

# Millennium

This simulation is good for

- Modelling galaxies with stellar mass above  $\sim 10^{8.5} M_{\text{sun}}$
- Probing scales up to  $500 h^{-1}$  Mpc (without repetition)
- General-purpose galaxy evolution studies with the likes of the SDSS
- Detailed structural stellar, H $\alpha$ , and H $_2$  properties of galaxies (with [Dark Sage](#))

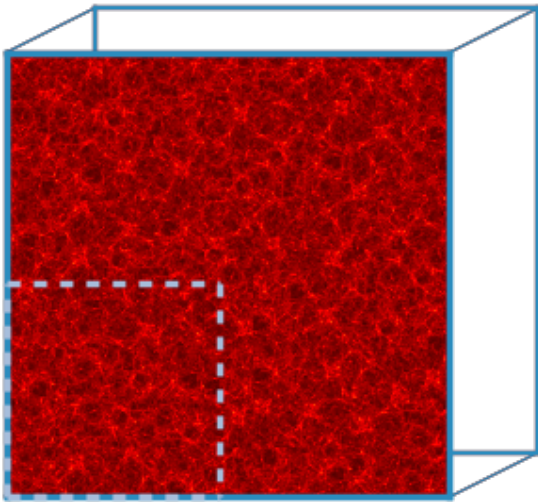
## Overview

At the time of its publication in 2005, the Millennium simulation was the largest CDM cosmological  $N$ -body simulation ever run. It has since become the standard simulation for constructing galaxies with semi-analytic models and is still actively used for research today. The simulation was performed with [GADGET2](#), which uses a 'Tree Particle Mesh' algorithm to compute gravitational forces. Further details of the simulation can be found in the paper by [Springel et al. \(2005\)](#) and at [this address](#).

## Size

Box length:  $500 h^{-1}$  cMpc

Relative volume to an [all-sky survey out to  \$z=0.05\$](#) :



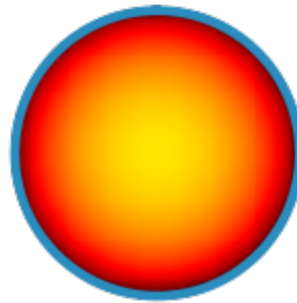
## Resolution

Particle mass:  $8.6 \times 10^8 h^{-1} M_{\text{sun}}$

Gravitational softening:  $5 h^{-1}$  ckpc

Number of particles:  $2160^3$

Number of snapshots to  $z=0$ : 64



## Cosmology

The cosmological parameters of the Millennium simulation are based on *WMAP-1* data ([Spergel et al. 2003](#)) and the 2dF Galaxy Redshift Survey ([Collins et al. 2001](#)).

$\Omega_m = 0.25$

$\Omega_b = 0.045$

$h = 0.73$

$\Omega_\Lambda = 0.75$

$n = 1$

$h = 0.73$

## Halo

Halo and subhalo were identified using the popular [SUBFIND](#) code. The merger trees of these halo were built using LHALOTREE, which is described in the [Supplementary Information](#) of the Millennium paper. A minimum of 20 particles was required for a (sub)halo to be included in the trees.

## Semi-analytic galaxies

Galaxy catalogues for the Millennium simulation available on *TAO* have been built with the following semi-analytic models:

[SAGE](#)  
[Dark Sage](#)