This document describes the extra modifications for the turbulence routine.

The Gadget2 code was developed by Volker Springel

<https://wwwmpa.mpa-garching.mpg.de/gadget/>

In this document, I assume that 1 code unit length = 1pc.

Before using this code, we might need to modify some parameters.

File **allvars.h**

The important parameters to modify are:

* cloud\_radius: half the physical length of an individual turbulence box (in pc)
* galactic\_radius: half the physical length of the large simulation box (outside this box there is no turbulence)
* number\_of\_grids: how many grids in 1D (basically, this number is equal to galactic\_radius/cloud\_radius)

///////////////// Turbulence definitions ///////////////////

#define grid\_size 129

#define cloud\_radius 4.0 ///half box size 1 grid

#define galactic\_radius 512.0 ///// edge of the box = half box size GC simulation

#define delta ( 2.0\*cloud\_radius/128.0 ) ///2\*cloud\_radius/grid\_size-1 "resolution"

#define dim\_turb 3

#define size\_turb (grid\_size\*grid\_size\*grid\_size)

#define sec2 (3\*size\_turb) //// 3\* 128^3

#define number\_of\_grids (512 / 4) /// 2\*galactic\_radius / 2\*cloud\_radius

File **main.c**

We need to specify the path to the turbulent files. This is self-explanatory once you inspect the file.

File **gravtree\_zhao.c**

A modification of the original gravtree.c. Here is where the gravitational potential is added. This can be modified accordingly. Modification starts in line 368.

**Makefile**

The flags needed for the code are:

OPT += -DGRAVITY\_GALAXY

This is to enable the gravitational potential

OPT += -DDRIVING

This is to enable the turbulence routine

#OPT += -DEXTERNALPRESSURE

Optional. This is to enable external pressure. See paper for details.

File **galaxy.param**

This is the parameter file needed for Gadget2. The parameters to keep in mind are:

TimeBetStatistics 0.002 -> This is the time where the statistics files are printed, but I made it also time when turbulence is added. To work, this number should me an integer times the timestep.

MaxSizeTimestep 0.001

MinSizeTimestep 0.001

Make sure both are the same to fix the timestep

UnitLength\_in\_cm 3.085678e18 % cm = 1 pc

The code is written assuming the unit length is 1 pc.

Finally:

DensityDepenTurb 1 -> keep this for density dependence. 0 for no density dependece

TurbEnergyIn 1.0e47 % ergs -> energy to be injected every time

ExternalPressure 1.0e-10 % erg/cm^3 🡪 external pressure term. See paper

OutTestTurbFile turbout.txt % 🡪 irrelevant

OmegaBar 40.0 % km/(s kpc) 🡪 Bar pattern speed.

Questions?

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