗ **m_lat** = nullptr
- std::vector< Observable ∗ > **m_obs**
- std::vector< double > **m_obsValues**
- std::vector< std::string > **m_inputConfList**
- std::array< int, 4 > **m_size**
- const char ∗ **m_outDir**

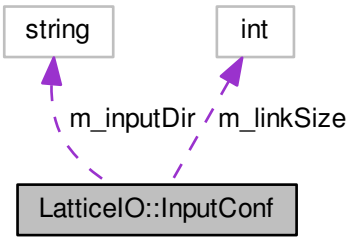
Additional Inherited Members

The documentation for this class was generated from the following files:

- gaugefieldreader.h
- gaugefieldreader.cpp

5.8 LatticeIO::InputConf Class Reference

Collaboration diagram for LatticeIO::InputConf:



Static Public Member Functions

- static void **readConf** (GluonField &lattice, int confNum)
- static void **readConf** (GluonField &lattice, const char *inputFile)
- static void **readSubLattice** (GluonField &lattice, int confNum)
- static void **setInputDir** (std::string inputDir)
- static void **getInputList** (std::vector< std::string > &inputConfList)

Static Private Attributes

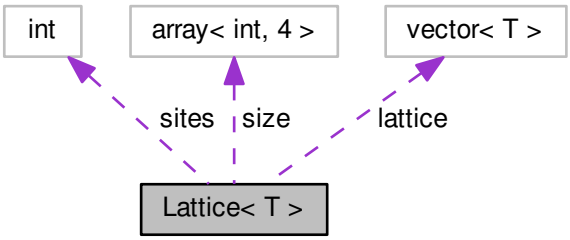
- static int **m_linkSize** = 18 * sizeof(double)
- static std::string **m_inputDir**

The documentation for this class was generated from the following files:

- inputconf.h
- inputconf.cpp

5.9 Lattice< T > Class Template Reference

Collaboration diagram for Lattice< T >:



Public Member Functions

- **Lattice** (const Lattice &other) noexcept
- **Lattice** (Lattice &&other) noexcept
- **Lattice** (std::array< int, 4 > sizeArray)
- void **allocate** (std::array< int, 4 > sizeArray)
- T & **at** (int x, int y, int z, int t)
- T & **at** (const std::vector< int > &site)
- T & **at** (const std::array< int, 4 > &site)
- T & **at** (int i)
- const T & **at** (int x, int y, int z, int t) const
- const T & **at** (const std::vector< int > &site) const
- const T & **at** (const std::array< int, 4 > &site) const
- const T & **at** (int i) const
- Lattice & **operator=** (const Lattice &other) noexcept
- Lattice & **operator=** (Lattice &&other) noexcept
- Lattice & **operator+=** (const Lattice &other) noexcept
- Lattice & **operator+=** (Lattice &&other) noexcept
- Lattice & **operator-=** (const Lattice &other) noexcept
- Lattice & **operator-=** (Lattice &&other) noexcept
- Lattice & **operator*=** (const Lattice &other) noexcept
- Lattice & **operator*=** (Lattice &&other) noexcept
- Lattice & **operator+=** (double scalar) noexcept
- Lattice & **operator-=** (double scalar) noexcept
- Lattice & **operator*=** (double scalar) noexcept

Public Attributes

- std::vector< T > **lattice**
- std::array< int, 4 > **size**
- int **sites**

Friends

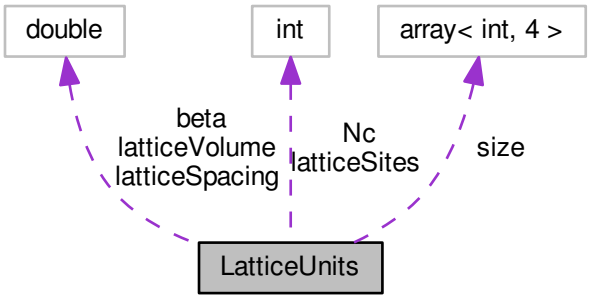
- Lattice **operator+** (Lattice lhs, const Lattice &rhs) noexcept
- Lattice **operator+** (Lattice lhs, Lattice &&rhs) noexcept
- Lattice **operator-** (Lattice lhs, const Lattice &rhs) noexcept
- Lattice **operator-** (Lattice lhs, Lattice &&rhs) noexcept
- Lattice **operator*** (Lattice lhs, const Lattice &rhs) noexcept
- Lattice **operator*** (Lattice lhs, Lattice &&rhs) noexcept
- Lattice **operator+** (Lattice lhs, double scalar) noexcept
- Lattice **operator-** (Lattice lhs, double scalar) noexcept
- Lattice **operator*** (Lattice lhs, double scalar) noexcept

The documentation for this class was generated from the following files:

- action.h
- lattice.h

5.10 LatticeUnits Struct Reference

Collaboration diagram for LatticeUnits:



Static Public Member Functions

- static void **initialize** (double beta)
- static double **plaquette** (double value)
- static double **energyDensity** (double value)
- static double **topologicalCharge** (double value)
- static double **calculateLatticeSpacing** (double beta)

Static Public Attributes

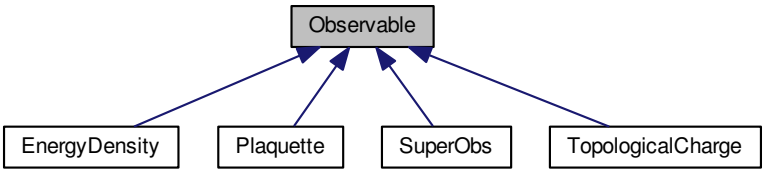
- static double **beta** = 0
- static double **latticeVolume** = 0
- static double **latticeSpacing** = 0
- static std::array< int, 4 > **size**
- static int **latticeSites** = 0
- static int **Nc** = 0

The documentation for this struct was generated from the following files:

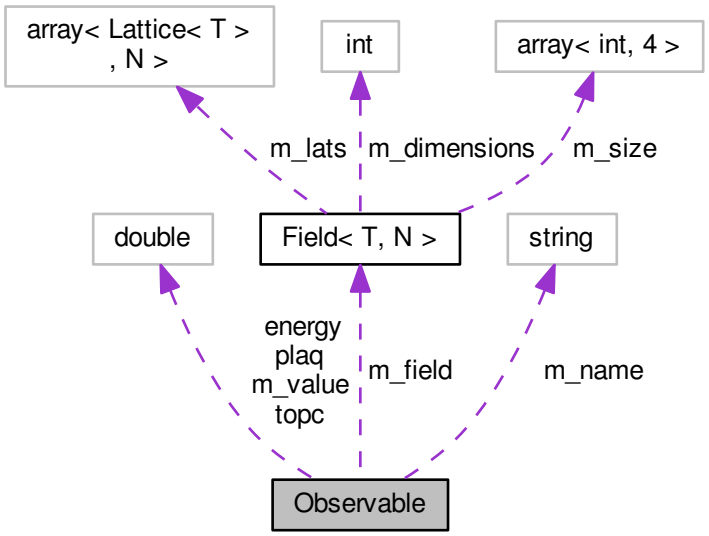
- latticeunits.h
- latticeunits.cpp

5.11 Observable Class Reference

Inheritance diagram for Observable:



Collaboration diagram for Observable:



Public Member Functions

- virtual void **compute** ()=0
- virtual void **initObservable** (GluonField ∗field)=0
- const char ∗ **getName** ()
- double **value** ()

Public Attributes

- double **plaq**
- double **energy**
- double **topc**

Protected Member Functions

- void **gatherResults** ()

Protected Attributes

- GluonField * **m_field** = nullptr
- double **m_value**
- std::string **m_name**

The documentation for this class was generated from the following files:

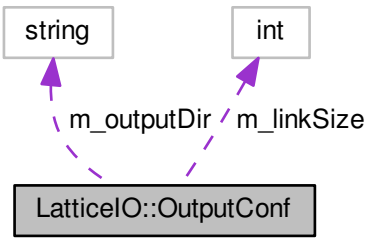
- observable.h
- observable.cpp

5.12 LatticeIO::OutputConf Class Reference

Class for saving lattices to binary files.

`#include <outputconf.h>`

Collaboration diagram for LatticeIO::OutputConf:



Static Public Member Functions

- static void writeConf (GluonField &lattice, int confNum)

  Saves the given GluonField object to the ouput directory.
- static void writeSubLattice (GluonField &lattice, int confNum)

  Saves the GluonField object in a set of files, one for each core.
- static void setOutputDir (std::string outputDir)

  Sets the output directory path.

Static Private Attributes

- static int m_linkSize = 72 ∗ sizeof(double)

  Contains the size in bytes of a 4 links on a lattice site.
- static std::string m_outputDir

  The path of the ouput directory.

5.12.1 Detailed Description

Class for saving lattices to binary files.

This object allows saving of GluonField objects as binary files.

Author

Giovanni Pederiva

Version

1.0

Date

2017-2018

Copyright

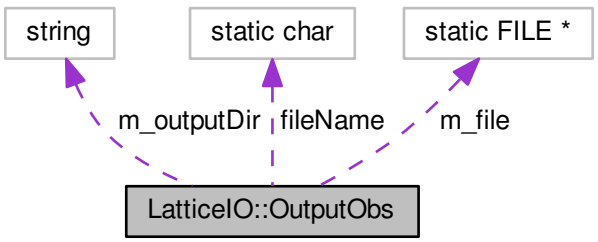
MIT License.

The documentation for this class was generated from the following files:

- outputconf.h
- outputconf.cpp

5.13 LatticeIO::OutputObs Class Reference

Collaboration diagram for LatticeIO::OutputObs:



Static Public Member Functions

- static void **initialize** (std::vector< Observable * > &obsList)
- static void **writeObs** (std::vector< Observable * > &obsList, int MCSteps)
- static void **writeFlowObs** (int confNum, std::vector< Observable * > &obsList, std::vector< std::vector< double >> &obsMatrix)
- static void **setOutputDir** (std::string outputDir)

Static Private Attributes

- static FILE * **m_file**
- static char **fileName** [1024]
- static std::string **m_outputDir**

The documentation for this class was generated from the following files:

- outputobs.h
- outputobs.cpp

5.14 LatticeIO::OutputTerm Class Reference

Static Public Member Functions

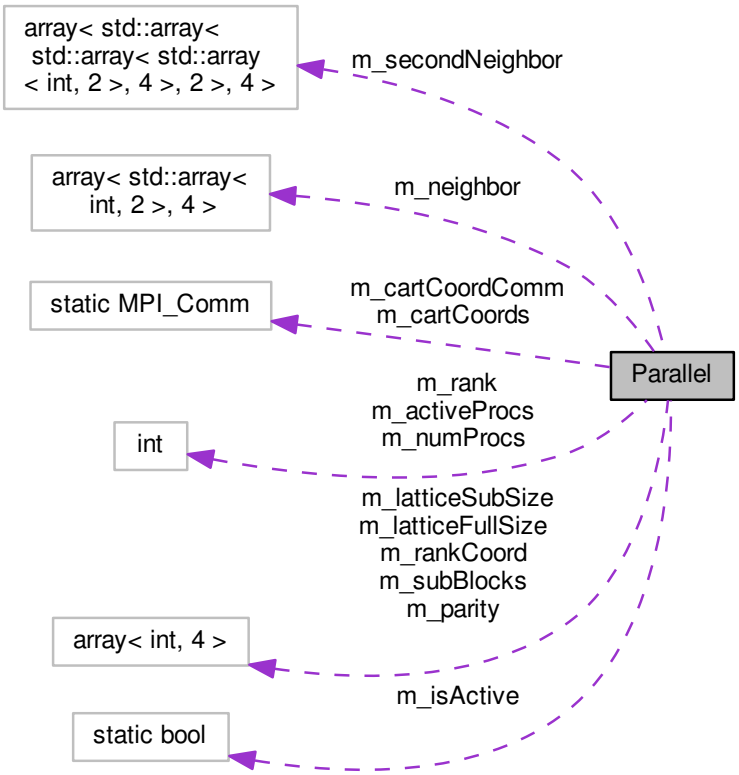
- static void **printInitialConditions** ()
- static void **writeObs** (int confNum, std::vector< Observable * > &obsList)
- static void **printThermStep** (int step, std::vector< Observable * > &obsList, double acceptRatio)
- static void **printGenStep** (int confNum, std::vector< Observable * > &obsList, double acceptRatio)
- static void **writeFlowObs** (double flowTime, std::vector< Observable * > &obsList)

The documentation for this class was generated from the following files:

- outputterm.h
- outputterm.cpp

5.15 Parallel Class Reference

Collaboration diagram for Parallel:



Static Public Member Functions

- static void **initialize** ()
- static void **createGeometry** (std::array< int, 4 > latticeSize, std::array< int, 4 > subLatticeSize)
- static void **finalize** ()
- static int **rank** ()
- static int **numProcs** ()
- static int **activeProcs** ()
- static bool **isActive** ()
- static MPI_Comm **cartCoordComm** ()
- static std::array< int, 4 > & **subBlocks** ()
- static std::array< int, 4 > & **rankCoord** ()
- static std::array< int, 4 > & **latticeSubSize** ()
- static std::array< int, 4 > & **latticeFullSize** ()
- static std::array< int, 4 > & **parity** ()
- static int **getNeighbor** (int direction, int sign)
- static int **getSecondNeighbor** (int direction1, int sign1, int direction2, int sign2)
- static void **openFile** (MPI_File &file, const char *fileName)
- static void **closeFile** (MPI_File &file)

Static Private Member Functions

- static void **createNeighborLists** ()
- static void **assignNeighbor** (int direction)
- static void **assignSecondNeighbor** (int dir1, int dir2)
- static void **MyMPI_Cart_shift2** (MPI_Comm comm, int dir1, int shift1, int dir2, int shift2, int &source, int &dest)

Static Private Attributes

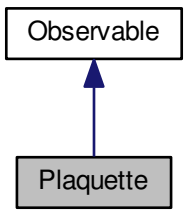
- static int **m_rank**
- static int **m_numProcs**
- static int **m_activeProcs**
- static bool **m_isActive**
- static MPI_Comm **m_cartCoordComm**
- static std::array< int, 4 > **m_subBlocks**
- static std::array< int, 4 > **m_rankCoord**
- static std::array< int, 4 > **m_latticeSubSize**
- static std::array< int, 4 > **m_latticeFullSize**
- static std::array< int, 4 > **m_parity**
- static MPI_Comm **m_cartCoords**
- static std::array< std::array< int, 2 >, 4 > **m_neighbor**
- static std::array< std::array< std::array< std::array< int, 2 >, 4 >, 2 >, 4 > **m_secondNeighbor**

The documentation for this class was generated from the following files:

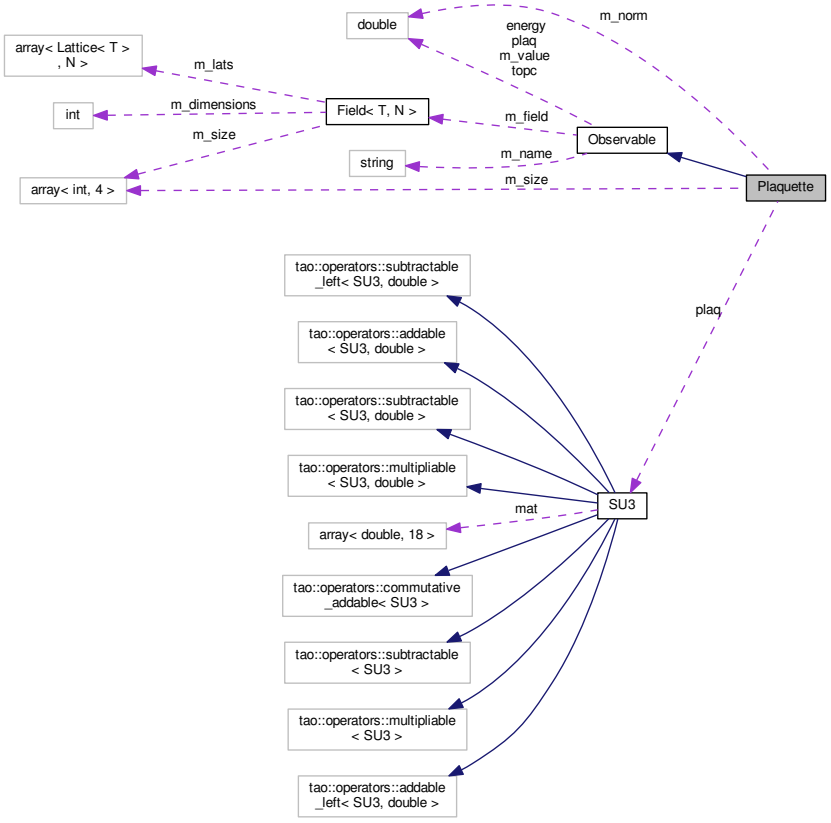
- parallel.h
- parallel.cpp

5.16 Plaquette Class Reference

Inheritance diagram for Plaquette:



Collaboration diagram for Plaquette:



Public Member Functions

- void **initObservable** (Lattice ∗lattice)
- void **compute** ()

Private Attributes

- std::array< int, 4 > **m_size**
- double **m_norm**
- SU3 **plaq**

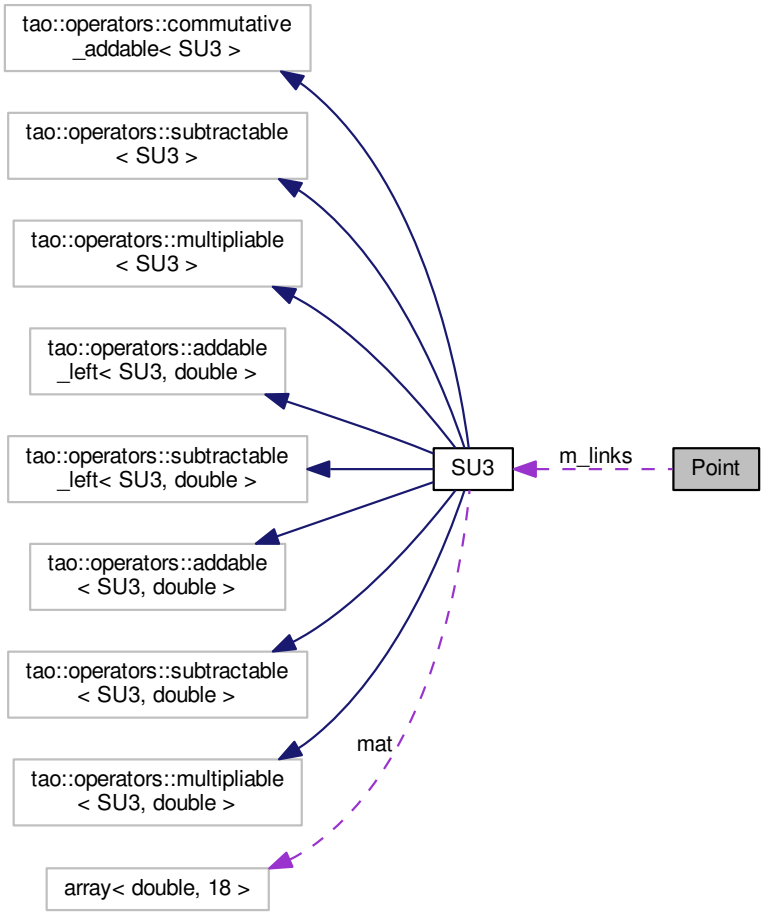
Additional Inherited Members

The documentation for this class was generated from the following files:

- plaquette.h
- plaquette.cpp

5.17 Point Class Reference

Collaboration diagram for Point:



Public Member Functions

- SU3 & **operator[ ]** (int i)
- SU3 **operator[ ]** (int i) const

Public Attributes

- SU3 **m_links** [4]

The documentation for this class was generated from the following files:

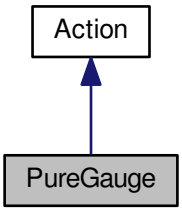
- point.h
- point.cpp

5.18 PureGauge Class Reference

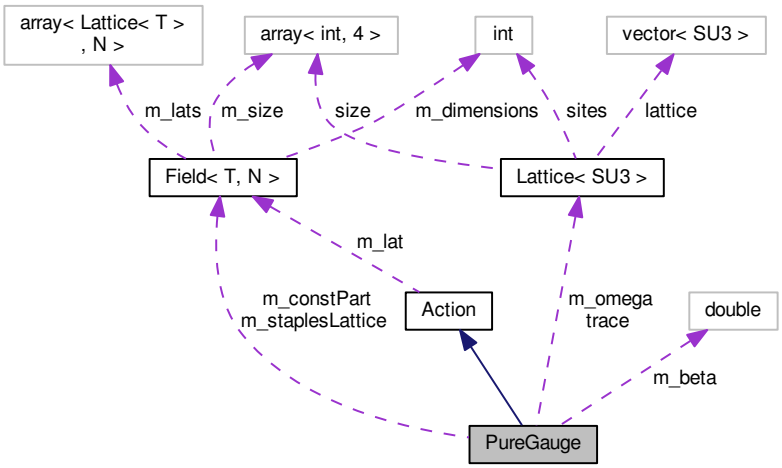
Initializer for the PureGauge Action class.

`#include <puregauge.h>`

Inheritance diagram for PureGauge:



Collaboration diagram for PureGauge:



Public Member Functions

- **PureGauge** (GluonField *lattice, double beta)
- PureGauge (double beta)

  Initializer for the PureGauge Action class.
- double **compute** (int x, int y, int z, int t, int mu, SU3 &newLink)
- void computeStaples (int mu)

  Computes the staples along the given directionfor all links in the given direction.
- Lattice< SU3 > computeDerivative (int mu)

  Computes the derivative of all links along the given direction.
- void **computeStaplez** (GluonField *lattice)
- void **computeOtherStaples** (int x, int y, int z, int t, int mu)

Private Attributes

- double **m_beta**
- GluonField * **m_staplesLattice** = nullptr
- GluonField * **m_constPart**
- Lattice< SU3 > **m_omega**
- Lattice< SU3 > **trace**

Additional Inherited Members

5.18.1 Detailed Description

Initializer for the PureGauge Action class.

beta The $/beta$ value of the action

5.18.2 Constructor & Destructor Documentation

5.18.2.1 PureGauge::PureGauge (double *beta*)

Initializer for the PureGauge Action class.

Parameters

beta	The $/beta$ value of the action

5.18.3 Member Function Documentation

5.18.3.1 Lattice< SU3 > PureGauge::computeDerivative (int *mu*) [virtual]

Computes the derivative of all links along the given direction.

Parameters

mu	The index of the directions to compute the staples of

Returns

m_omega Lattice<SU3> containing the derivative of the GluonField

Implements Action.

5.18.3.2 void PureGauge::computeStaples (int *mu*) [virtual]

Computes the staples along the given directionfor all links in the given direction.

Parameters

mu	The index of the directions to compute the staples of

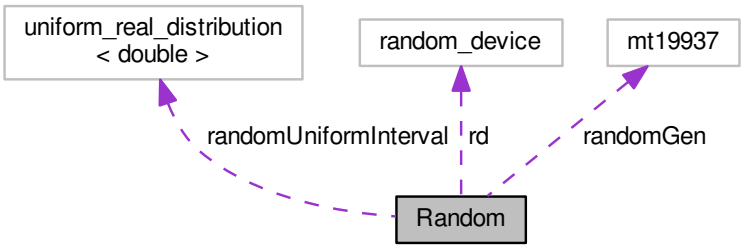
Implements Action.

The documentation for this class was generated from the following files:

- puregauge.h
- puregauge.cpp

5.19 Random Class Reference

Collaboration diagram for Random:



Static Public Member Functions

- static double **randUniform** ()
- static SU3 **randSU3** ()
- static SU3 **randSU3Transf** (double epsilon)

Static Private Attributes

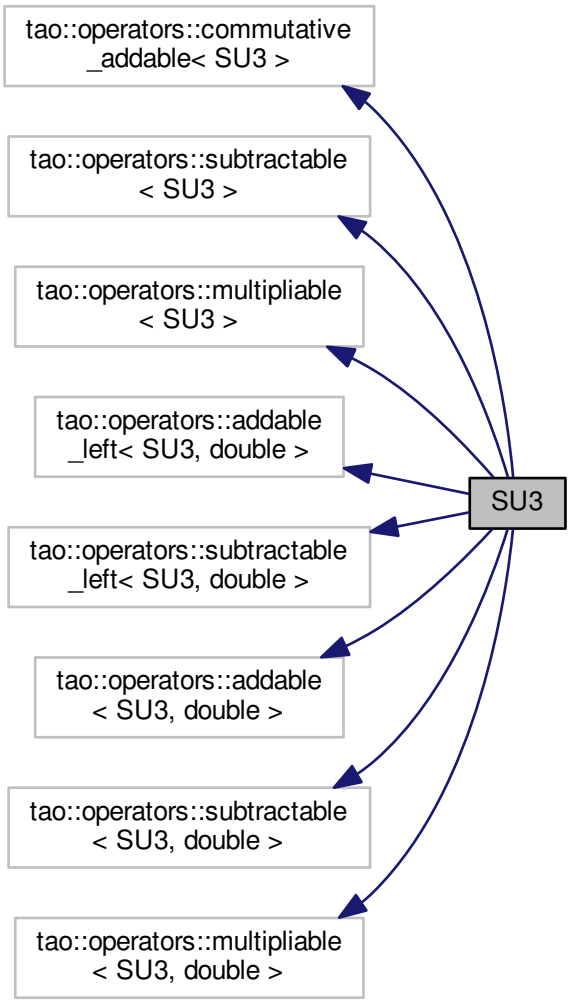
- static std::random_device **rd**
- static boost::random::mt19937 **randomGen**
- static boost::random::uniform_real_distribution< double > **randomUniformInterval**

The documentation for this class was generated from the following files:

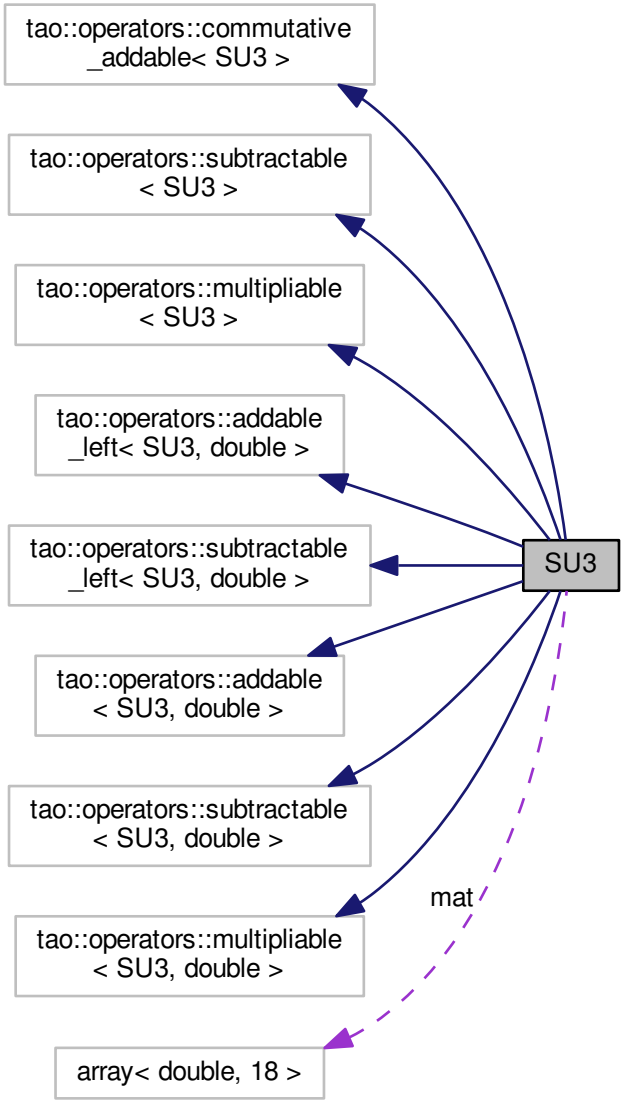
- random.h
- random.cpp

5.20 SU3 Struct Reference

Inheritance diagram for SU3:



Collaboration diagram for SU3:



Public Member Functions

- **SU3** (double value) noexcept
- **SU3** (const SU3 &source) noexcept
- **SU3** (SU3 &&source) noexcept
- SU3 & **operator=** (const SU3 &other) noexcept
- SU3 & **operator=** (SU3 &&other) noexcept
- SU3 & **operator+=** (const SU3 &other) noexcept
- SU3 & **operator+=** (SU3 &&other) noexcept
- SU3 & **operator-=** (const SU3 &other) noexcept
- SU3 & **operator-=** (SU3 &&other) noexcept

- SU3 & **operator*=** (const SU3 &other) noexcept
- SU3 & **operator*=** (SU3 &&other) noexcept
- SU3 & **operator+=** (const double scalar) noexcept
- SU3 & **operator-=** (const double scalar) noexcept
- SU3 & **operator*=** (const double scalar) noexcept
- void **setSU3Identity** ()
- void **setSU3Zero** ()
- void **setSU3Random** ()
- double **realTrace** ()
- double **imagTrace** ()
- SU3 **exp** ()
- void **printSU3** ()

Public Attributes

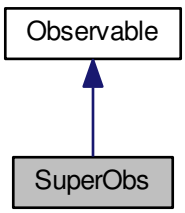
- std::array< double, 18 > **mat**

The documentation for this struct was generated from the following files:

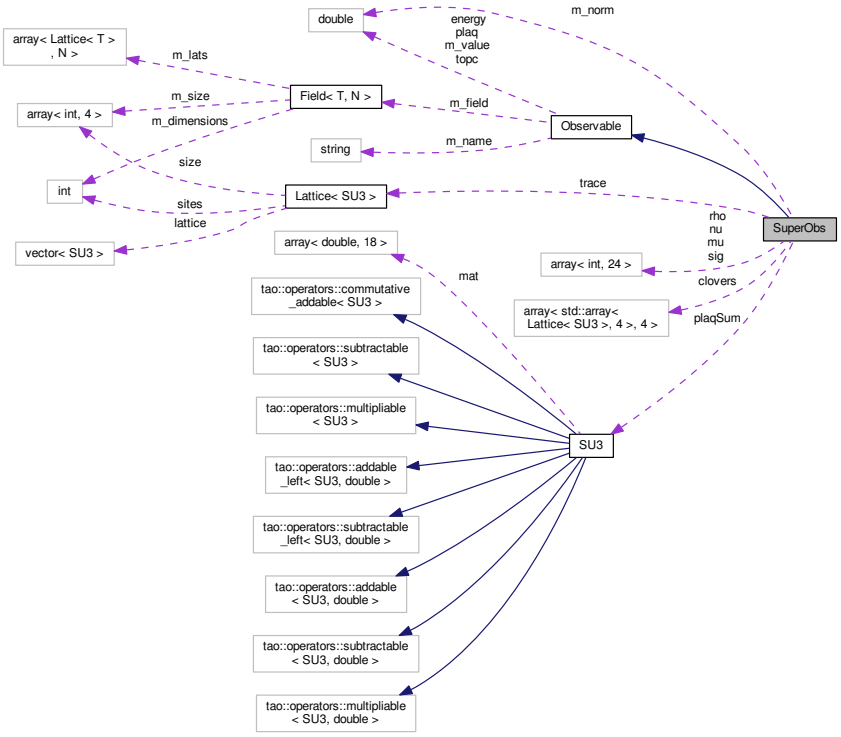
- su3.h
- su3.cpp

5.21 SuperObs Class Reference

Inheritance diagram for SuperObs:



Collaboration diagram for SuperObs:



Public Member Functions

- void **initObservable** (GluonField ∗field)
- void **compute** ()

Private Member Functions

- void **superGatherResults** ()

Private Attributes

- Lattice< SU3 > **trace**
- double **m_norm**
- std::array< std::array< Lattice< SU3 >, 4 >, 4 > **clovers**
- SU3 **plaqSum**
- std::array< int, 24 > **mu**
- std::array< int, 24 > **nu**
- std::array< int, 24 > **rho**
- std::array< int, 24 > **sig**

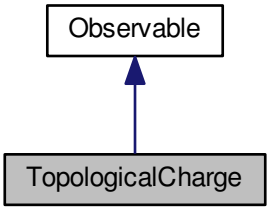
Additional Inherited Members

The documentation for this class was generated from the following files:

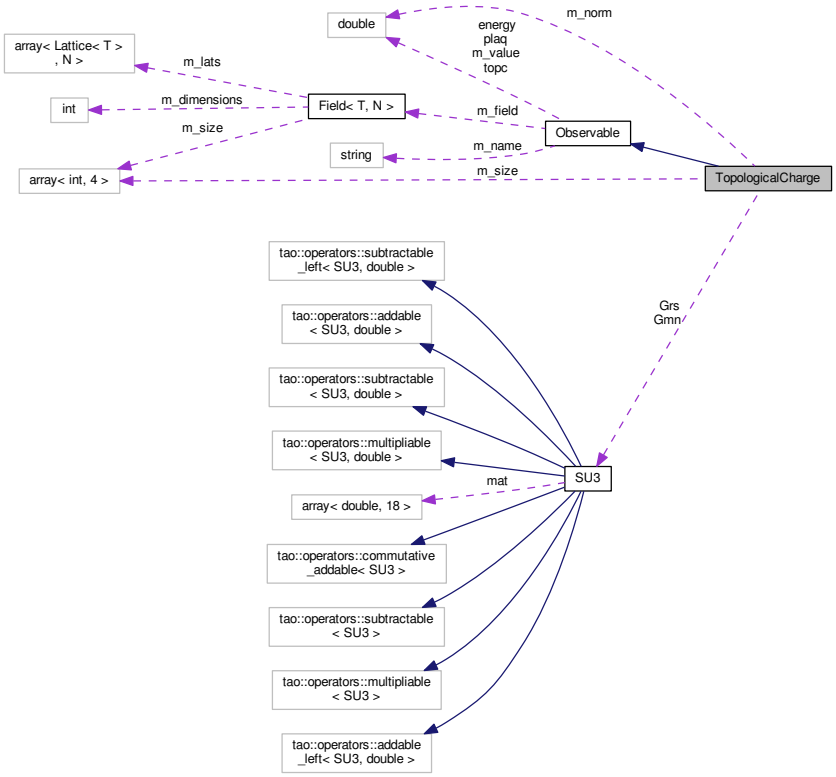
- superobs.h
- superobs.cpp

5.22 TopologicalCharge Class Reference

Inheritance diagram for TopologicalCharge:



Collaboration diagram for TopologicalCharge:



Public Member Functions

- void **initObservable** (Lattice *lattice)
- void **compute** ()

Private Attributes

- std::array< int, 4 > **m_size**
- double **m_norm**
- SU3 **Gmn**
- SU3 **Grs**

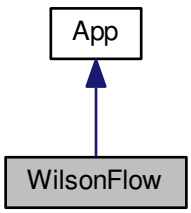
Additional Inherited Members

The documentation for this class was generated from the following files:

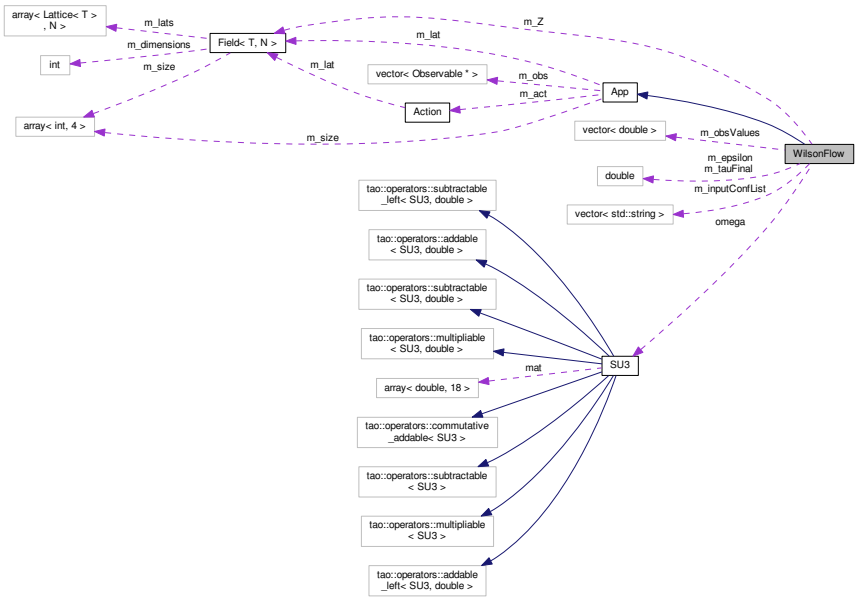
- topologicalcharge.h
- topologicalcharge.cpp

5.23 WilsonFlow Class Reference

Inheritance diagram for WilsonFlow:



Collaboration diagram for WilsonFlow:



Public Member Functions

- **WilsonFlow** (double tauFinal, double epsilon)
- void **flowConfigurations** ()
- void **setAction** (Action ∗action)
- void **addObservable** (Observable ∗observable)
- std::array< int, 4 > & **getSize** ()
- std::vector< double > & **getObsValues** ()
- std::vector< Observable ∗ > & **getObs** ()
- void **createLattice** (std::array< int, 4 > latticeSize)
- void **execute** ()
- void **initialize** ()

Private Member Functions

- void **computeObservables** ()
- void **flowStep** (double epsilon)
- void **applyWilsonFlow** (int confNum, double epsilon)

Private Attributes

- GluonField ∗ **m_Z** = nullptr
- std::vector< double > **m_obsValues**
- std::vector< std::string > **m_inputConfList**
- SU3 **omega**
- double **m_epsilon**
- double **m_tauFinal**

Additional Inherited Members

The documentation for this class was generated from the following files:

- wilsonflow.h
- wilsonflow.cpp

Chapter 6

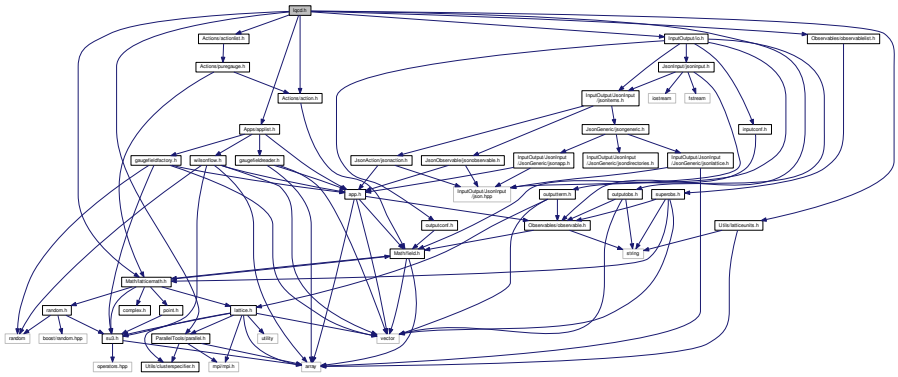
File Documentation

6.1 lqcd.h File Reference

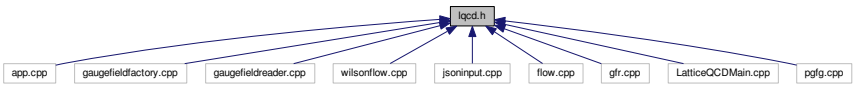
Main include file for all headers.

```
#include "Actions/action.h"
#include "Actions/actionlist.h"
#include "Apps/applist.h"
#include "InputOutput/io.h"
#include "Math/latticemath.h"
#include "Observables/observable.h"
#include "Observables/observablelist.h"
#include "ParallelTools/parallel.h"
#include "Utils/latticeunits.h"
```

Include dependency graph for lqcd.h:



This graph shows which files directly or indirectly include this file:



6.1.1 Detailed Description

Main include file for all headers.

This file provides a simple access to all of the classes defined in the project. Includes all actions, apps, observables as well as base objects.

Author

Giovanni Pederiva

Version

1.0

Date

2017-2018

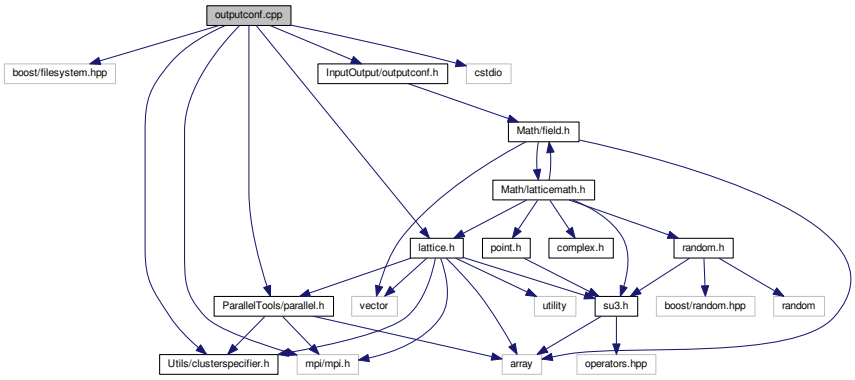
Copyright

MIT License.

6.2 outputconf.cpp File Reference

```
#include <boost/filesystem.hpp>
#include "Utils/clusterspecifier.h"
#include <mpi/mpi.h>
#include <cstdio>
#include "InputOutput/outputconf.h"
#include "Math/lattice.h"
#include "ParallelTools/parallel.h"
```

Include dependency graph for outputconf.cpp:



6.2.1 Detailed Description

Author

Giovanni Pederiva

Version

1.0

Date

2017-2018

Copyright

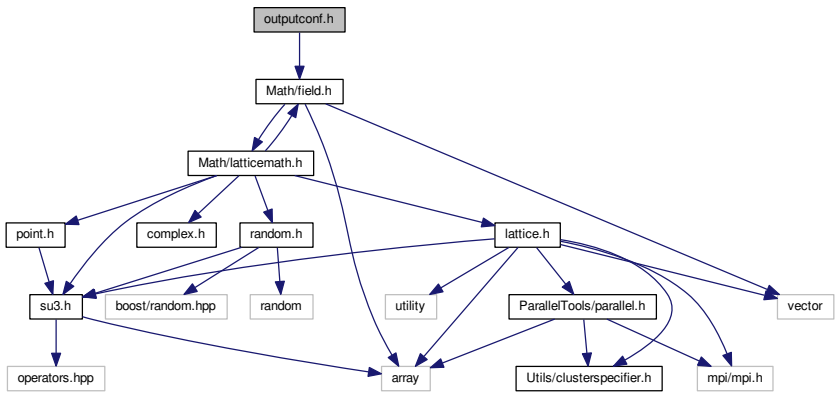
MIT License.

6.3 outputconf.h File Reference

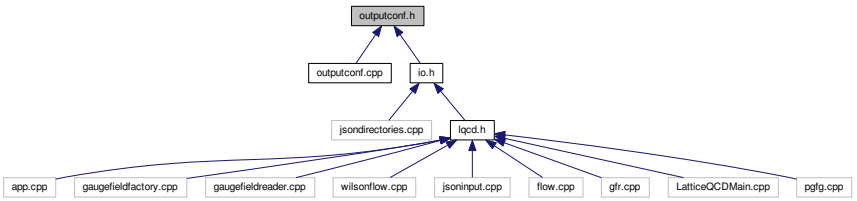
Contains classes for saving lattices to binary files.

```
#include "Math/field.h"
```

Include dependency graph for outputconf.h:



This graph shows which files directly or indirectly include this file:



Classes

- class LatticeIO::OutputConf

  Class for saving lattices to binary files.

6.3.1 Detailed Description

Contains classes for saving lattices to binary files.

Author

Giovanni Pederiva

Version

1.0

Date

2017-2018

Copyright

MIT License.

This file mainly serves the purpose of providing an interface for saving GluonField objects into binary format.

Index