Status of Ginnungagap ICs generator

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Outline

- What is ginnungagap
- New features:
  - Gas
  - Tool to view and fix the mask
- Caveats of increasing the resolution
- Potential applications

Ginnungagap

http://ginnungagapgroup.github.io/ginnungagap/

src/ginnungagap

- create velocity fields
- white noise fields

tools/realSpaceConstraints

- scale white noise

tools/generateICs

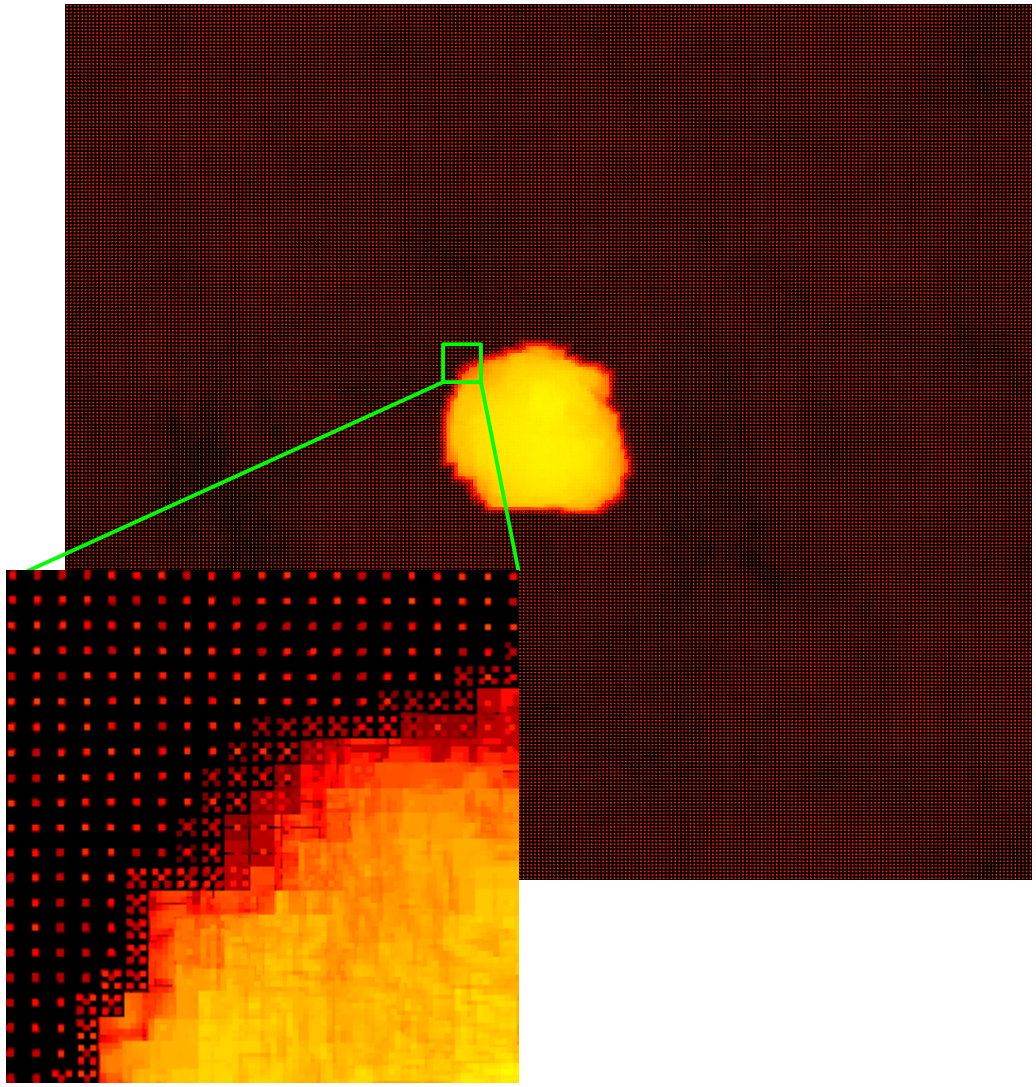
- convert to GADGET
- make zoom

tools/zoomTools

- create and analyze mask

Zoomed Initial Conditions

- The approach:
  - produce several levels, in steps of 2 in resolution
  - produce velocity fields
  - combine particles from different levels according to *mask*



Workflow

1) create base level simulation

```
> ginnungagap base128.ini # create vel and random WN
> generateICs base128.ini # transform vel to GADGET
```

2) run it, analyze snapshots, make mask

```
> GADGET2 base128.param # produce out/snapshot_000
> ahf ahf.input # make ahf_Z0.000.halos
> larewrite ahf_z0.000.halos out/snapshot_000 > lare.dat
> lareshow lare.dat 128
> larefix lare.dat 128
```

3) scale the white noise

```
> realSpaceConstraints scale256.ini
> realSpaceConstraints scale512.ini
> mpirun -n 12 realSpaceConstraints scale1024.ini
```

4) produce velocity fields

```
> ginnungagap zoom256.ini # create only vel from WN
> ginnungagap zoom512.ini # create only vel from WN
> mpirun -n 16 ginnungagap zoom1024.ini
```

5) produce GADGET files applying the mask

```
> generateICs zoom128.ini
> generateICs zoom256.ini
> generateICs zoom512.ini
> generateICs zoom1024.ini
```

.ini files

```
[Ginnungagap]
dim1D = 256
boxsizeInMpch = 100
zInit = 120.0
gridName = testGrid
normalisationMode = sigma8
doHistograms = true
histogramNumBins        = 131
histogramExtremeWN = 6.5
histogramExtremeDens = .7
histogramExtremeVel = 300.

[Output]
type = hdf5
path = ./
prefix = p01_32
overwriteFileIfExists = true
writerSection = OutputHDF5

[OutputHDF5]
suffix = .h5
doChunking = false

[WhiteNoise]
useFile = false
dumpWhiteNoise = true
rngSectionName = rng
readerSection = WhiteNoiseReader
writerSection = WhiteNoiseWriter
```

```
[WhiteNoiseWriter]
type = grafic
prefix = wn_32
isWhiteNoise = true
size = 32, 32, 32
iseed = 4422

[rng]
generator = 4
numStreamsTotal = 2
randomSeed = 4422

[WhiteNoiseReader]
type = grafic
prefix = BigMD_3840_wn
qualifier = _delta
isWhiteNoise = true


[MPI]
nProcs = 1 0  0


[Cosmology]
modelOmegaRad0 = 0.0
modelOmegaLambda0 = 0.692885
modelOmegaMatter0 = 0.307115
modelOmegaBaryon0 = 0.048206
modelHubble = 0.6777
modelSigma8 = 0.8288
modelNs = 0.9611
powerSpectrumFileName =
./Planck1_CAM.dat
```

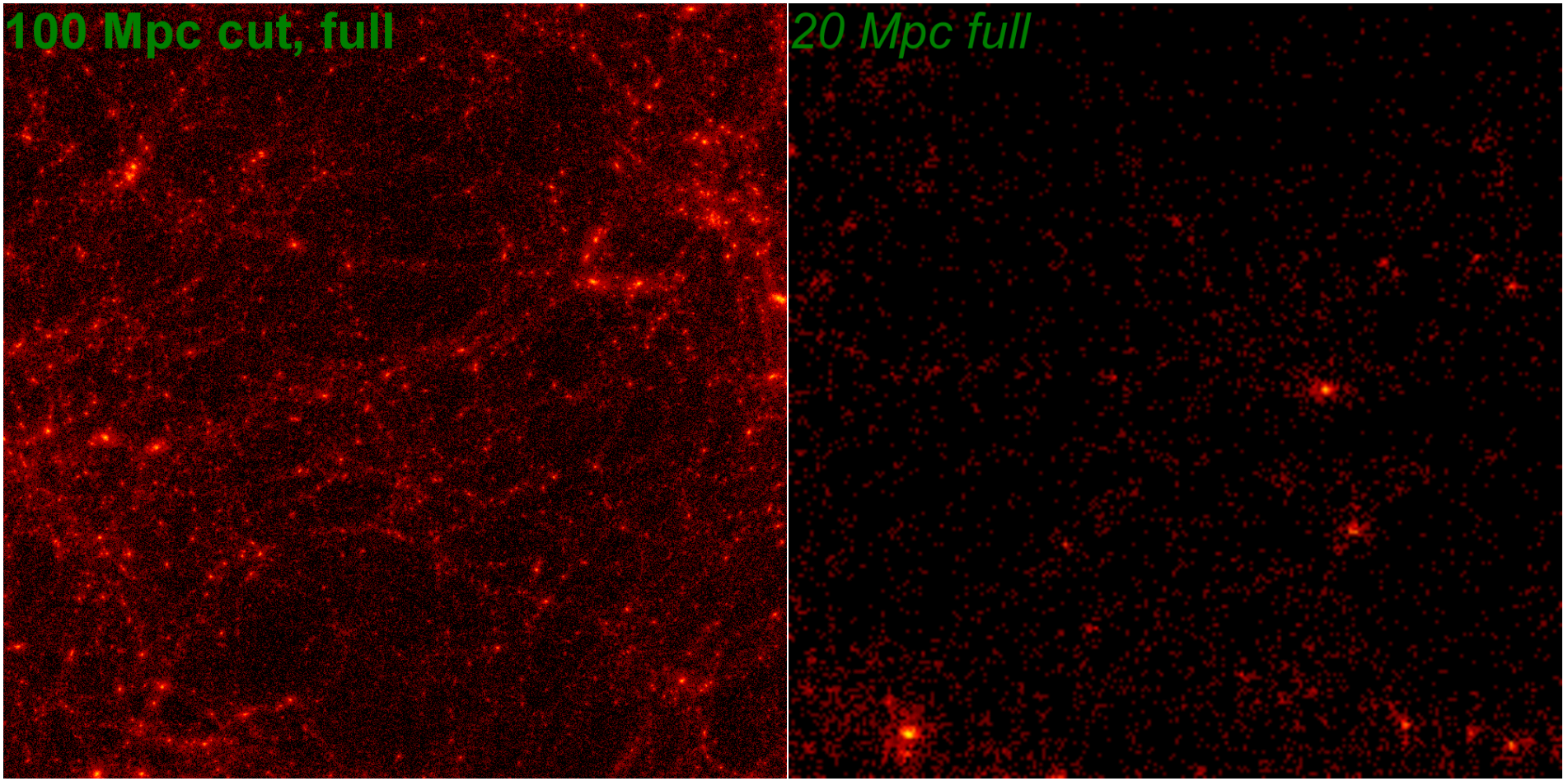
.ini files (continued)

```
[GenerateICs]
ginnungagapSection = Ginnungagap
doGas = false
doLongIDs = true
bufferSection = Buffer
inputSection = GenicsInput
outputSection = GenicsOutput
cosmologySection = Cosmology
maskSection = Mask
hierarchySection = Hierarchy
zoomLevel = 9
typeForLevel7 = 4
typeForLevel8 = 3
typeForLevel9 = 2
typeForLevel10 = 1

[Mask]
maskLevel = 7
minLevel = 7
maxLevel = 10
tileLevel = 1
readerType = legacy
readerSection = Lare

[Hierarchy]
numLevels = 11
minDim1D = 2
factor = 2

[Lare]
hasHeader = false
fileName = lare.dat
ngrid = 256 256 256
```

```
[GenicsInput]
velxSection = GenicsInput_velx
velySection = GenicsInput_vely
velzSection = GenicsInput_velz

[GenicsInput_velx]
type = hdf5
path = ./
prefix = ic_1024
qualifier = _velx
suffix = .h5

[GenicsInput_vely]
type = hdf5
path = ./
prefix = ic_1024
qualifier = _vely
suffix = .h5

[GenicsInput_velz]
type = hdf5
path = ./
prefix = ic_1024
qualifier = _velz
suffix = .h5

[GenicsOutput]
numFilesForLevel7 = 1
numFilesForLevel8 = 1
numFilesForLevel9 = 1
numFilesForLevel10 = 1
prefix = gzlv
```

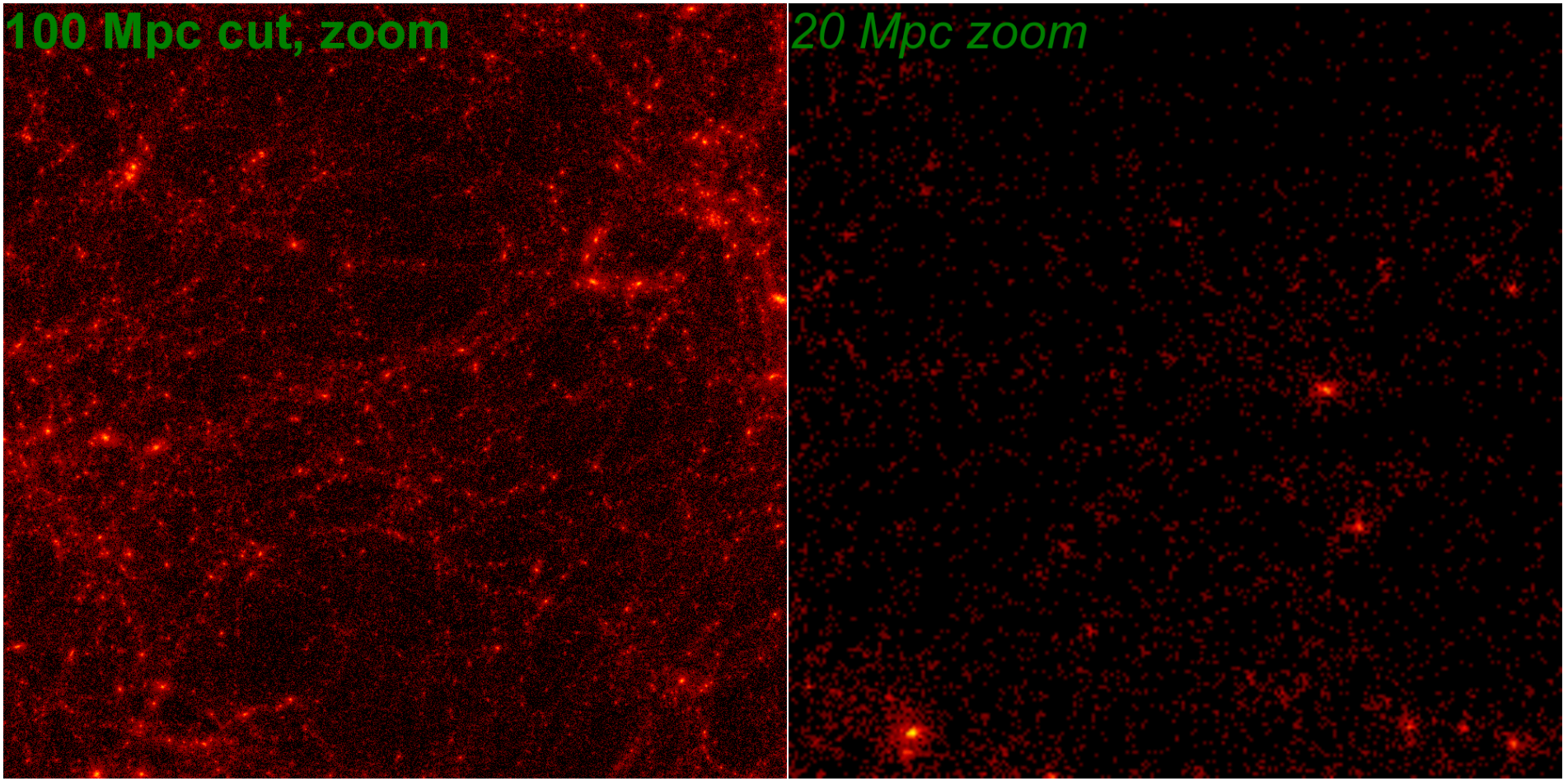
Results – 2 levels

Sphere of D=200 Mpc was zoomed



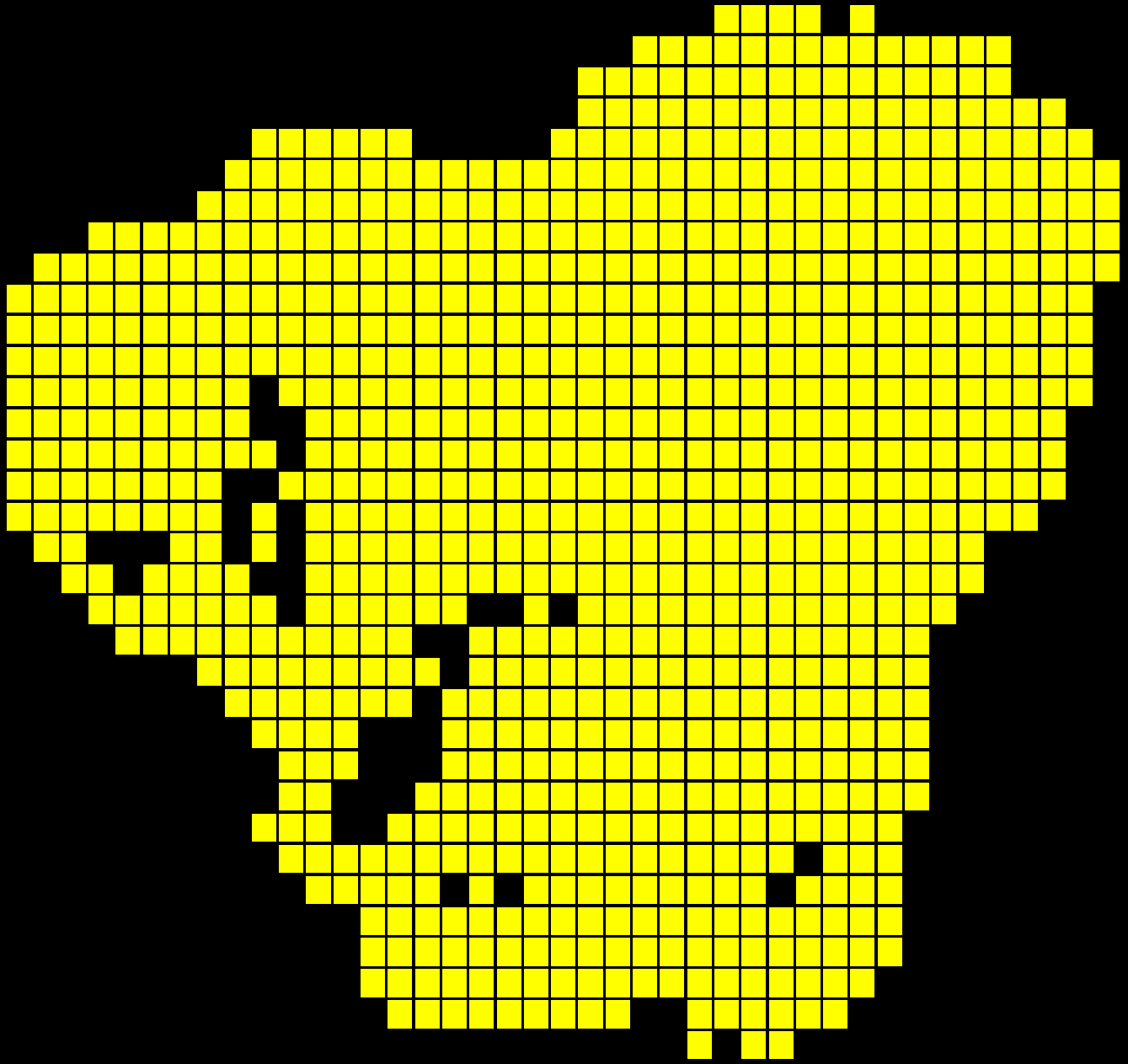
Results – 2 levels

Sphere of D=200 Mpc was zoomed

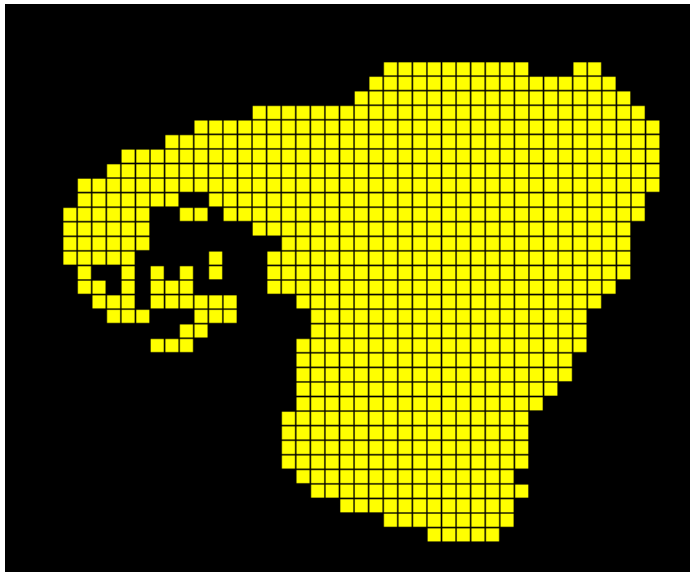


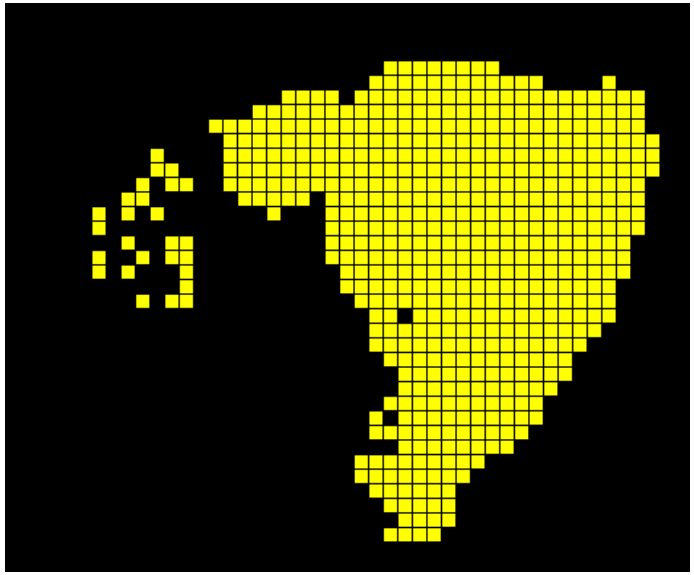
New features

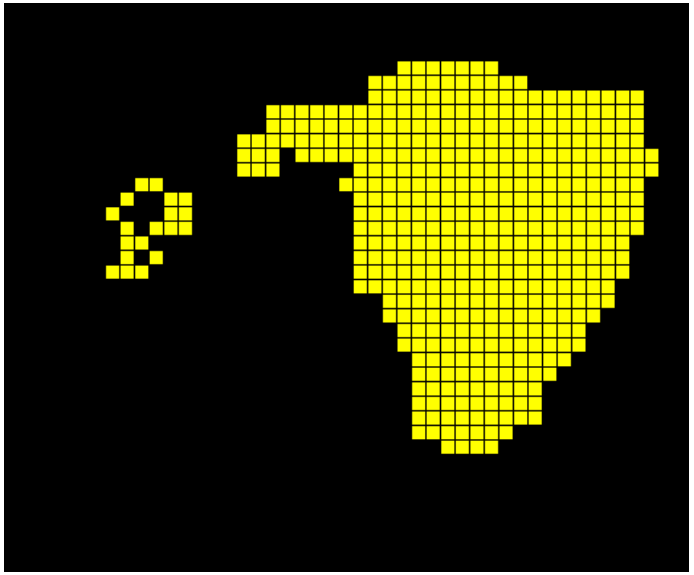
- Gas - produced from the highest resolution DM
- Tools to analyze the mask
- Minor changes: documentation, bug fixes, auto centering



Analyzing and fixing the mask



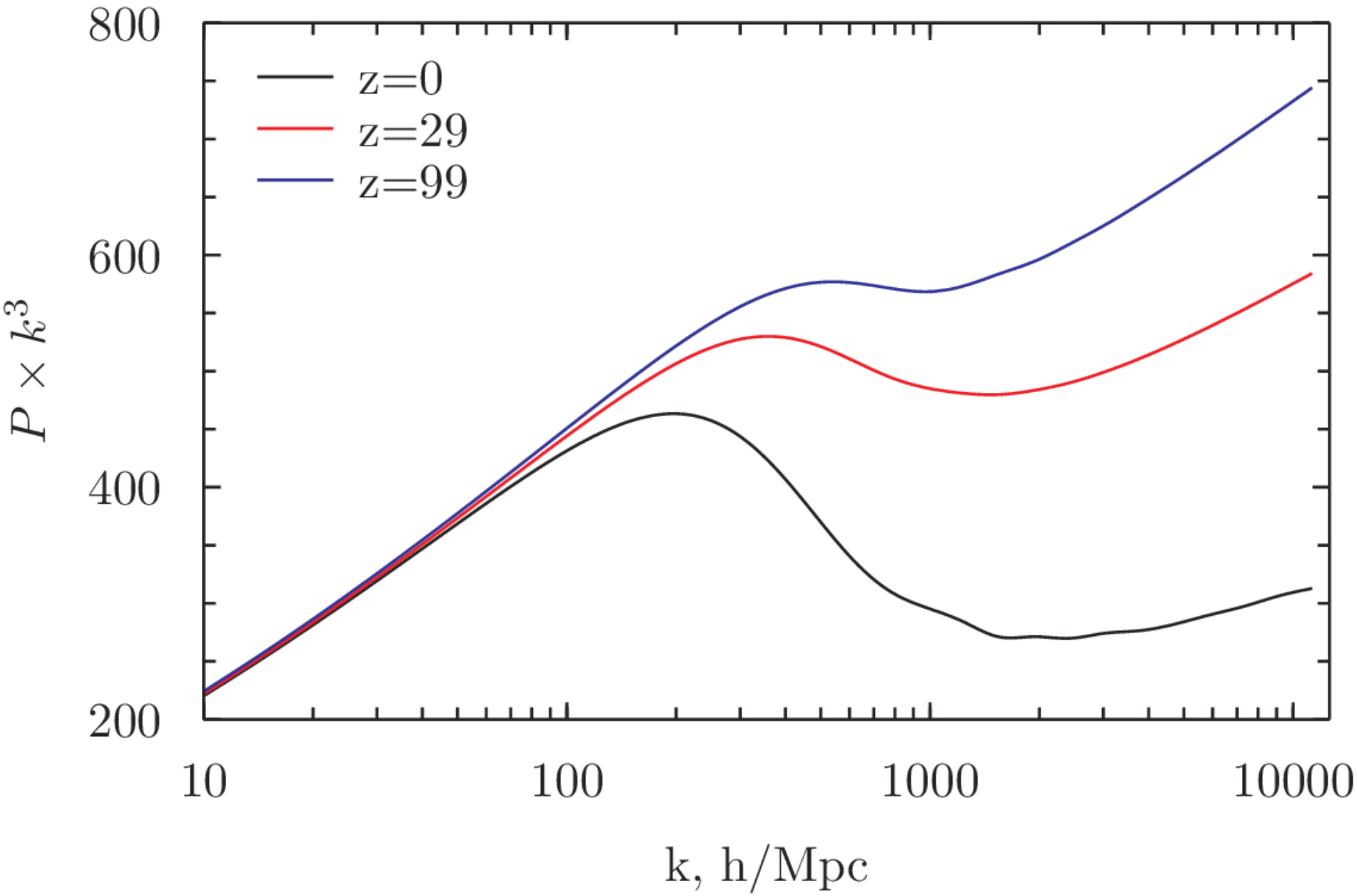




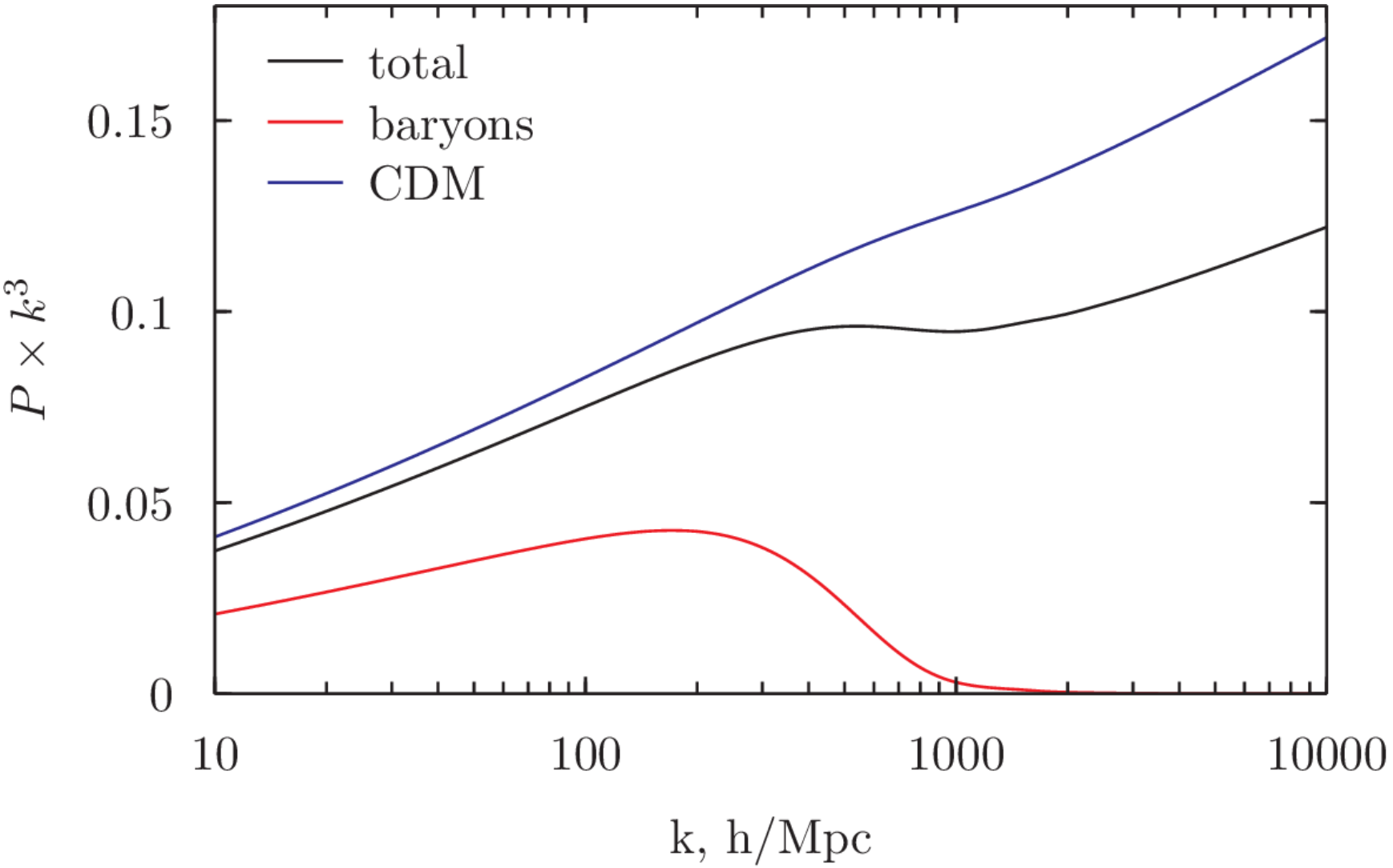
Projects

- LG: Box 64 Mpc/h, effective resolution 8192^3
  - SuperMUC, 8192 cores
- concentration run: 32 Mpc/h, resolution 4096^3
  - Lomonosov, 1024 cores

Power spectrum at k>200



P(k) at z=99


total
baryons
CDM
0.15
0.1
0.05
0
$P \times k^3$
10
100
1000
10000
k, h/Mpc