Exercise 6: Cosmological simulations II

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Problem 11: `Simulations using Gadget2`

Gadget2 is an N-body code designed for general purposes (cosmological and non-cosmological simulations) that can deal with two component systems (colissionless matter and gas). For solving the equation for the potential, it uses a treePM algoritm. The aim of this excerices is to make a gross comparison between this code and AMIGA repeating what you did in problems 9 and 10.

1. `Initial conditions:` Use the same initial conditions as used in excercise 9 (ΛCDM and ΛWDM cosmological models). Compile and use the tool `ascii2gadget`[1] to convert your ascii files to Gadget2 format. Be carefull with the units. If you use the convertion factors given in the manual in section 5.9, the positions should be in kpc/h (not Mpc/h like in AMIGA).

   (4 points)

2. `Snapshots:` Generate input files for the two simulations to run and run them.

   (4 points)

3. `Results:` Use the tool `gadget2ascii`[1] to come back to ascii format. Use gnuplot to plot the files and make a visual comparison between this frames and the frames you already generated with AMIGA.
   Do the analysis you already did in problem 10 using the new snapshots. Compare results with the previous analysis. Note that the halo finder AHF is capable of directly reading the snapshots of Gadget2 when compiled with the flag `-DGADGET2`.

   (4 points)

[1] available at the webpage where this exercise sheet was downloaded

Gadget2 tips

- `Getting and compiling the code:` The code can be donwloaded from http://www.mpa-garching.mpg.de/gadget/. The manual can be taken from the same place. In order to run the code, you will need to install also the libraries mpi, gsl and fftw. The information of where to get these libraries is in the manual. You don't need to install hdf5. In order to compile the code, you can use one of the Makefile given as example in the package. The file is in the directory `Gadget2/parameterfiles` and its name is `lcdm_gas.Makefile`. You should copy this file to the `Gadget2` directory and change its name to `Makefile`. Remember to use always `make clean` before to compile.

- `Runing the code:` If you have a multiprocesor computer, you can try to run the code in paralell with something like:

  `mpirun -np 2 ./Gadget2 myparameterfile.param`.

  If you have only one procesor you don't need to use `mpirun -np 1`. (but you need to have mpi).
  To restart a simulation you have to use:

  `mpirun -np 2 ./Gadget2 myparameterfile.param 1`.

- `Input files:` The information that Gadget2 needs in the input file can be found in the manual. You can use the file `lcdm_gas.param` in the directory `Gadget2/parameterfiles` as example. Use standard parameters. Don't forget to switch on the options `ComovingIntegrationOn` and `PeriodicBoundariesOn`. You also have to tell Gadget2 wich is your `Boxsize`, your `TimeBegin` (scale factor(=1/(1+z) of your initial conditions) and your cosmology (remember you are making a simulation without barions).
  You are invited to switch of the automatic calculation of the opening criterion (using `TypeOfOpeningCriterion 1`) and make many runs and compare results using diferent opening criteria (option `ErrTolTheta`). Otherwise, you can run with automatic opening criterion using `TypeOfOpeningCriterion 0`.