

# **Simulations Documentation**

## the AWESOME Project

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# Chapter 1

## Notes

11.03.2012 NGenIC\_15039 produces "unreadable" output, is being rerockstarred from scratch

```
+++
Plot_Star_Formation_History.pl:
+++
Useless use of private variable in void context at ../../perl//XMP/MetaData.pm line
HDF5-DIAG: Error detected in HDF5 (1.8.4-patch1) thread 0:
#000: ../../src/H5D.c line 507 in H5Dget_type(): not a dataset
    major: Invalid arguments to routine
    minor: Inappropriate type
Error Calling PDL::IO::HDF5::Dataset::get: Can't get HDF5 Dataset type.
at ../../perl//Galacticus/HDF5.pm line 88
HDF5-DIAG: Error detected in HDF5 (1.8.4-patch1) thread 0:
#000: ../../src/H5D.c line 507 in H5Dget_type(): not a dataset
    major: Invalid arguments to routine
    minor: Inappropriate type
Error Calling PDL::IO::HDF5::Dataset::get: Can't get HDF5 Dataset type.
at ../../perl//Galacticus/HDF5.pm line 88
Illegal division by zero at Plot_Star_Formation_History.pl line 58.
```

09.03.2012 strange error in 2 galacticus jobs `stages_12` and `stages_13` → Markus' converter outdated with new consistenttrees?

**idea:** `drd5_r256_2` shows a major merger in progress → make a set of similar simulations with slightly different parameters

**idea:** make voids as constraints so that netto gravity is more centered towards over-densities

08.03.2012 add nohup to `./rockstar server_ib.cfg` in `qsubrockstar.sh` and rename `rocky_startscript` to something recognizable

83973	0.60500	wcon1Gy.st	jan	r	11:01:23	astro14.astro-beowulf.	64
83974	0.50500	rocky_star	harre	r	13:14:22	astro-x4600-04.astro-beo	1
83976	0.55421	stages_28_	harre	r	13:52:36	astro22.astro-beowulf.	32
83977	0.55421	stages_29_	harre	r	13:56:35	astro25.astro-beowulf.	32
83980	0.55421	stages_30_	harre	r	14:07:12	astro28.astro-beowulf.	32
83984	0.55421	stages_31_	harre	r	14:14:23	astro31.astro-beowulf.	32
83988	0.51611	rocky_star	harre	r	14:49:20	astro-x4600-04.astro-beo	8
83989	0.51611	rocky_star	harre	r	14:50:54	astro-x4600-03.astro-beo	8
83993	0.51611	rocky_star	harre	r	15:12:52	astro-x4600-04.astro-beo	8

83995	0.51611	rocky_star	harre	r	15:16:43	astro-x4600-03.astro-beo	8
83992	0.58278	c803_test_	markus	qw	14:54:54		50
83985	0.55421	stages_32_	harre	qw	14:14:31		32
83986	0.55421	stages_33_	harre	qw	14:14:41		32

re-galacticussing NgenIC\_15039 again since plotting scripts complain that there is no output for a=0

2DO: test speedup of galacticus with 1,2,4,8 threads

**Rockstar** works if infiniband is forced with PARALLEL\_IO\_SERVER\_INTERFACE = "ib0", the client IP address is indeed NOT necessary, client process is started with auto-rockstar.cfg Gadget recompiled with newest openmpi version → should use infiniband now

06.03.2012 submitted 4 jobs with same seed but different constraints parameters

Memory agglomeration fix also on cluster + email to developer

Wrote E-Mails to Rien de Weijgaert and Peter Behroozi

re-rockstarring stages\_21 on my machine pc122 → dumped due to memory

02.03.2012 re-galacticussing NgenIC\_15039 cause 200 output redshifts lead to > 30GB file + added luminosity output redshifts from Markus' .xml file

Peter answered and sent consistent\_trees v0.99, but problem persists - suspicion: Snapshotnames.dat must be changed (delete corresponding lines) for runs that have < 200 outputs!

rockstar won't start any more ... network problem suspected

01.03.2012 wrote E-Mail to Peter concerning find\_parents\_and\_cleanup:

find\_parents\_and\_cleanup.c:130 problem

consistentree: NgenIC\_15039, galacticussing

restarted: stages\_21 rockstarred auf AMD-04

first 512<sup>3</sup> simulation NgenIC\_7755 finished successfully - lasted 1 day on 64 cores

wrote E-mail to de Weijgaert concerning constrained ICs

29.02.2012 stages\_12 re-rockstarred auf AMD-03

stages\_21 rockstarred auf AMD-04 - crashed

100Mpc 512<sup>3</sup> jobs: 11410, 15725, 27036, 7755

10 100Mpc ICs generated

**Note: try bigger volumes with NGen-IC**

added output redshifts derived from gadget\_timer.txt as parameter outputRedshifts in .xml file

Random seeds that do not create cluster like structures at 32Mpc box: 589, 12170, 13610, 16604, 16749, 17362, 17433, 29666, 32223, 17595, 22045, 3724, 3183, 4152, 7581, 8502, 10153, 10657, 22946, 14841, 25060, 29468, 32634

Random seeds that look a little interesting: 15039 → rockstarred on AMD-03 (finished), 26214 → rockstarred on AMD-04

28.02.2012 Successfully started some N-GenIC jobs for comparison of IC generation

17.02.2012 Discussion with Asmus about Stages Cluster → try more systematic approach to ICs

15.02.2012 Galacticus revision 708 - drd5\_r256\_2 not fixed → E-Mail to Andrew  
 check tomorrow: Galacticus jobs fuenfincr256\_1 and drdx\_3\_r256  
**Note: think about / find a good method for common metadata**

14.02.2012 Wrote E-Mail to Bertschinger.

13.02.2012 Deleted some jobs I started yesterday because they had artificial crosses or were practically unconstrained  
 Third simulation fuenfincr256\_1 ran through - Galacticus restart worked well!  
**Note: IC with same seed but higher resolution do not yield the same simulation!** → started two more test runs from r128 sims to doublecheck

12.02.2012 Updated Galacticus to revision 707 as suggested by Andrew and added parameter `hotHaloOutflowAngularMomentumAlwaysGrows` to xml file.  
 Two of four simulations ran through (copied hdf5 to transfer), two crashed → try to continue at saved states!

10.02.2012 wrote E-Mail to Andrew about performance problems and wavelenght computation error in fuenfincr256\_1  
 started some runs with higher central delta and broader smoothing lenghts, i.e. 32/dx and 100/dx; all 128 resolution except second last one (same seed!):

83492	0.60500	d31c_1_st	harre	r	02/10/2012	15:19:56	astro18	16
83493	0.60500	d31c_2_st	harre	r	02/10/2012	15:20:37	astro29	16
83494	0.60500	d31c_3_st	harre	r	02/10/2012	15:21:17	astro25	16
83495	0.60500	d51c_s100	harre	r	02/10/2012	15:23:21	astro31	16
83496	0.54786	d3+3c_s150	harre	r	02/10/2012	15:37:13	astro12	16
83497	0.60500	d3+3c_s150	harre	r	02/10/2012	15:39:16	astro30	32
83498	0.60500	d15+3c_s15	harre	r	02/10/2012	15:44:23	astro30	16

09.02.2012 drd5\_r256 last written to hdf5 file feb 09, 05:07  
 fuenfincr256\_2 last written to hdf5 file feb 06, 03:28  
 drd5\_r256\_2 last written to hdf5 file feb 07, 00:50

02.02.2012 drdx\_h100\_128\_1 run has again severe consistency metric problem  
 → not clear why  
 upper python script does not work, was commented out again  
 plan: **move to python scripts in general in order to have easier arithmetic calculations**  
 plan: create new folder structure and remove old simulations → done

31.01.2012 note: h=70.3 in galacticus xml input file is expected, consistent tree obviously implies it  
 → fixed: changed in markus parameter file for the converter and in xml file  
 → question: why not read out?  
 → python updateGalacticusStart.py from Markus

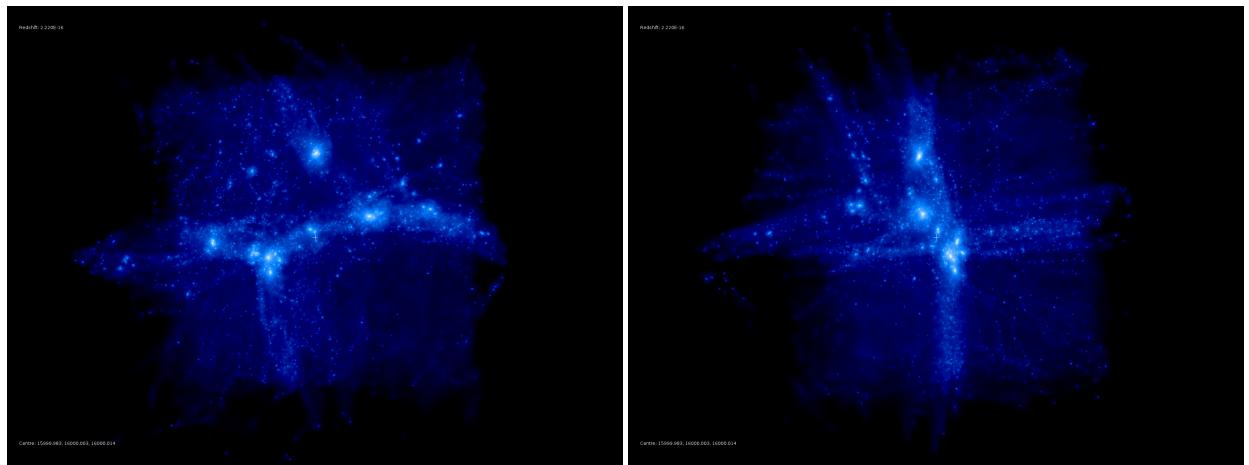
30.01.2012 new consistenttree with vmax=20

# Chapter 2

## Simulations

### 2.1 r128

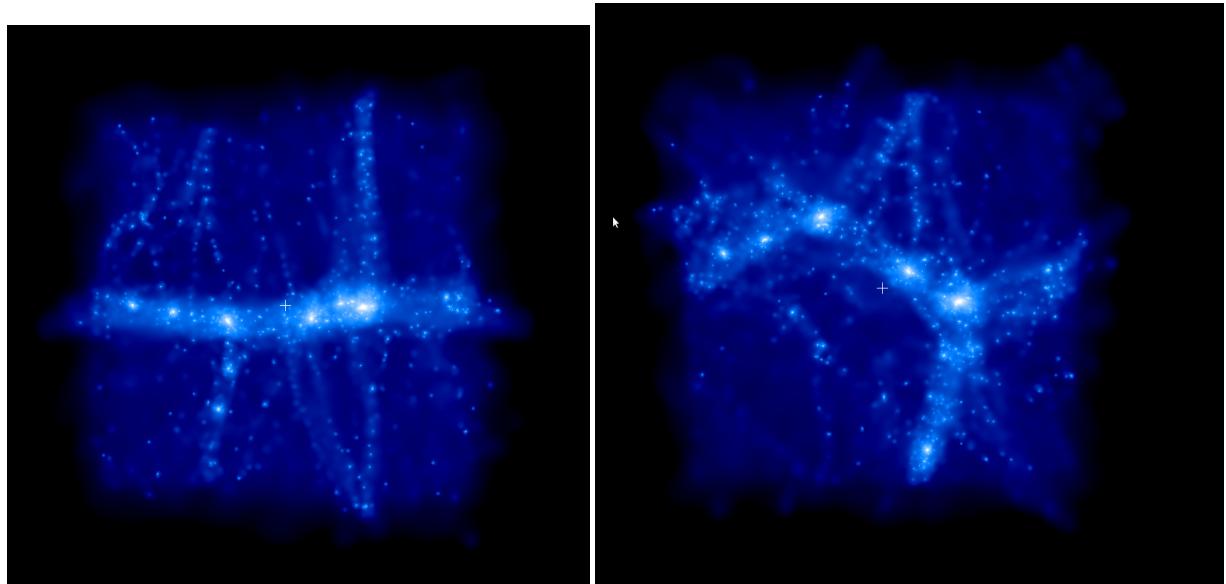
#### 2.1.1 drdx\_3



ROCKSTARRED ✓

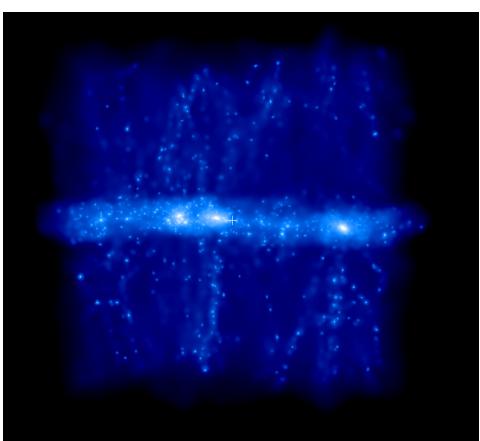
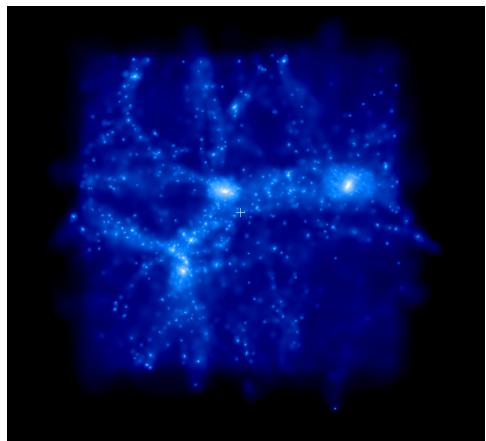
pfff → Error: too few halos at scale factor 0.926072 to calculate consistency metric.

### 2.1.2 drdx\_h100\_r128\_1



ROCKSTARRED ✓  
consistenttree: too few halos at scale factor 0.896 ... → wtf?

### 2.1.3 drdx\_h100\_r128\_2



is being rock-

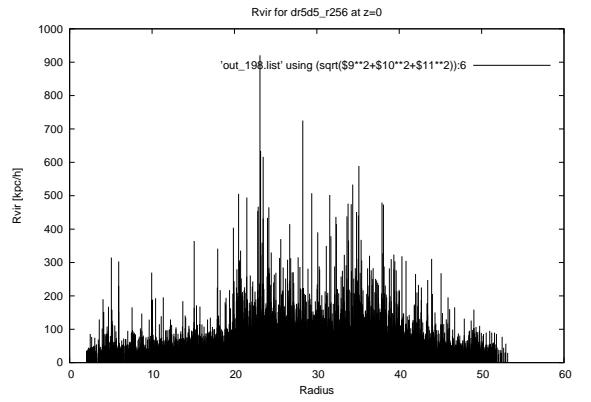
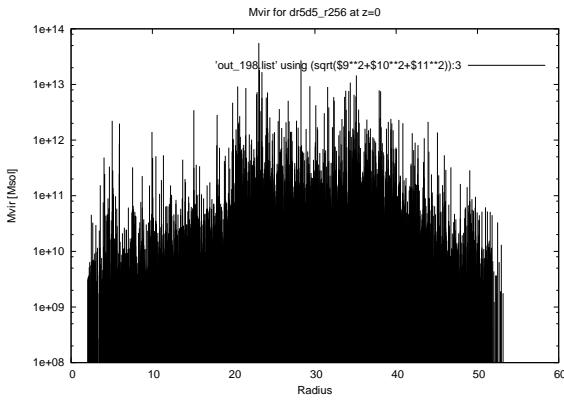
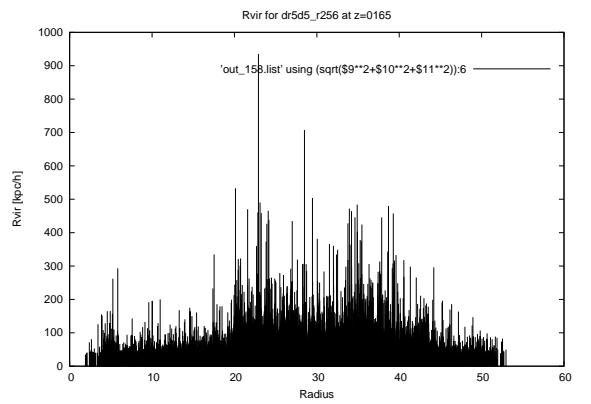
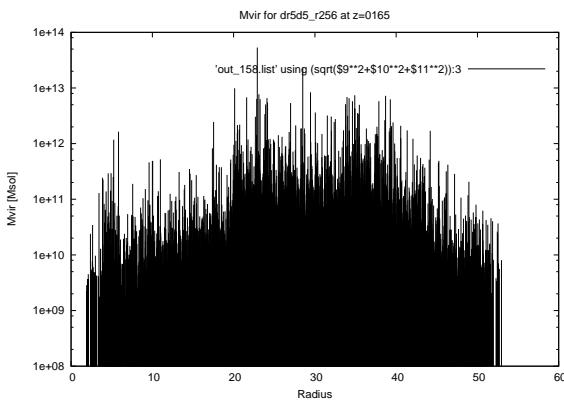
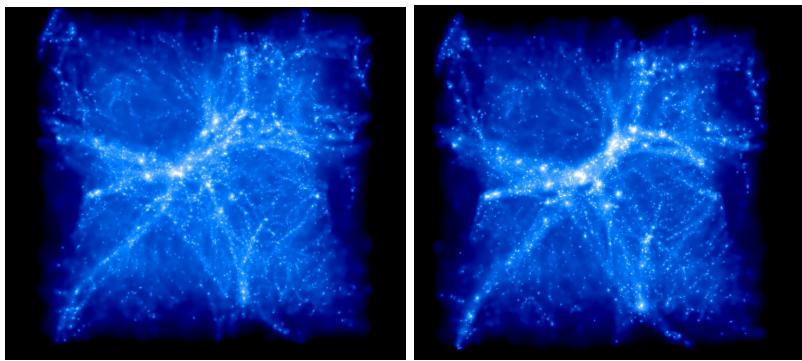
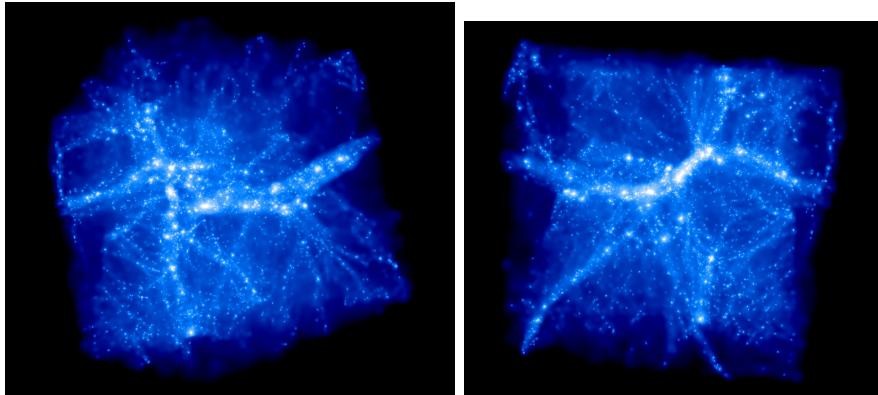
starred

### 2.1.4 drkltest+3c+sl50\_1

Error: too few halos at scale factor 0.890265 to calculate consistency metric.  
Please remove this and all earlier timesteps from the scale file and rerun.  
(DescScales.txt)

## 2.2 r256

### 2.2.1 dr5d5\_r256

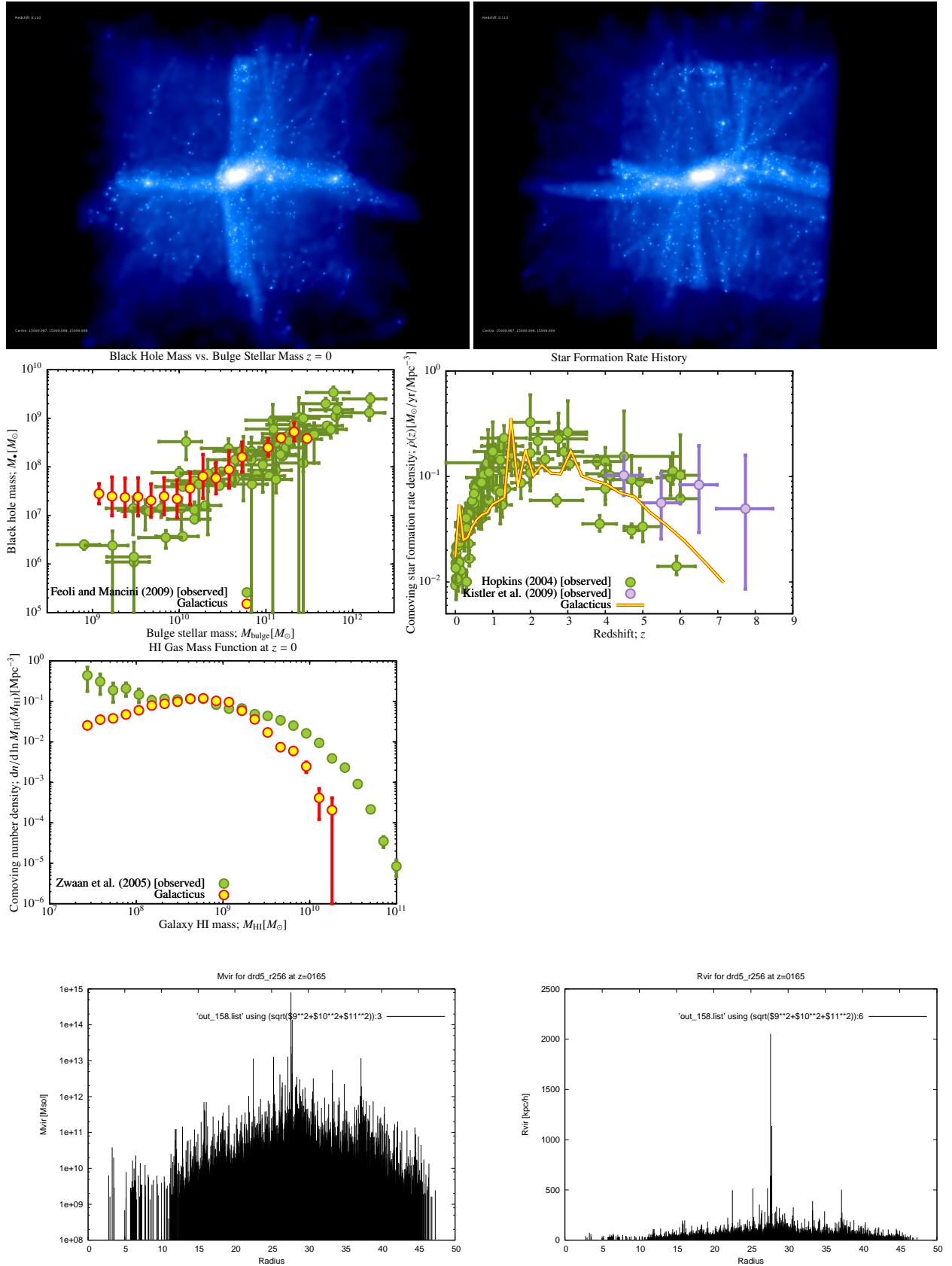


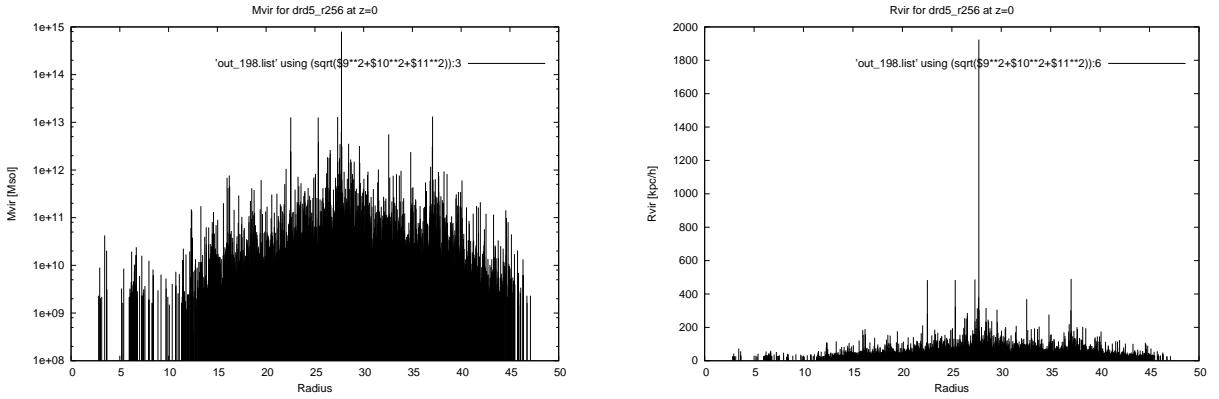
is being galacticussed  
CONSISTENTTREED ✓  
ROCKSTARRED ✓  
→ re-rockstar on AMD ...-03

```
find_parents_and_cleanup.c:130:  
lookup_new_id: Assertion 'new_id' failed.
```

is being consistentreed

### 2.2.2 drd5\_r256 ( $\sim$ )





GALACTICUSSED ✓

galacticus running on SGE

→ re-converted with bugfixed converter

tree copied to markus transfer

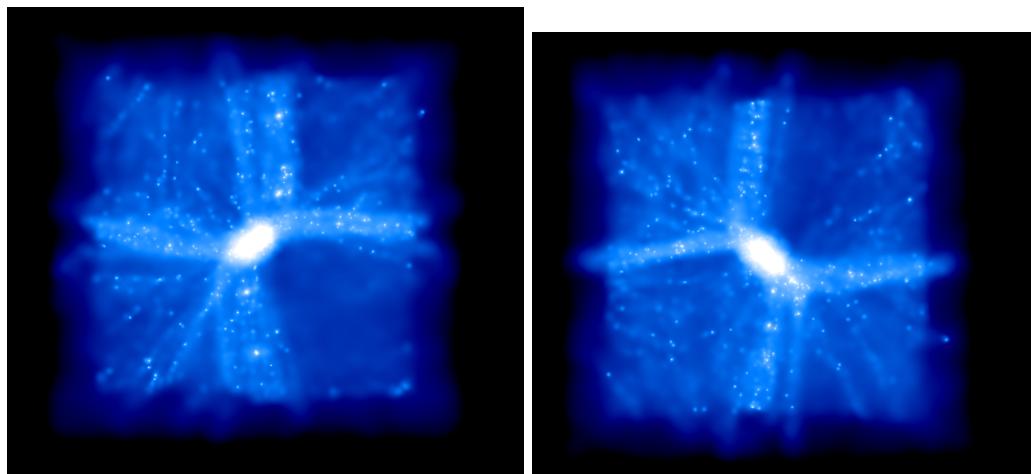
GALACTICUS:

```
Fatal error in Build_Descendent\_Pointers():
failed to find descendant node: 5546454 of 5522259
galacticus.sh: line 67: 25689 Aborted
```

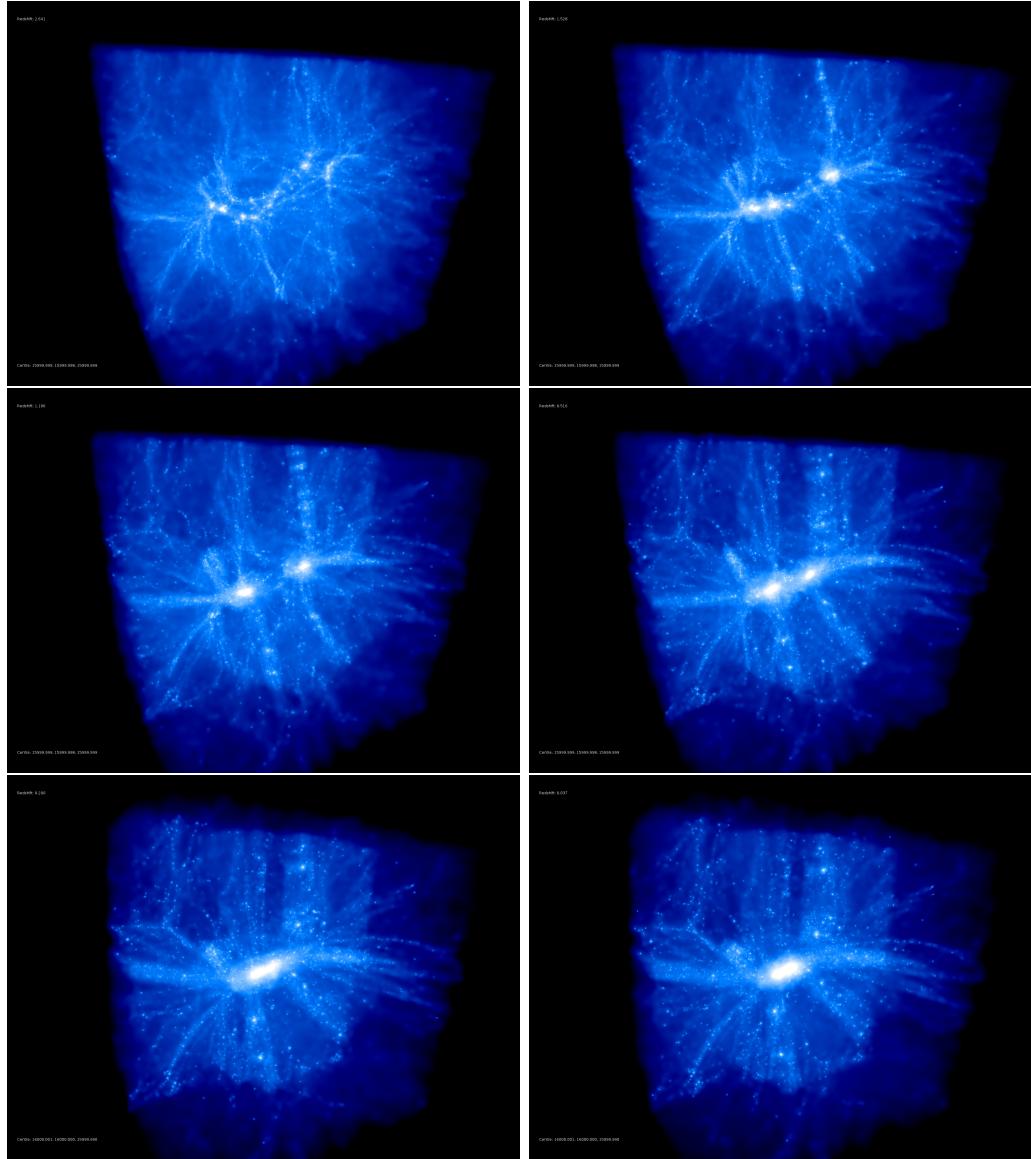
CONSISTENTTREEED ✓

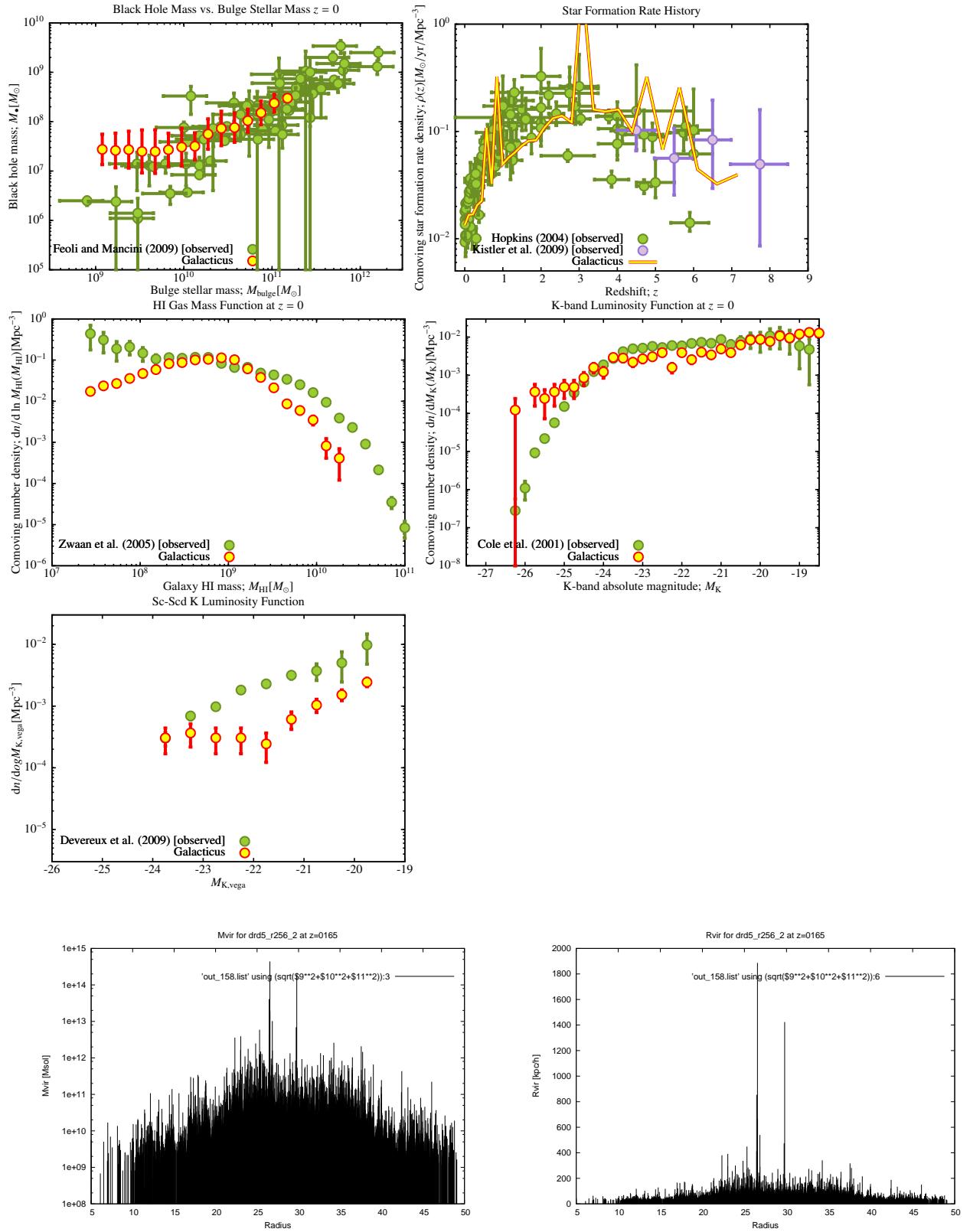
ROCKSTARRED ✓

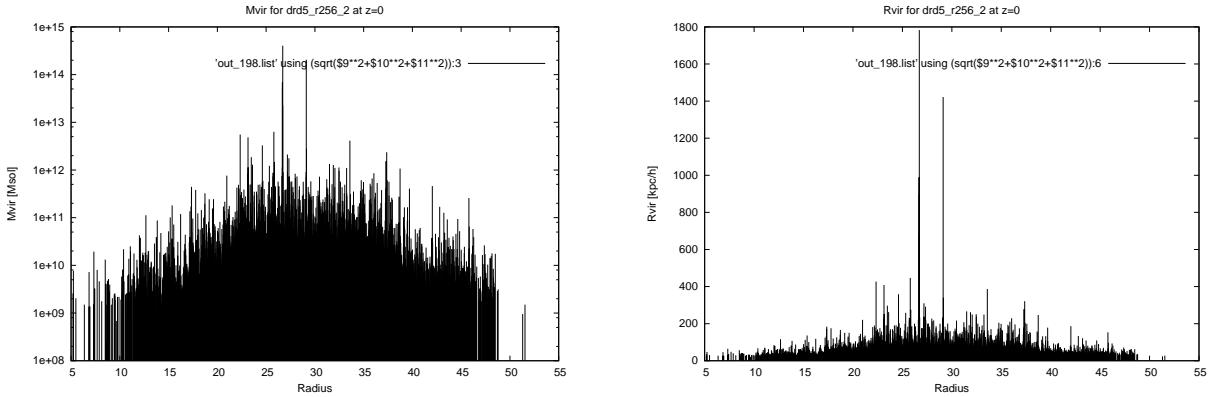
### 2.2.3 drd5\_r256\_2 (+ major merger in progress)



**Evolution:**







GALACTICUSSED ✓

→ fixed in revision 709

→ not fixed! E-Mail to Andrew

After fix in rev. 708 → is being re-galacticussed

→ DUMP IT ?

→ gadgetviewer: simulation has "artificial" cross galacticus running on SGE

→ re-converted with bugfixed converter (v0.3)

is being galacticussed → job seems to run!

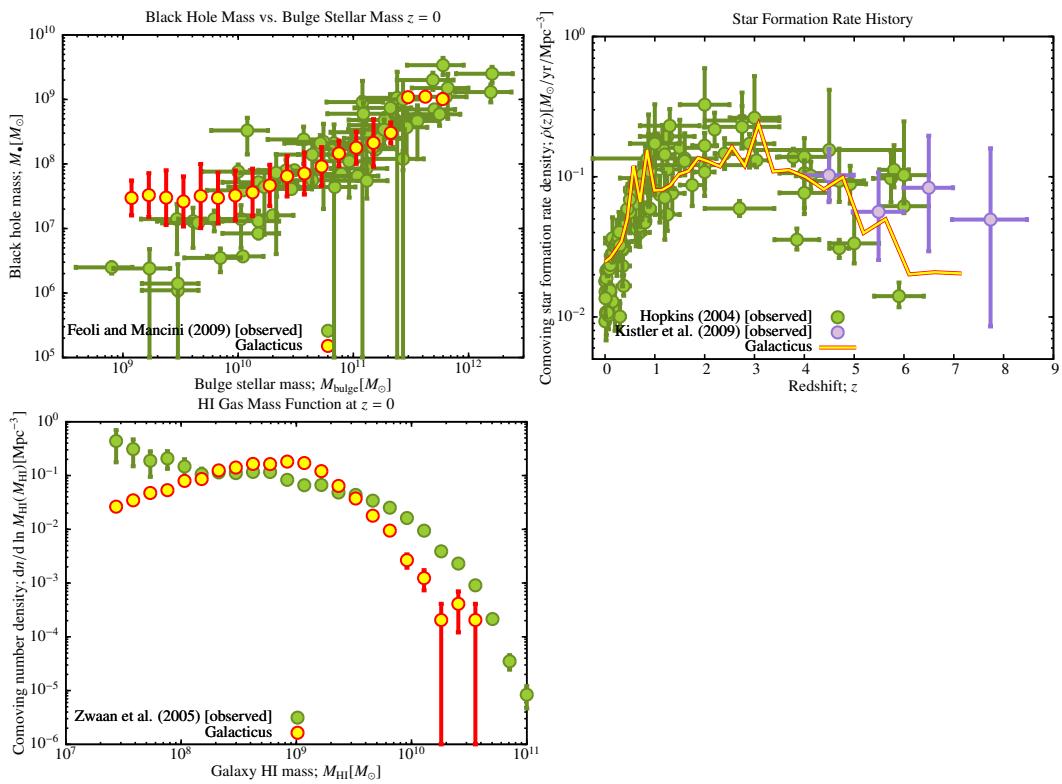
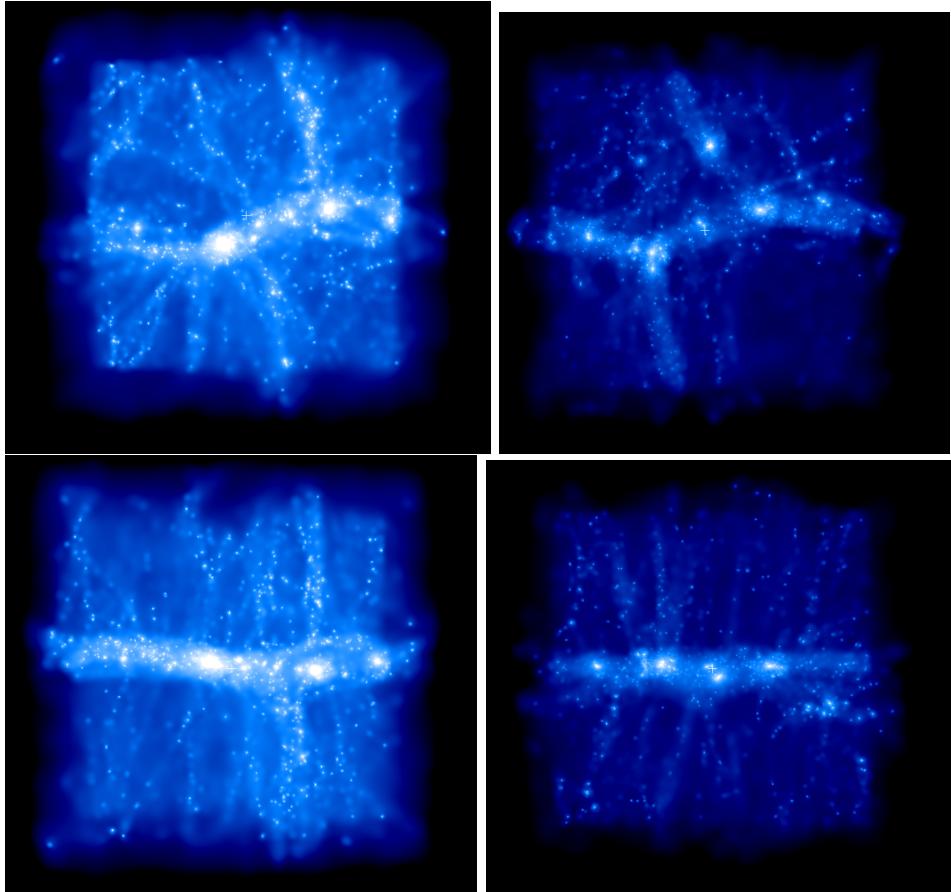
no: A fatal error occurred! Backtrace for this error:

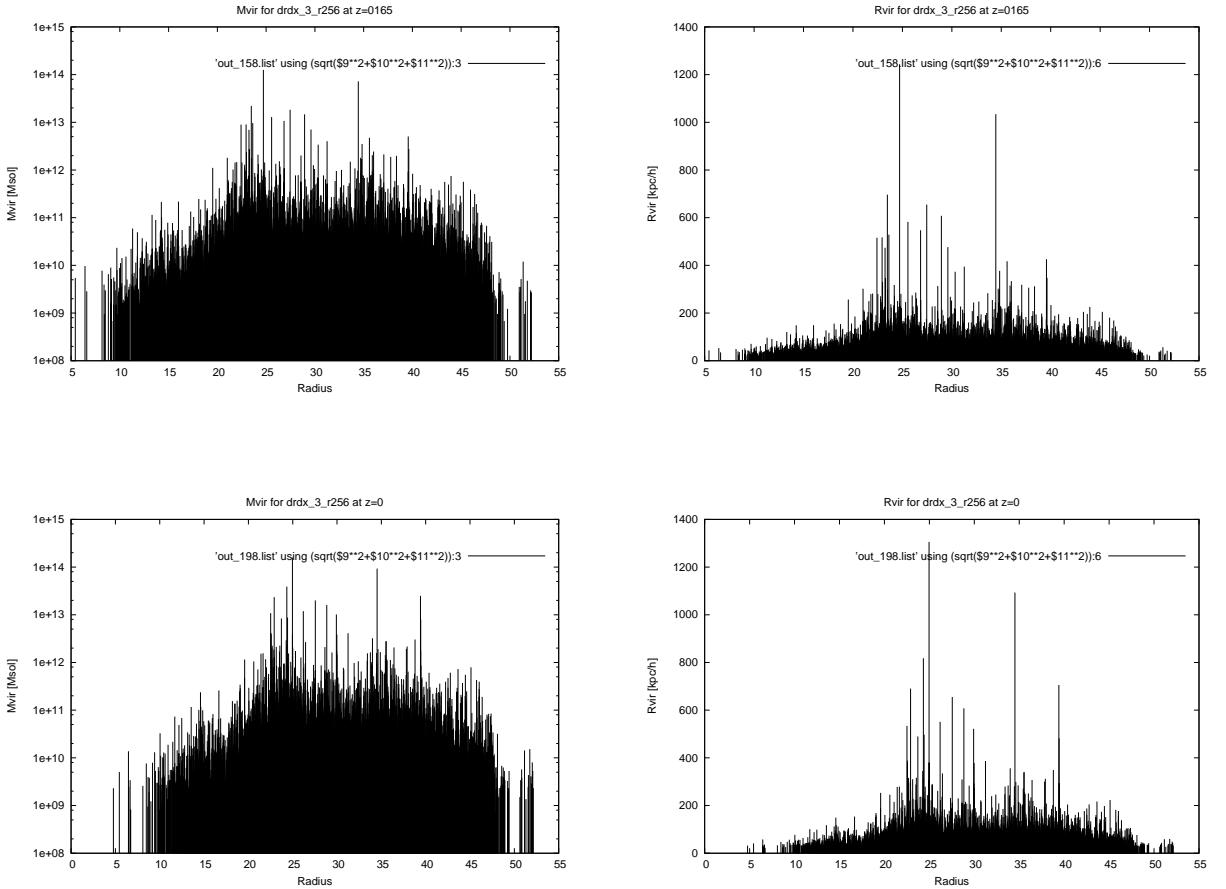
```
#0 0x2B3F2E65E897
#1 0x2B3F2E65EE4E
#2 0x301763648F
#3 0x487AA0 in __merger_tree_read_MOD_build_descendent_pointers
#4 0x48ADC3 in __merger_tree_read_MOD_merger_tree_read_do
#5 0x48205E in __merger_tree_construction_MOD_merger_tree_create
#6 0x46F469 in __galacticus_tasks_evolv
tree_MOD_galacticus_task_evolv
tree._omp_fn.0.F90:0
#7 0x46F9C4 in __galacticus_tasks_evolv
tree_MOD_galacticus_task_evolv
tree
#8 0x46FA4F in __galacticus_tasks_MOD_galacticus_task_d
o
#9 0x4600E4 in MAIN__ at Galacticus.F90:0
```

CONSISTENTTREEED ✓

ROCKSTARRED ✓ (lasted about 9000minutes)

### 2.2.4 drdx\_3\_r256





GALACTICUSSED ✓  
→ fixed in revision 709

GALACTICUS REV708:

```
#4 0x301763648F
#5 0x49B1B8 in __merger_tree_read_MOD_build_descendent_pointers at merger_trees.construct.read
#6 0x49FF70 in __merger_tree_read_MOD_merger_tree_read_do at merger_trees.construct.read
#7 0x4923BE in __merger_tree_construction_MOD_merger_tree_create at merger_trees.construc...
#8 0x4800C6 in __galacticus_tasks_evolve_tree_MOD_galacticus_task_evolve_tree._omp_fn.0
#9 0x2AC099B4F829
#10 0x3017A07CD0
#11 0x30176DFD3C
#12 0xFFFFFFFFFFFFFF
/sge-root/sge/AMD64/spool/astro13/job_scripts/83594: line 22: 13318 Aborted
```

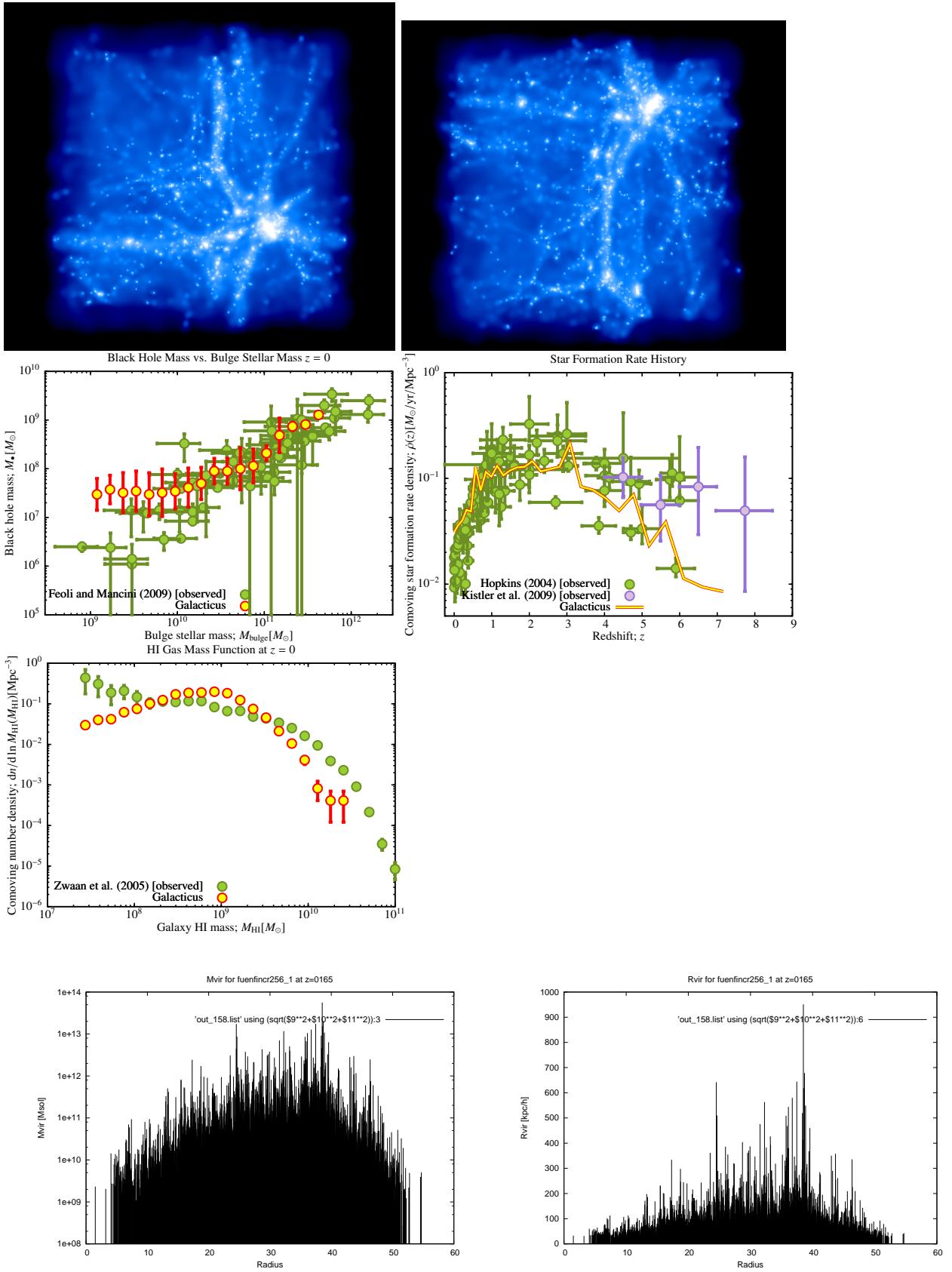
CONSISTENTTREED ✓

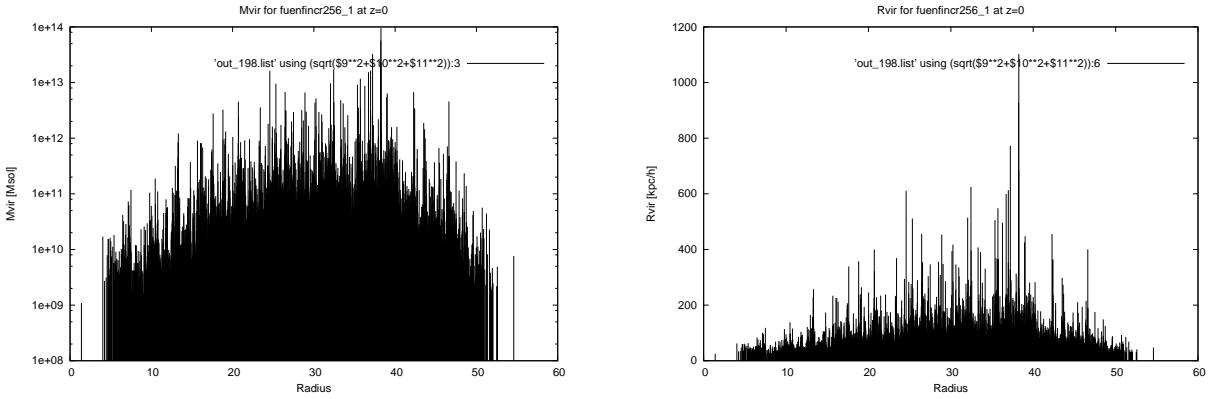
ROCKSTARRED ✓

is being rockstarred on `astro-x4600-03`

This run is a test if r256 and r128 (`drdx_3`) are comparable → see pictures.

### 2.2.5 fuenfincr256\_1





GALACTICUSSED ✓

→ re-galacticussing with rev708

GALACTICUS: rev707 exited without error but not finished

GALACTICUSSED ✓ BUT:

```
[3:46:48 PM CEST] Markus Haider: der fuenfincr256_1 hat a problem
[3:46:52 PM CEST] Markus Haider: der hat keine output gruppe
[3:46:58 PM CEST] Markus Haider: also keinen output
[3:47:30 PM CEST] Markus Haider: btw schon einen output
[3:47:34 PM CEST] Markus Haider: aber es scheint was zu fehlen
```

→ E-Mail to Andrew

→ re-converted with bugfixed converter

Running model.....

Reading data for metallicity  $\log_{10}(Z/Z_{\text{Solar}}) = 0.198$ 

Found 188 ages in the file

Found 1963 wavelengths in the file

```
gsl: ../../roots/brent.c:57: ERROR: function value is not finite
Default GSL error handler invoked.
```

tree copied to markus transfer

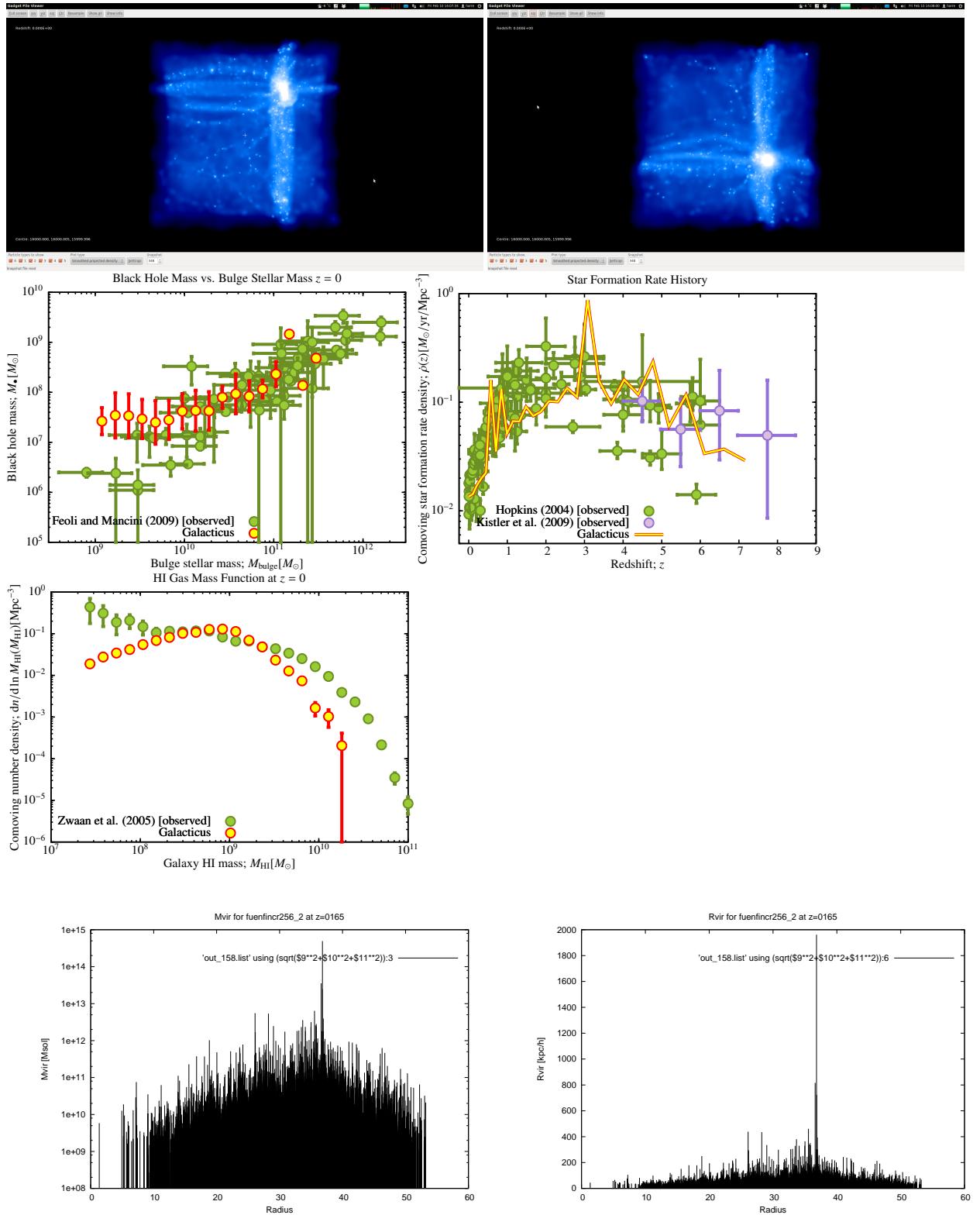
GALACTICUS:

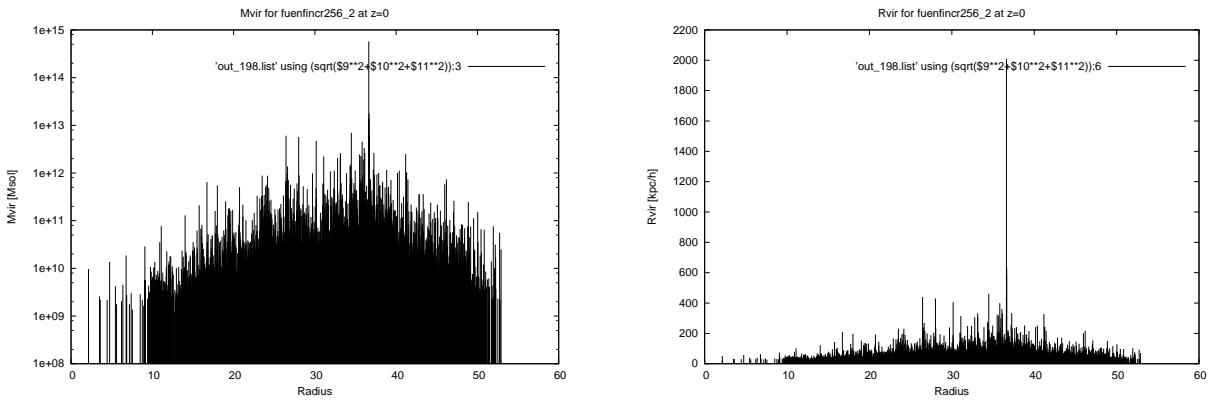
```
Fatal error in Build_Descendent_Pointers():
failed to find descendent node: 12048576 of 12014628
galacticus.sh: line 67: 5751 Aborted
```

ROCKSTARRED ✓

CONSISTENTTREEDE ✓

### 2.2.6 fuenfincr256\_2 → dump!





GALACTICUSSED ✓ → gadgetviewer: simulation has "artificial" cross on right upper corner  
 → DUMP IT ?

→ re-converted with bugfixed converter (v0.3)

galacticus running on SGE

is being galacticussed → job seems to run!

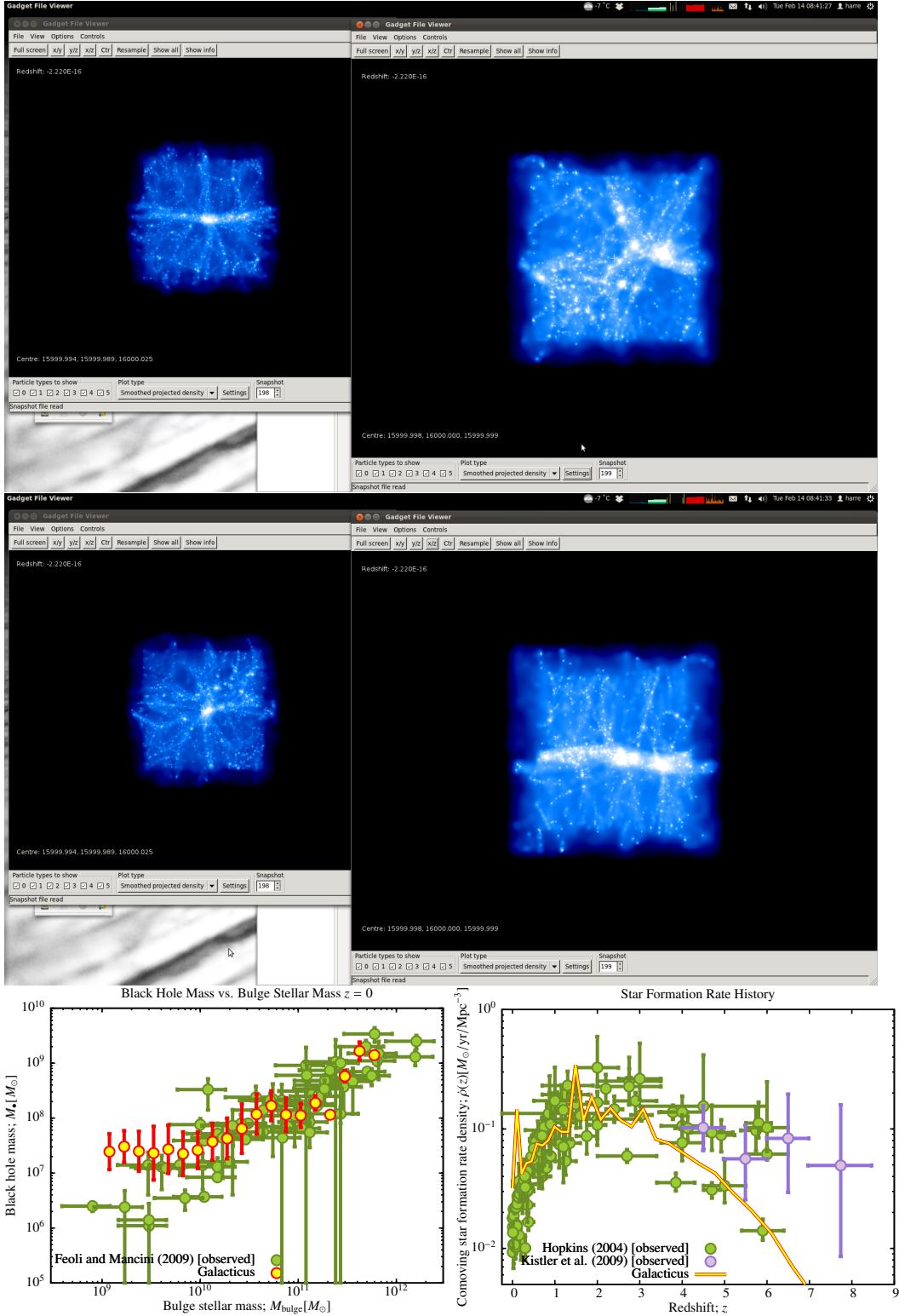
GALACTICUS:

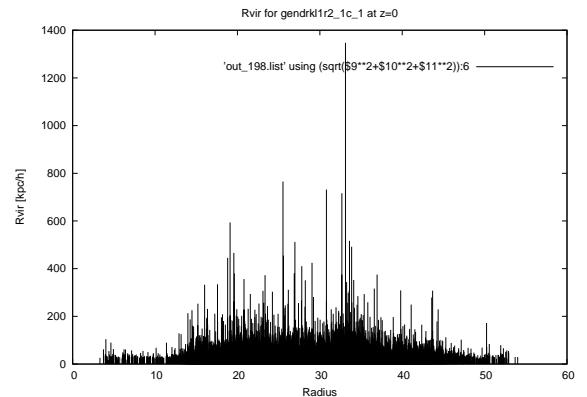
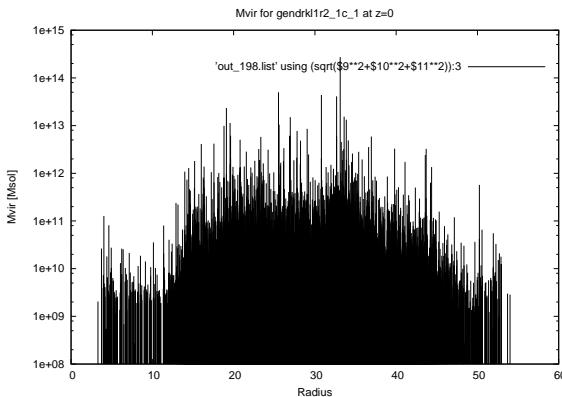
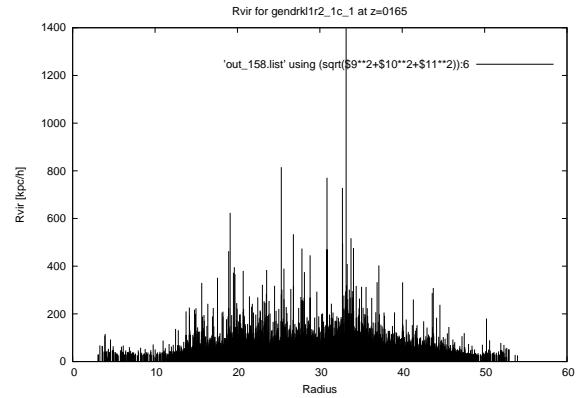
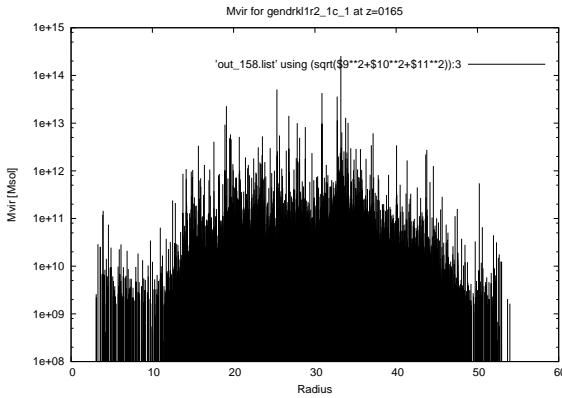
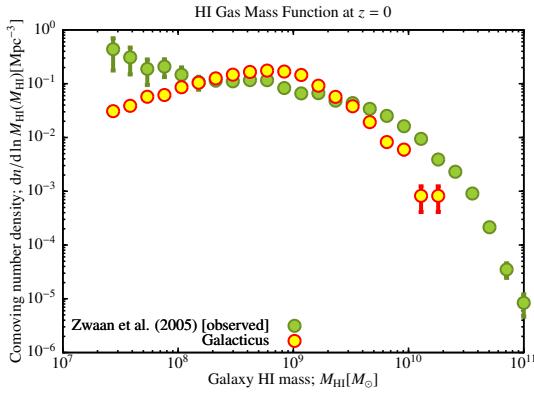
```
Fatal error in Build_Descendent_Pointers():
failed to find descendent node
```

CONSISTENTTREED ✓

ROCKSTARRED ✓ (lasted about 9000minutes)

### 2.2.7 gendrk1r2\_1c\_1





GALACTICUSSED WITH REVISION 709 ✓ CONSISTENT TREED ✓  
 ROCKSTARRED ✓  
 is being rockstarred on astro-x4600-03

E-Mail sent to Bertschinger

```
$ diff drkt+3c+s15_1+r2/constraints_drkt+3c+s15_1+r2.f
r128/h100/gendrkl1_1c_1/constraints_gendrkl1_1c_1.f

$ diff gendrkl1r2_1c_1/grafic_inc_gendrkl1r2_1c_1.f
r128/h100/gendrkl1_1c_1/grafic_inc_gendrkl1_1c_1.f
5c5
< parameter (np1=256,np2=256,np3=256,ncon=1)
---
```

```

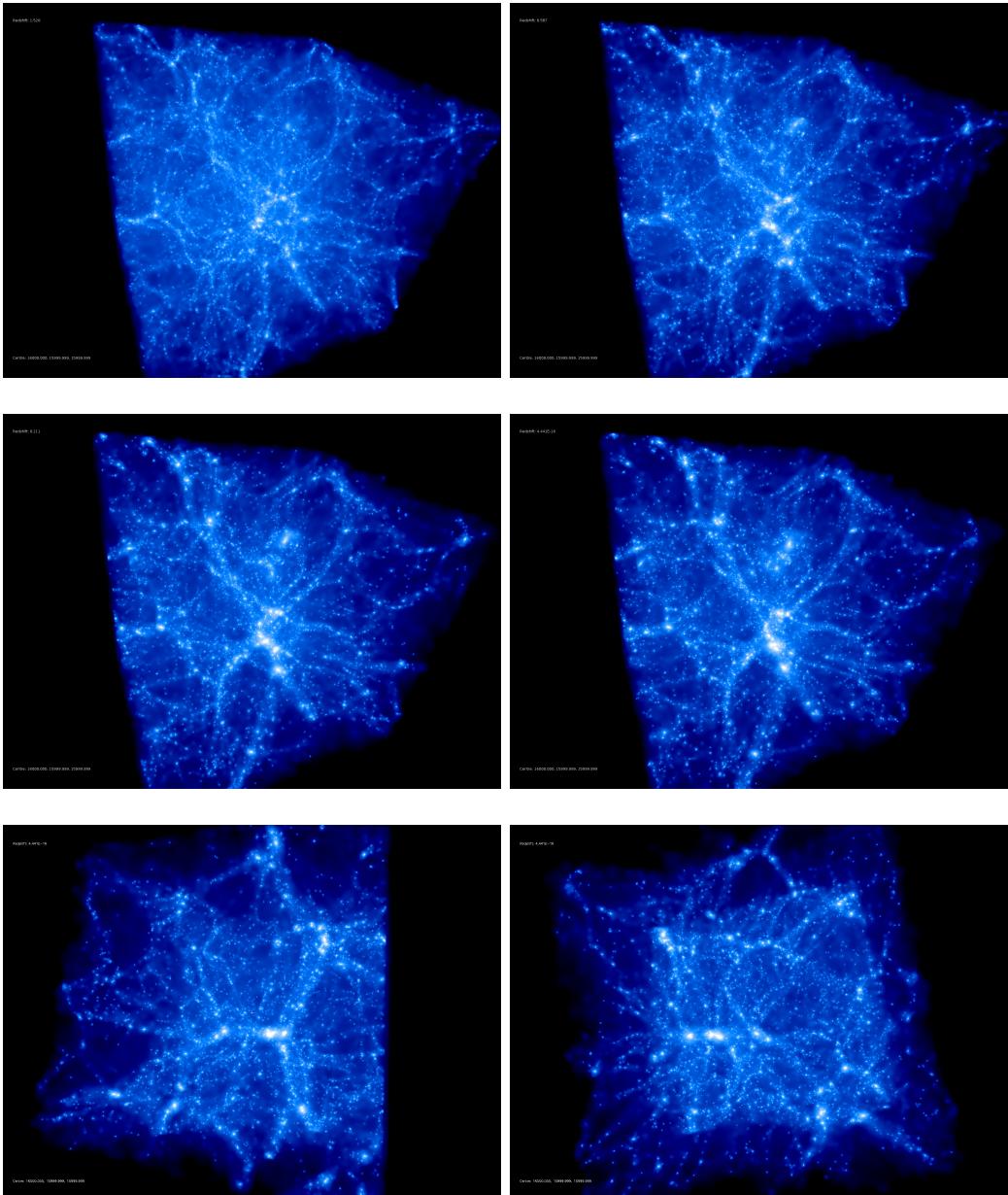
> parameter (np1=128,np2=128,np3=128,ncon=1)

diff gendrk1l1r2_1c_1/graficIO_gendrk1l1r2_1c_1.out r128/h100/gendrk1l1_1c_1/graficIO_gendrk1l1_1c_1.out
23c23
< Particle lattice size: np1,np2,np3=          256          256          256
---
> Particle lattice size: np1,np2,np3=          128          128          128
25,27c25,27
< chosen: 0.12500000 0.0000000 5.00000007E-02
< npart, L_x, L_y, L_z= 16777216 32.00 32.00 32.00 Mpc
< Particle mass= .1447E+09 solar masses
---
> chosen: 0.25000000 0.0000000 5.00000007E-02
> npart, L_x, L_y, L_z= 2097152 32.00 32.00 32.00 Mpc
> Particle mass= .1158E+10 solar masses
37c37
< ak,akmax= 16.100662 16.000005475554534
---
> ak,akmax= 16.068306 16.000005475554534
40,41c40,41
< Mean sigma_delta, sigma_psi= 4.8100653 4.7177238 Mpc
< Chisq, dof, nu= 16781832. 16777215 0.79710007
---
> Mean sigma_delta, sigma_psi= 4.1531582 4.7162638 Mpc
> Chisq, dof, nu= 2095840.0 2097151 -0.64012647
43c43
< Constraint 1: Sampled, desired= 0.28453870E-02 0.25000000E-01
---
> Constraint 1: Sampled, desired=-0.64672055E-02 0.25000000E-01
46c46
< Sampled, desired= 0.21657717 16.718990
---
> Sampled, desired= 1.1184790 16.713776
49c49
< Constraint 1: Final= 0.25000000E-01
---
> Constraint 1: Final= 0.25000002E-01
52,54c52,54
< sigma_delta, sigma_psi= 4.9692168 7.6522889 Mpc
< Chisq, dof= 16781832. 16777214
< Maximum delta, displacement= 27.548712 17.026833 Mpc
---
> sigma_delta, sigma_psi= 4.2376528 6.6093922 Mpc
> Chisq, dof= 2095838.9 2097150
> Maximum delta, displacement= 22.542503 14.168747 Mpc
56c56
< Scaling density and displacements to a= 2.75129788E-02
---
> Scaling density and displacements to a= 3.36233079E-02
58,59c58,59
< For a=astart: linear sigma, delmax= 0.18037927 0.99999994
< RMS, max. 3-D displacement= 0.27777302 0.61806273 Mpc
---
```

```
> For a=astart: linear sigma, delmax= 0.18798503      1.0000000
> RMS, max. 3-D displacement= 0.29319692      0.62853473      Mpc
```

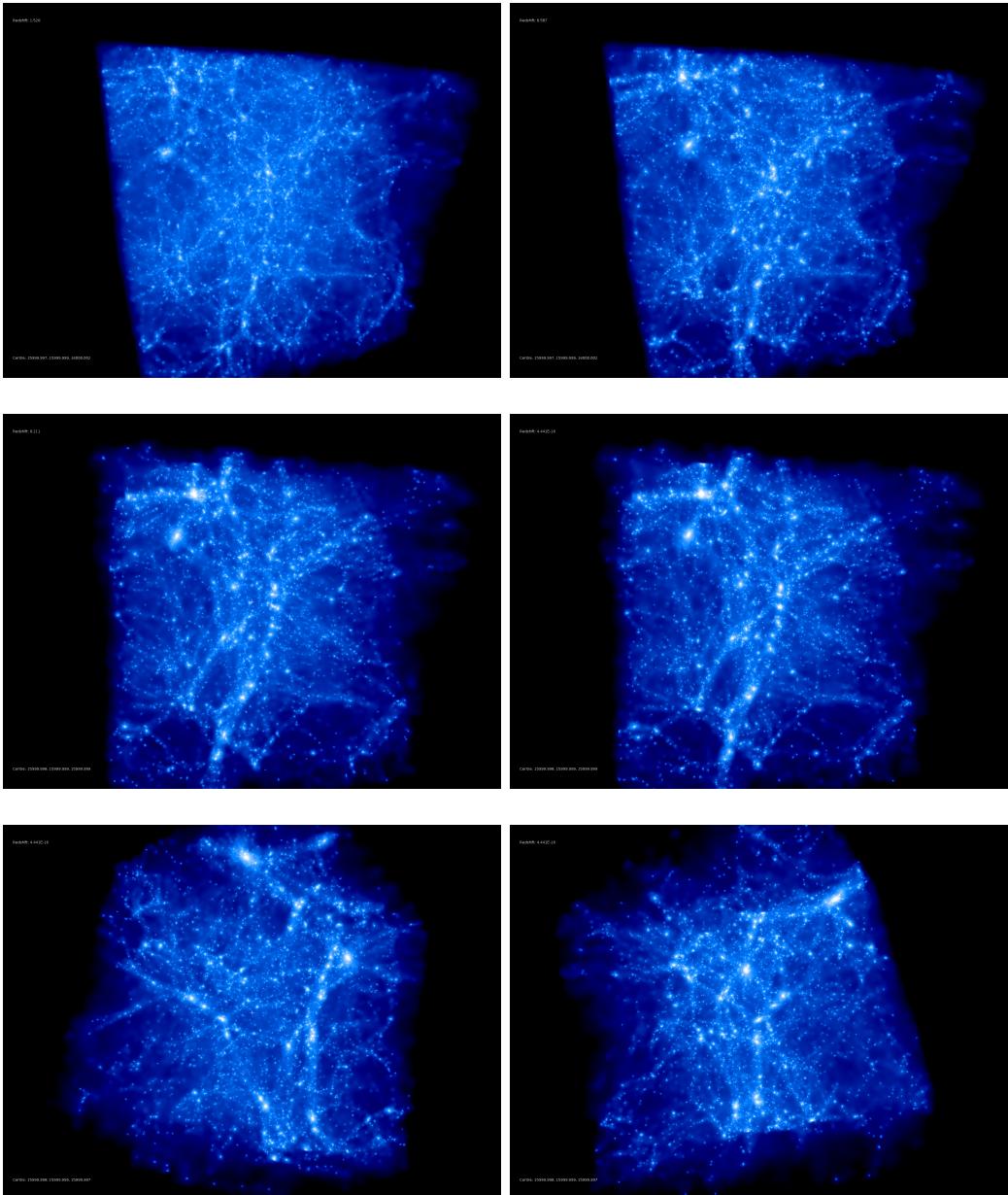
This run is a test if r256 and r128 (`gandrkl_1c_1`) are comparable → see pictures. Sims are not only different in resolution!

### 2.2.8 NGenIC\_15039



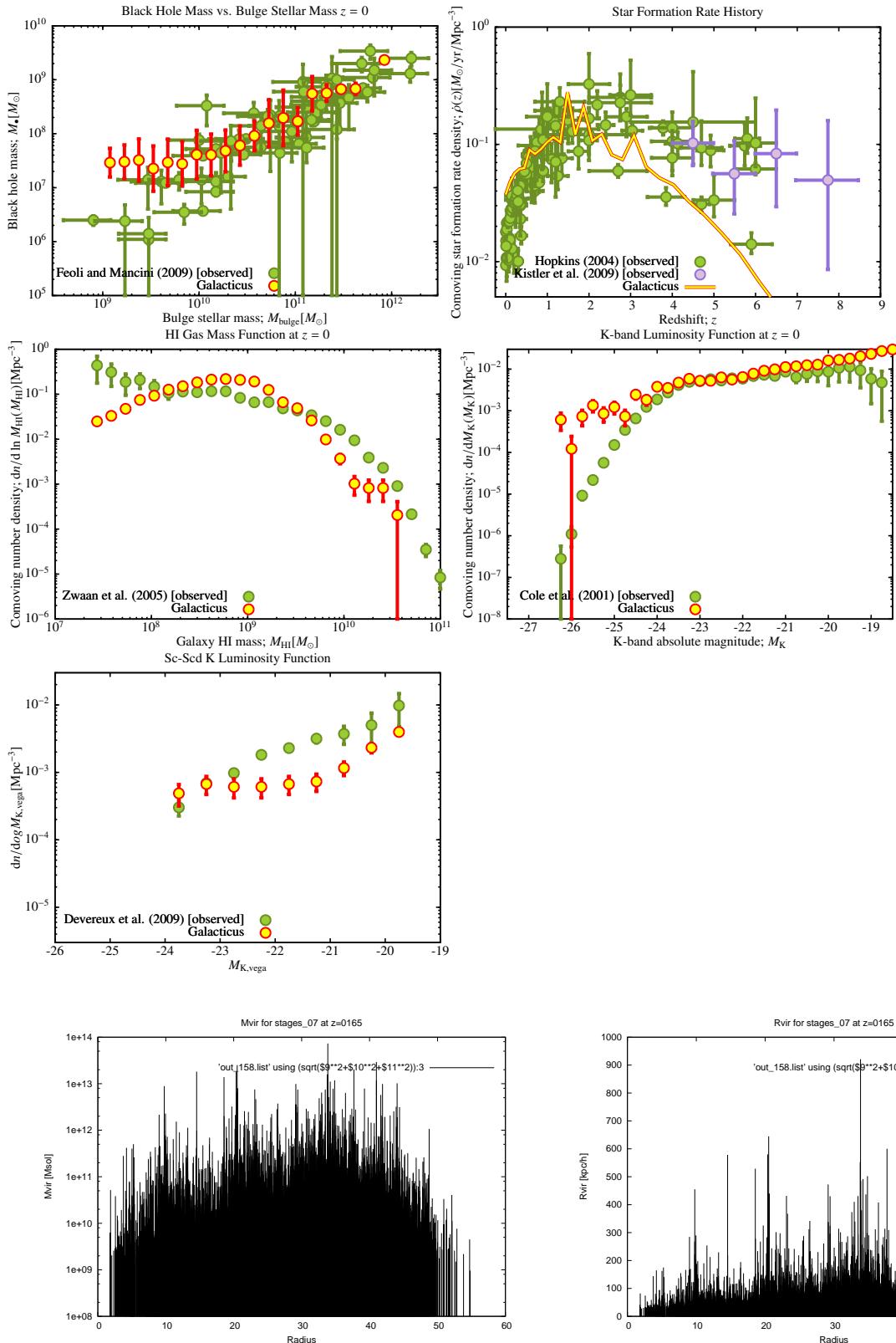
is being rockstarred (again)

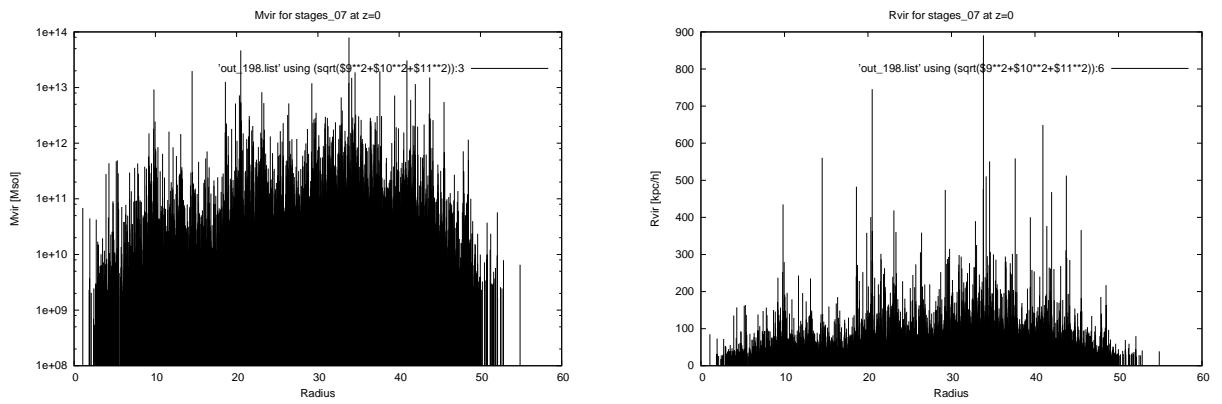
### 2.2.9 NGenIC\_26214



is being rockstarred

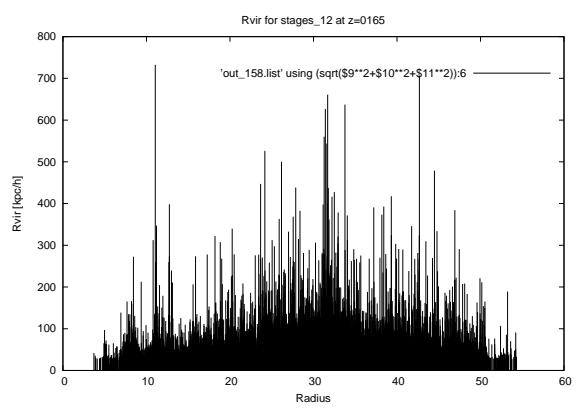
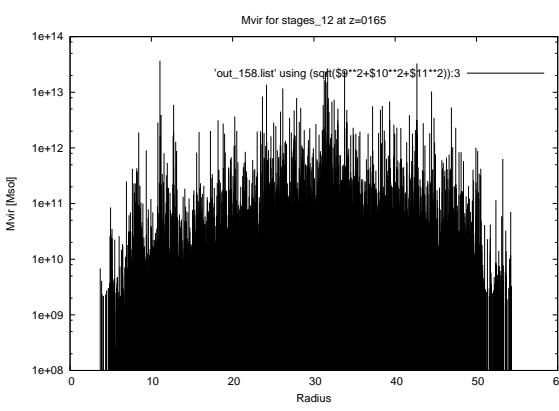
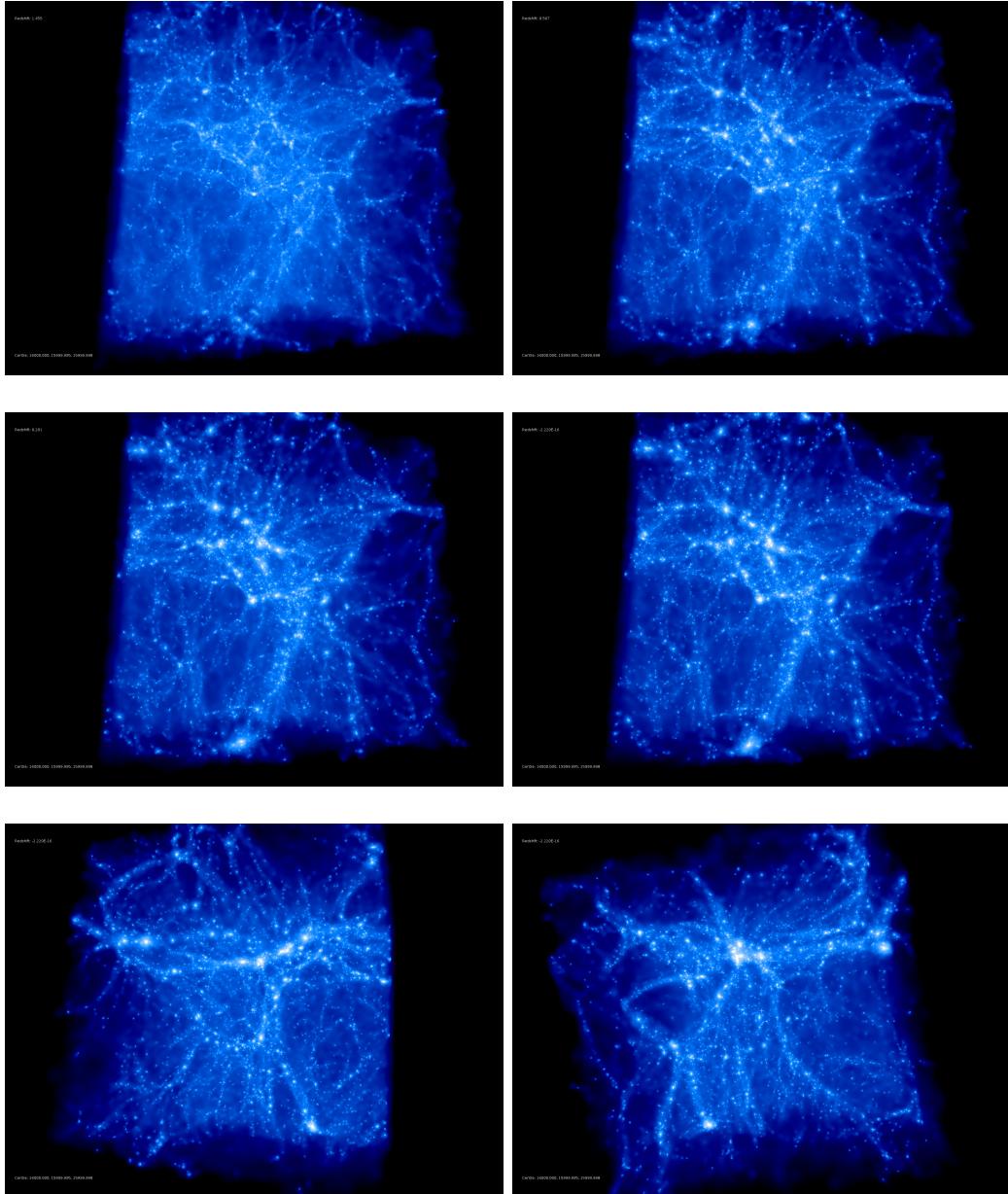
### 2.2.10 stages\_07

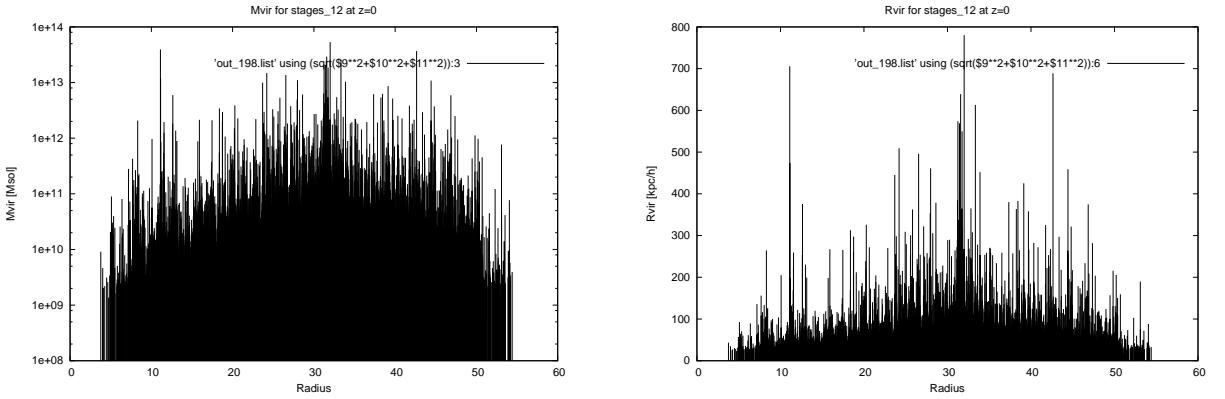




GALACTICUSSED ✓ CONSISTENTTREEDE ✓  
ROCKSTARRED ✓

### 2.2.11 stages\_12





after Markus converter update is being galacticussed again  
galacticus strange error:

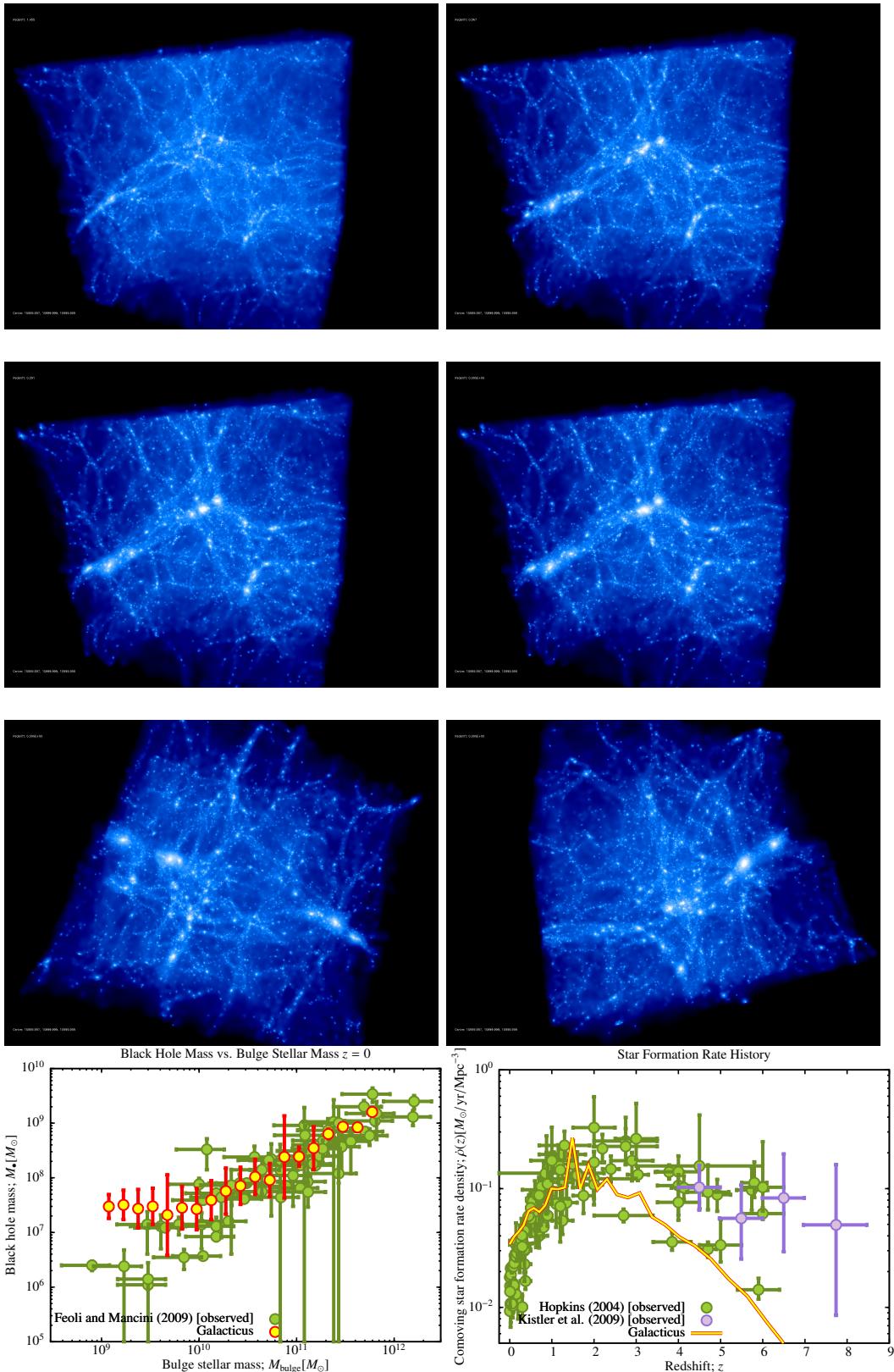
**Fatal error in Cosmology\_Age\_Matter\_Lambda():**  
expansion factor is invalid

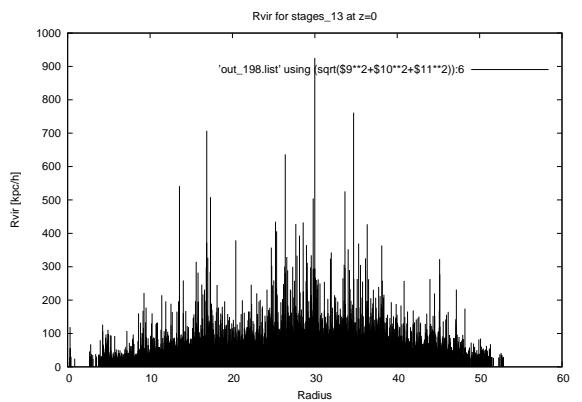
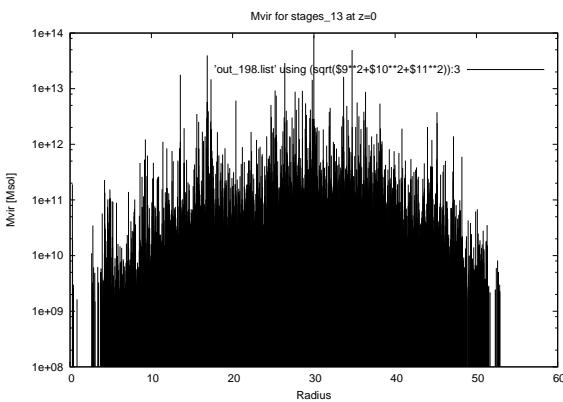
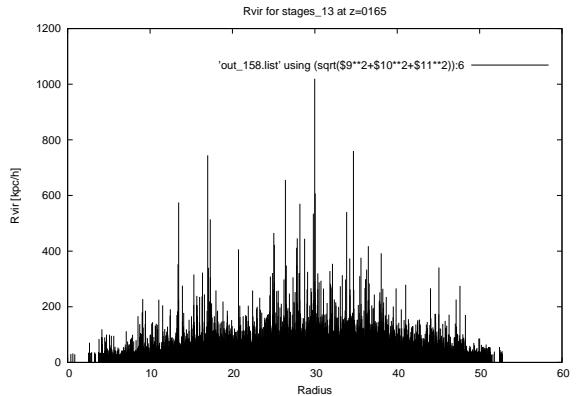
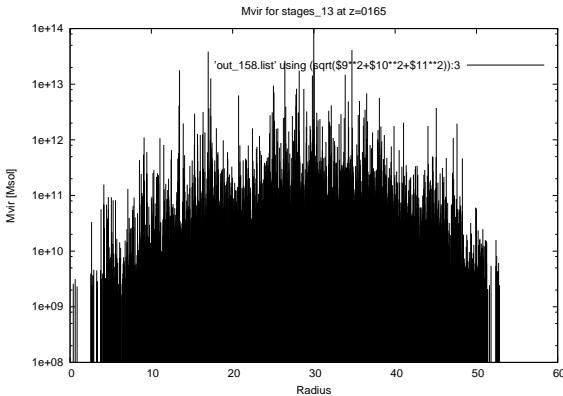
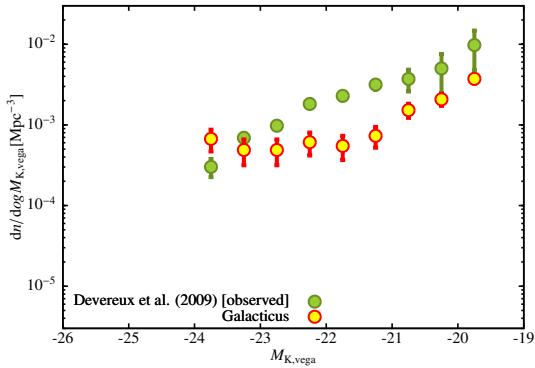
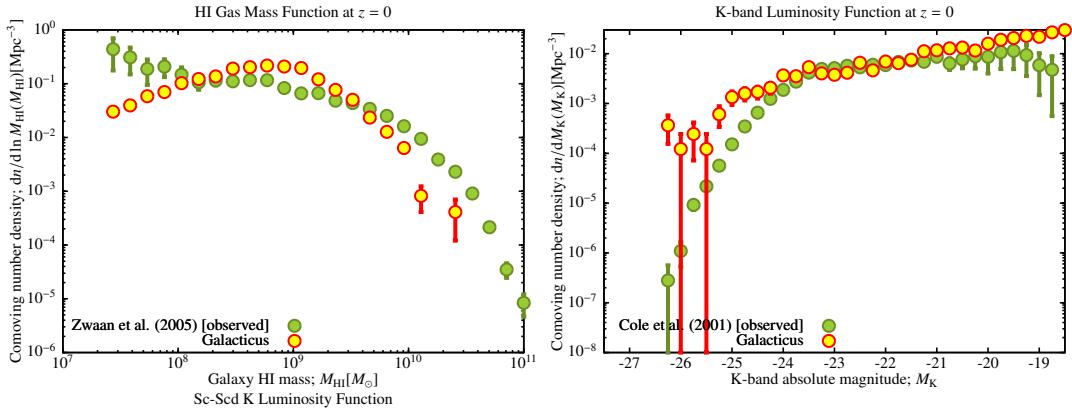
is being galacticussed

CONSISTENTTREEED ✓

ROCKSTARRED ✓

### 2.2.12 stages\_13





GALACTICUSSED ✓  
after Markus converter update is being galacticussed again  
galacticus strange error:

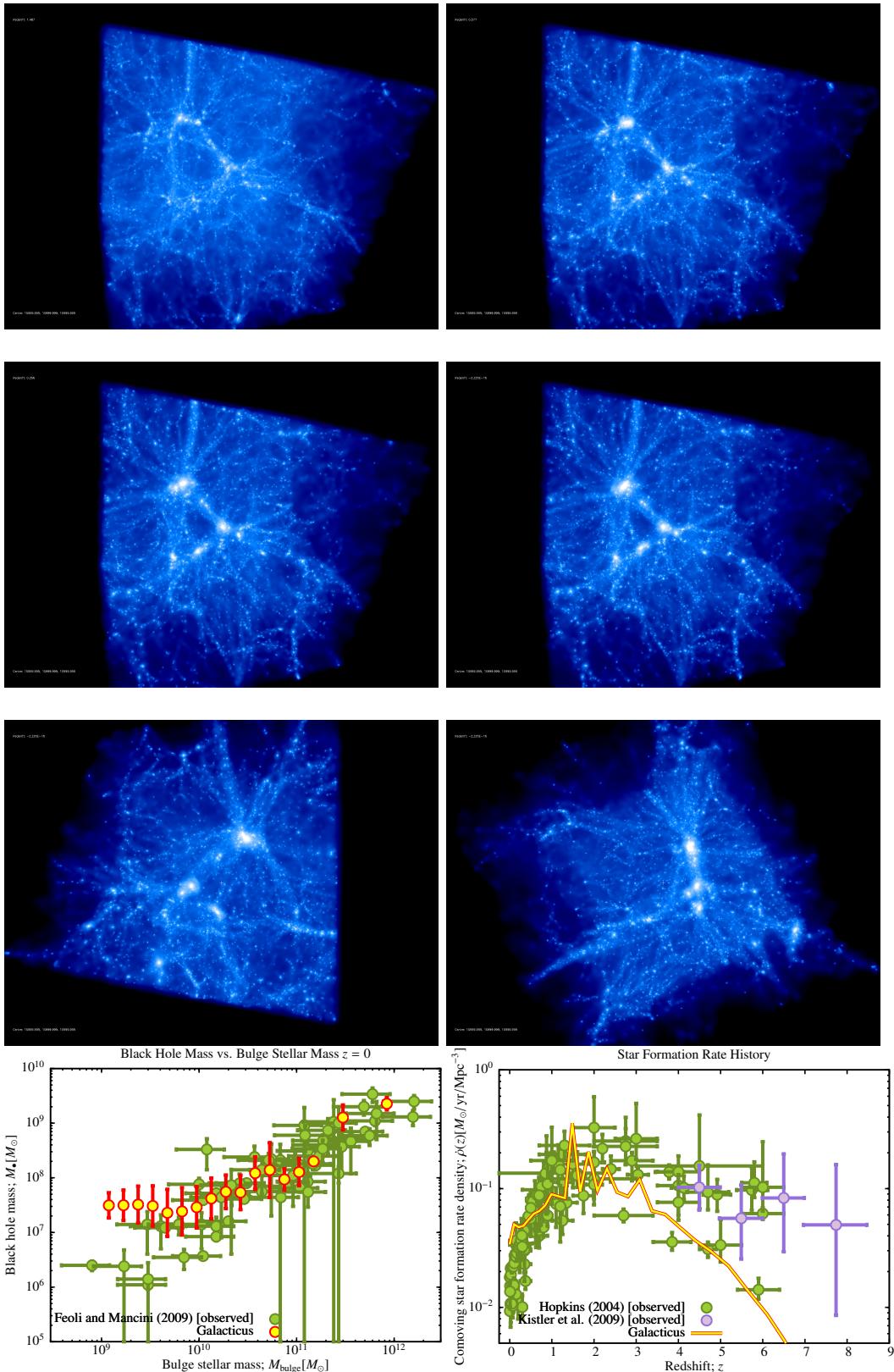
```
Fatal error in Cosmology_Age_Matter_Lambda():
expansion factor is invalid
```

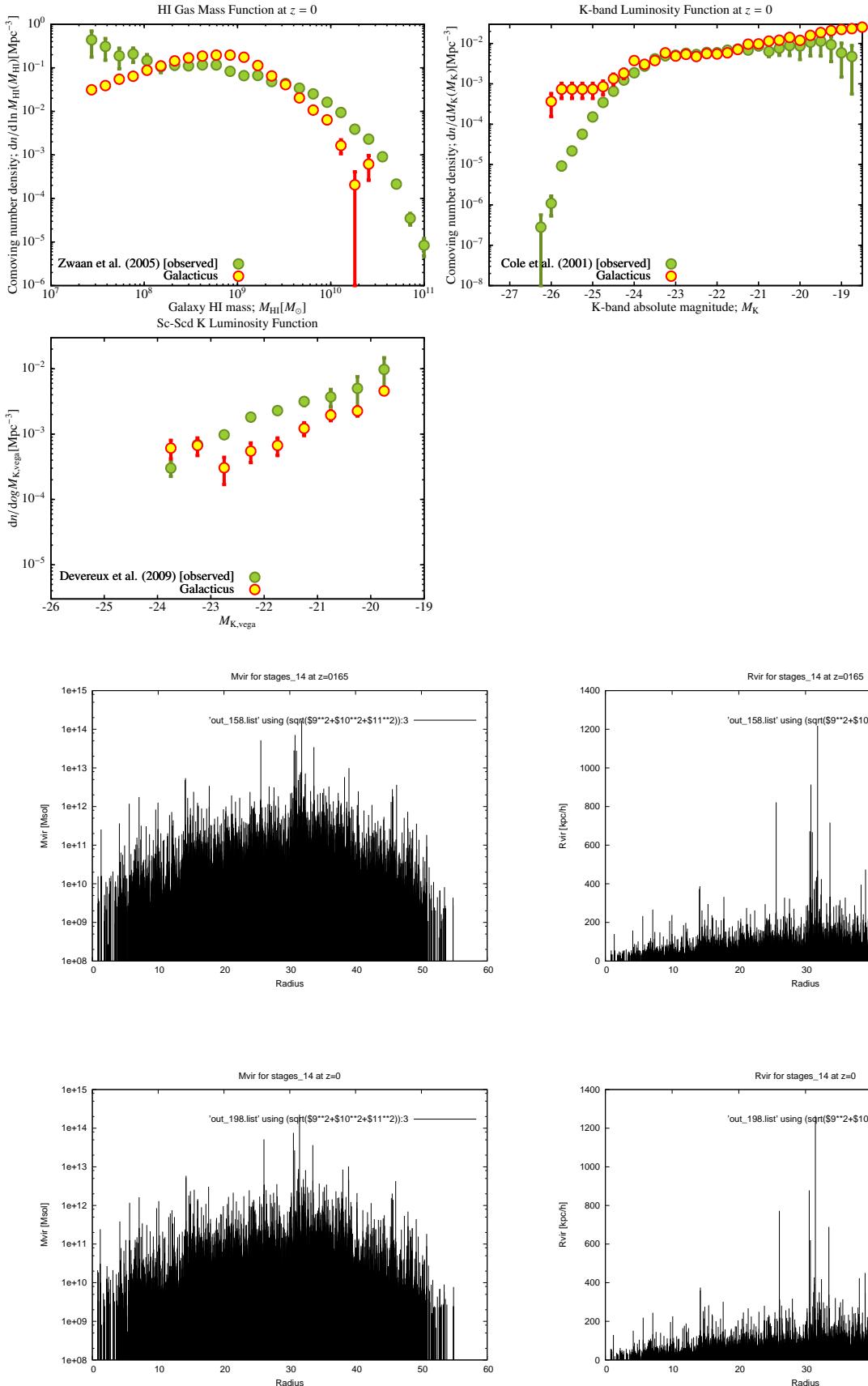
is being galacticussed

CONSISTENTTREEDE ✓

ROCKSTARRED ✓

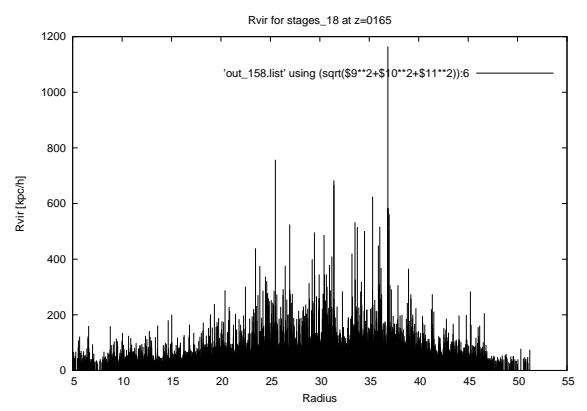
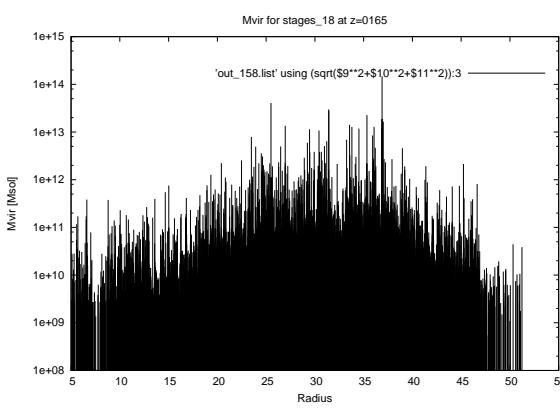
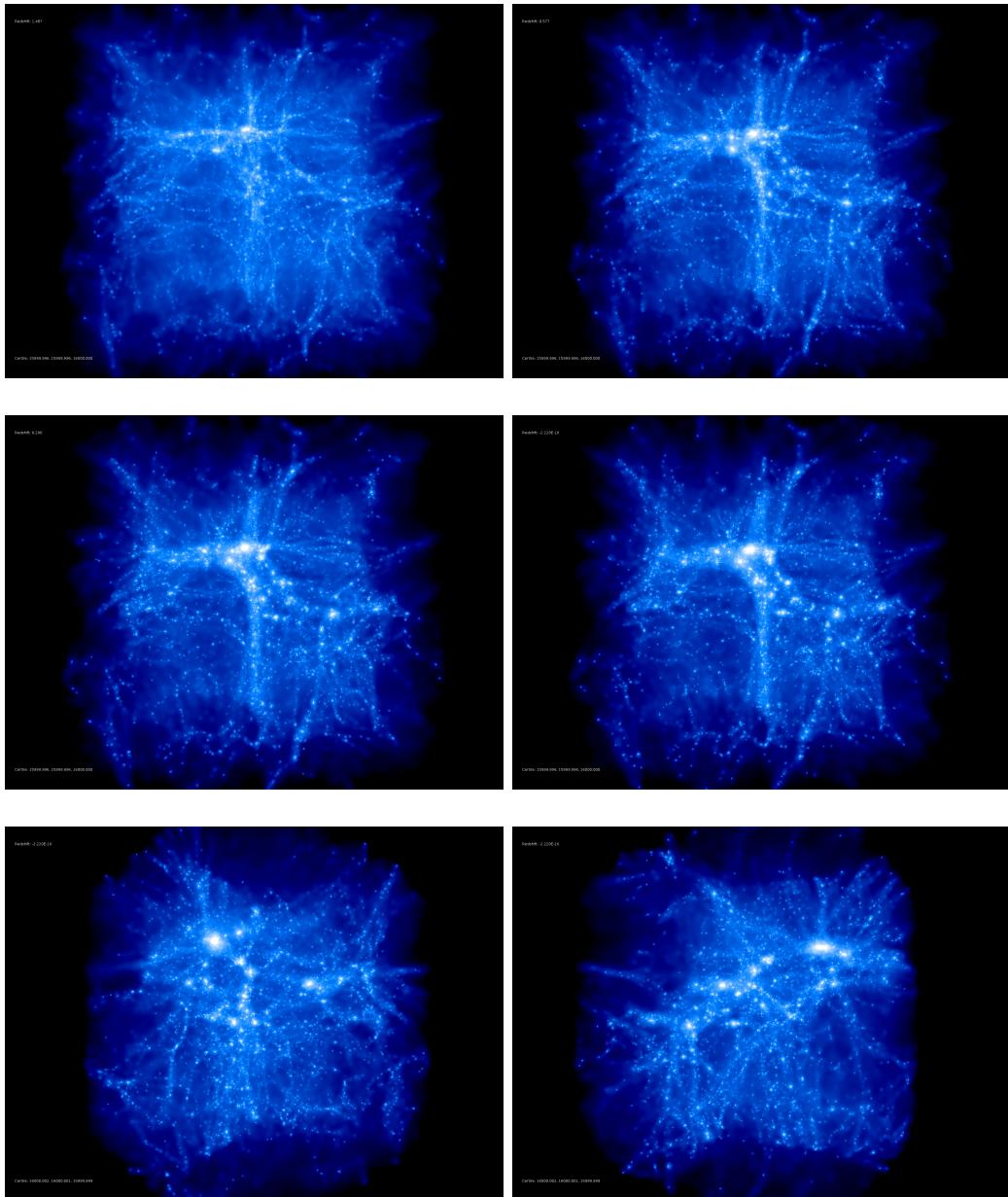
### 2.2.13 stages\_14

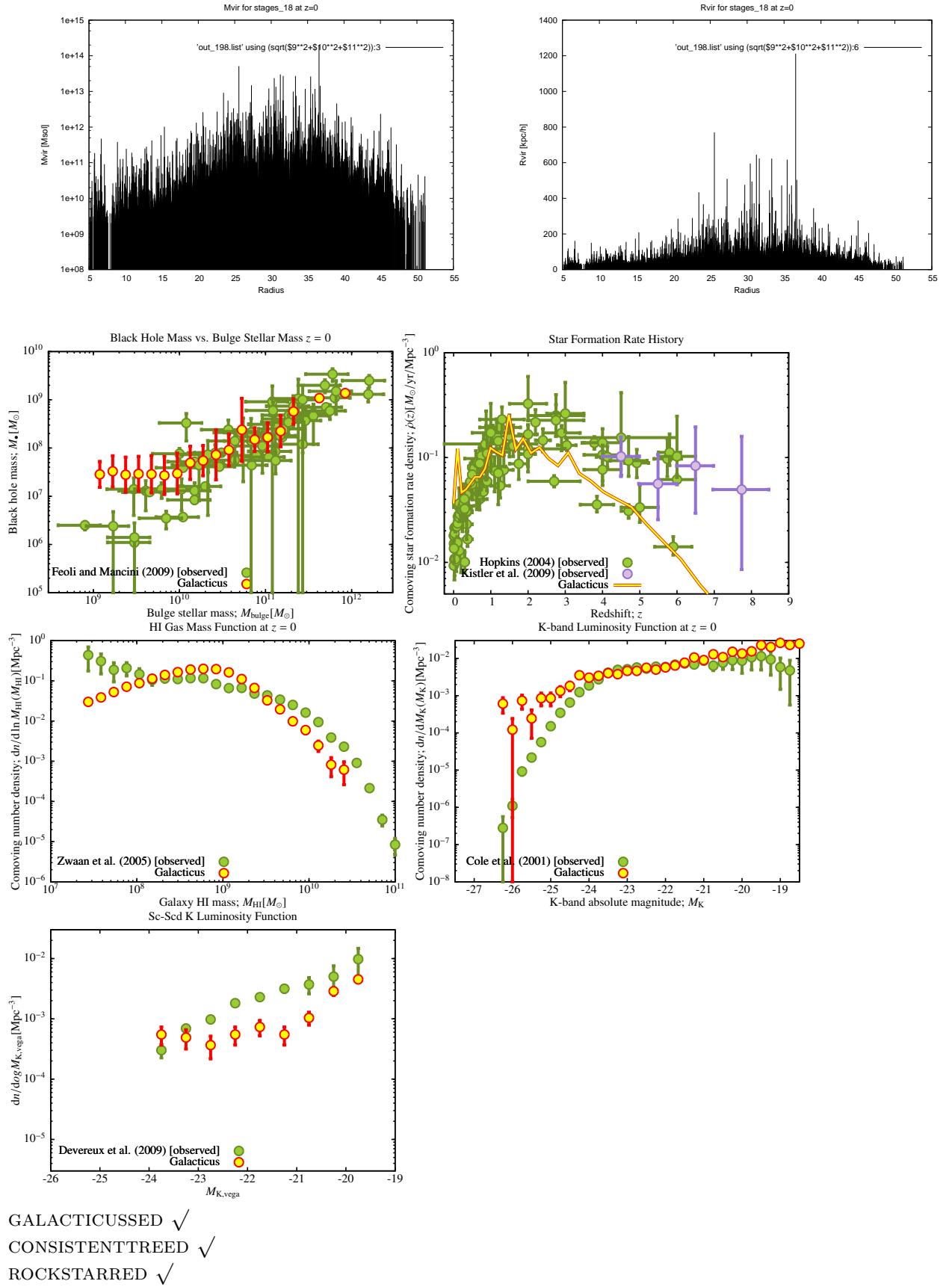




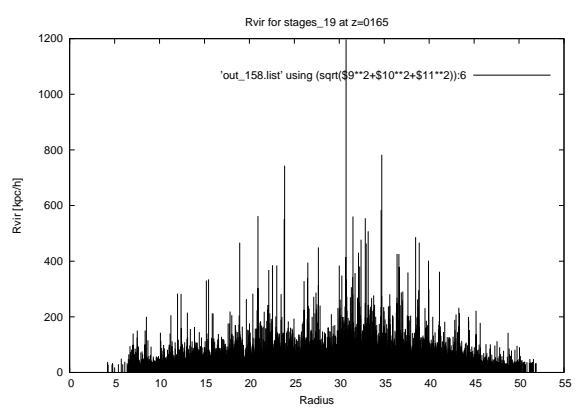
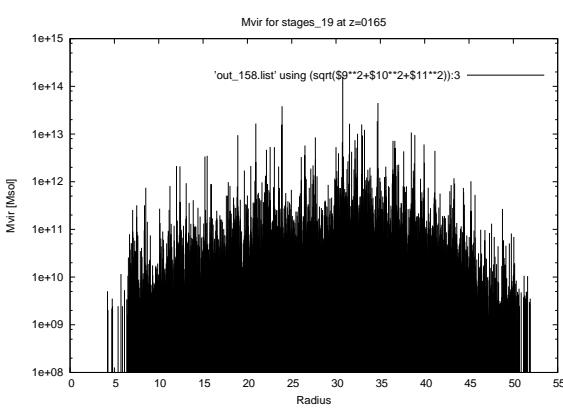
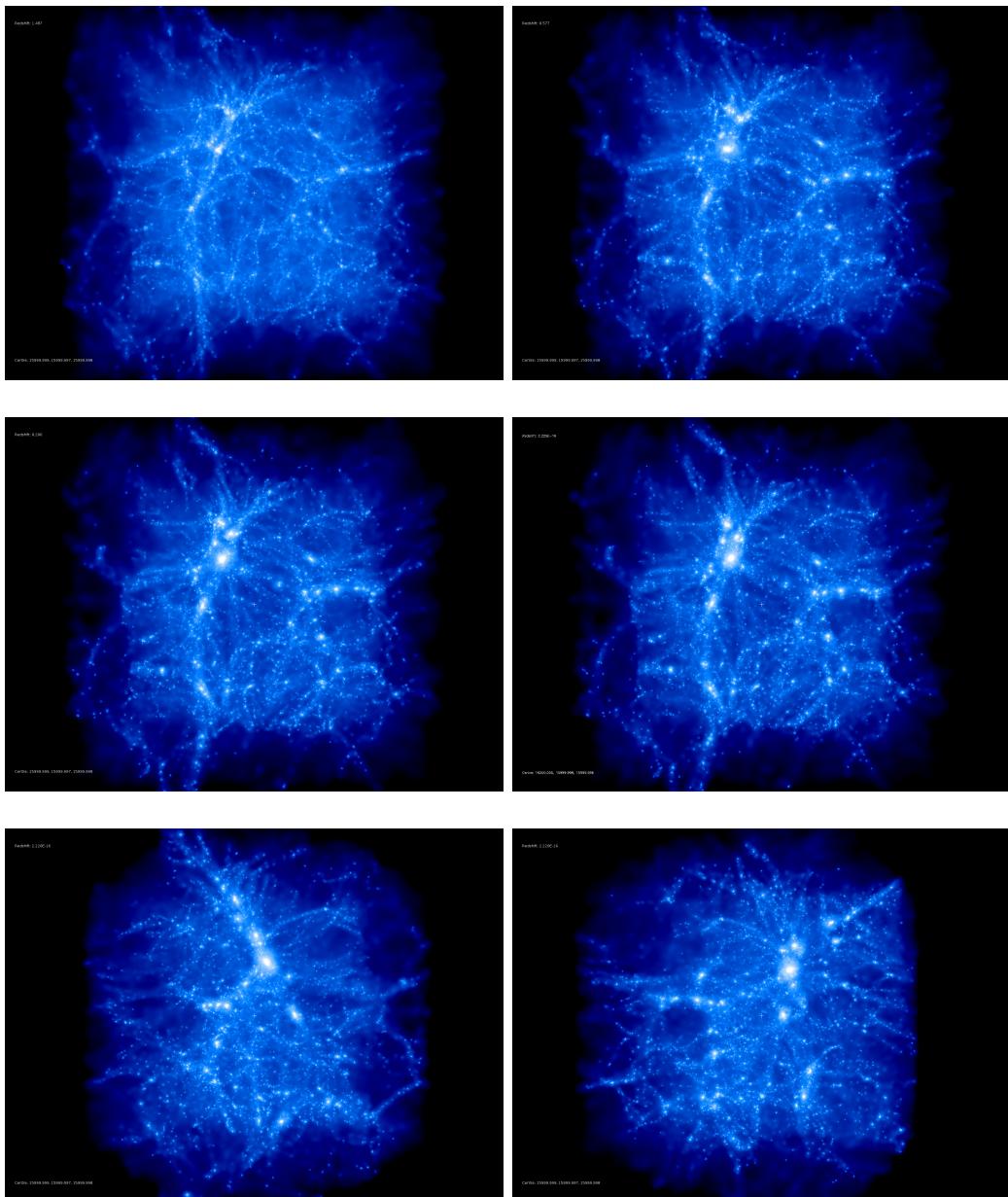
GALACTICUSSED ✓  
 CONSISTENTTREED ✓  
 ROCKSTARRED ✓

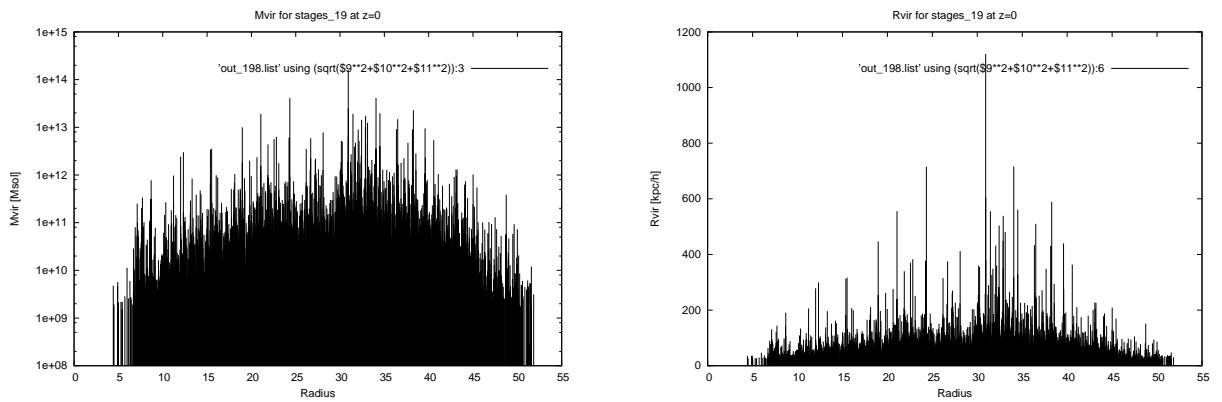
### 2.2.14 stages\_18



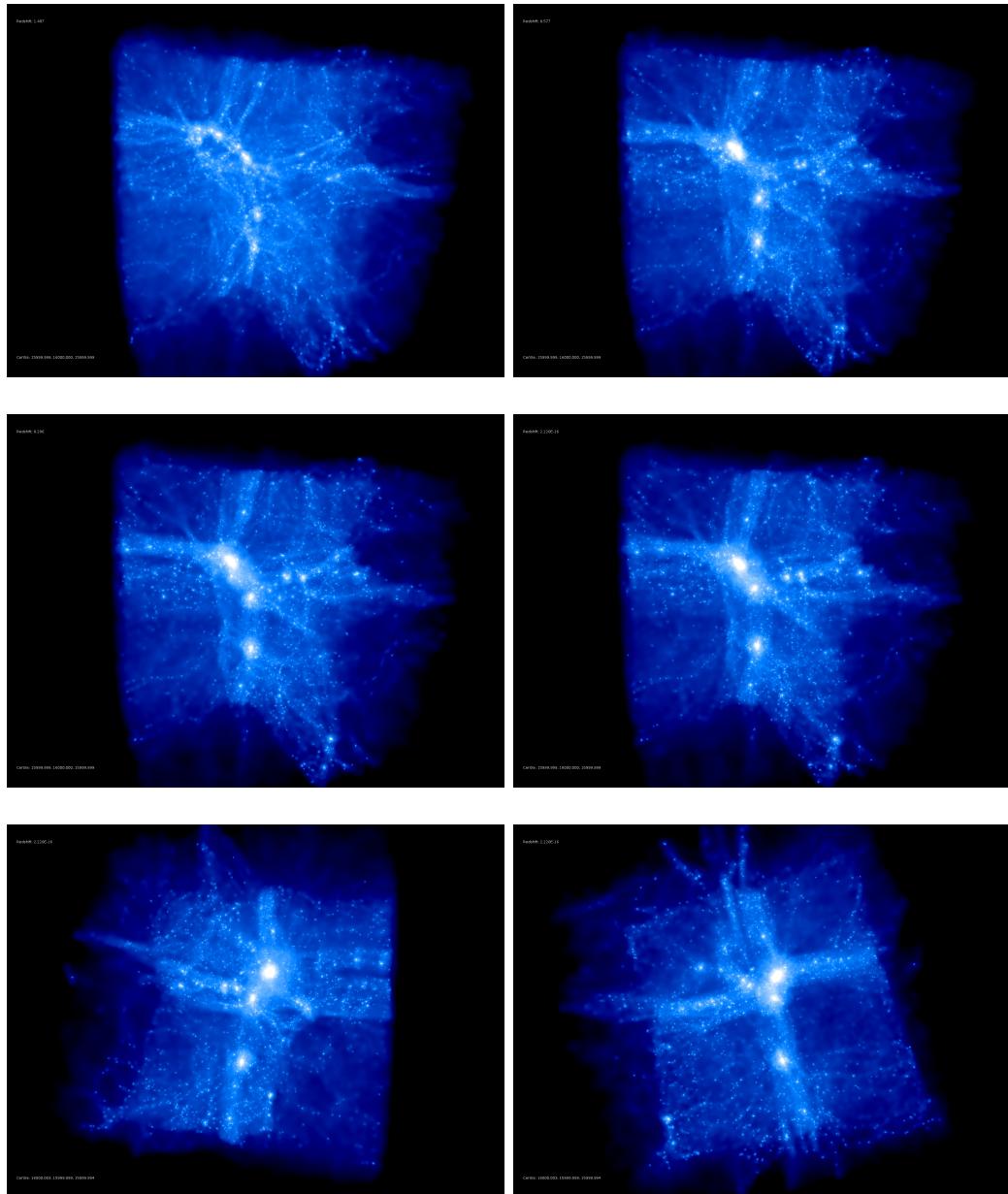


### 2.2.15 stages\_19

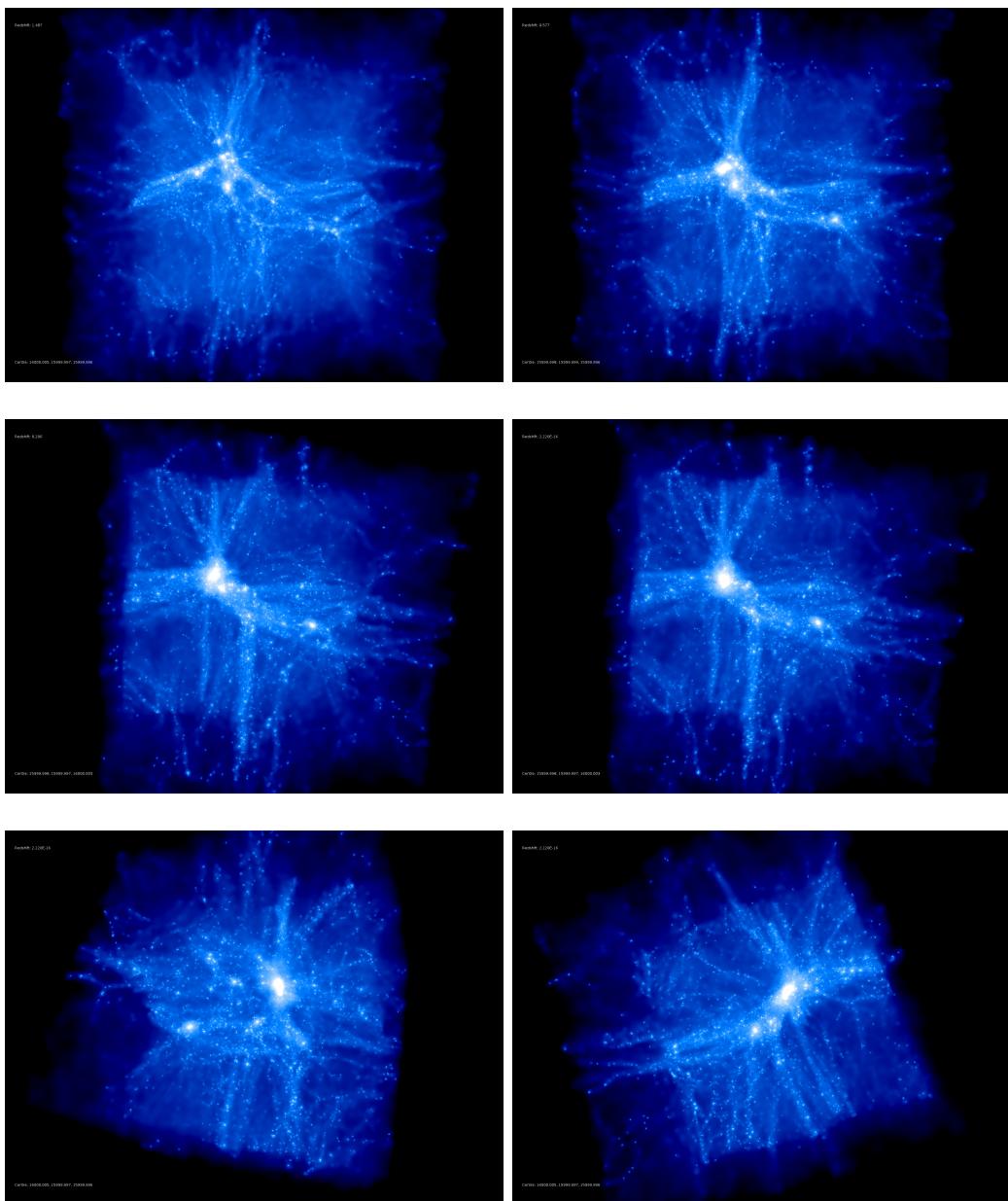




### 2.2.16 stages\_20



### 2.2.17 stages\_21



is being rockstarred