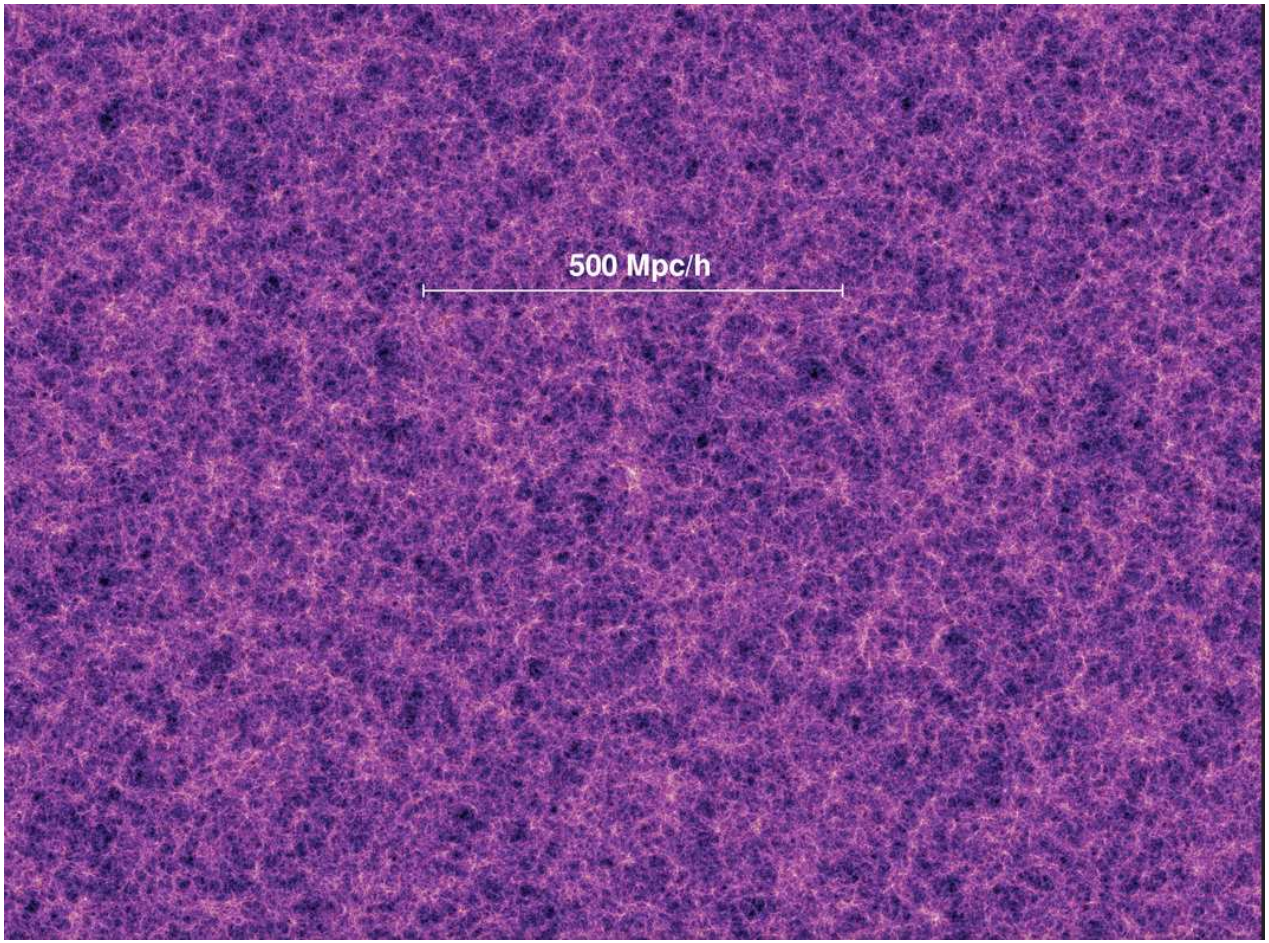
Comprehensive models of galaxy formation and evolution

Violeta Gonzalez-Perez

@violegp

The Millennium simulation



An excercise

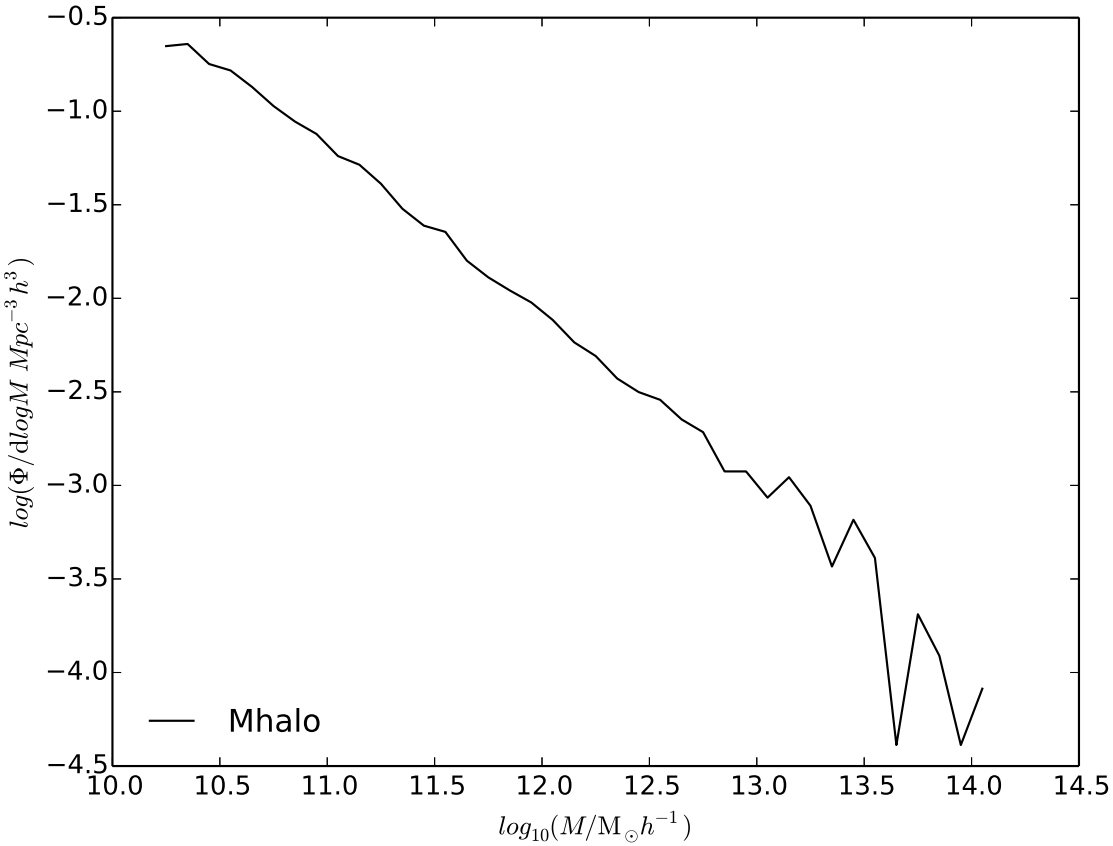
- Simulation:
  `http://virgodb.cosma.dur.ac.uk:8080/Millennium/`
  Millimillenium box size $= 62.5$ Mpch^{-1}
  Mass of each dark matter particle $= 8.6 \cdot 10^8 \mathrm{M}_\odot h^{-1}$
- Data: `http://www.astro.ljmu.ac.uk/~ikb/research/gama-gsmf-paper.html`

Query for getting the dark matter mass function

```
select .1*(.5+floor((log10(np*0.86)+9.)/.1)) as mass,
log10(count(*)/power(62.5,3.)/.1) as phi
from millimil..MPAHalo
where snapnum=63
group by .1*(.5+floor((log10(np*0.86)+9.)/.1))
order by mass
```

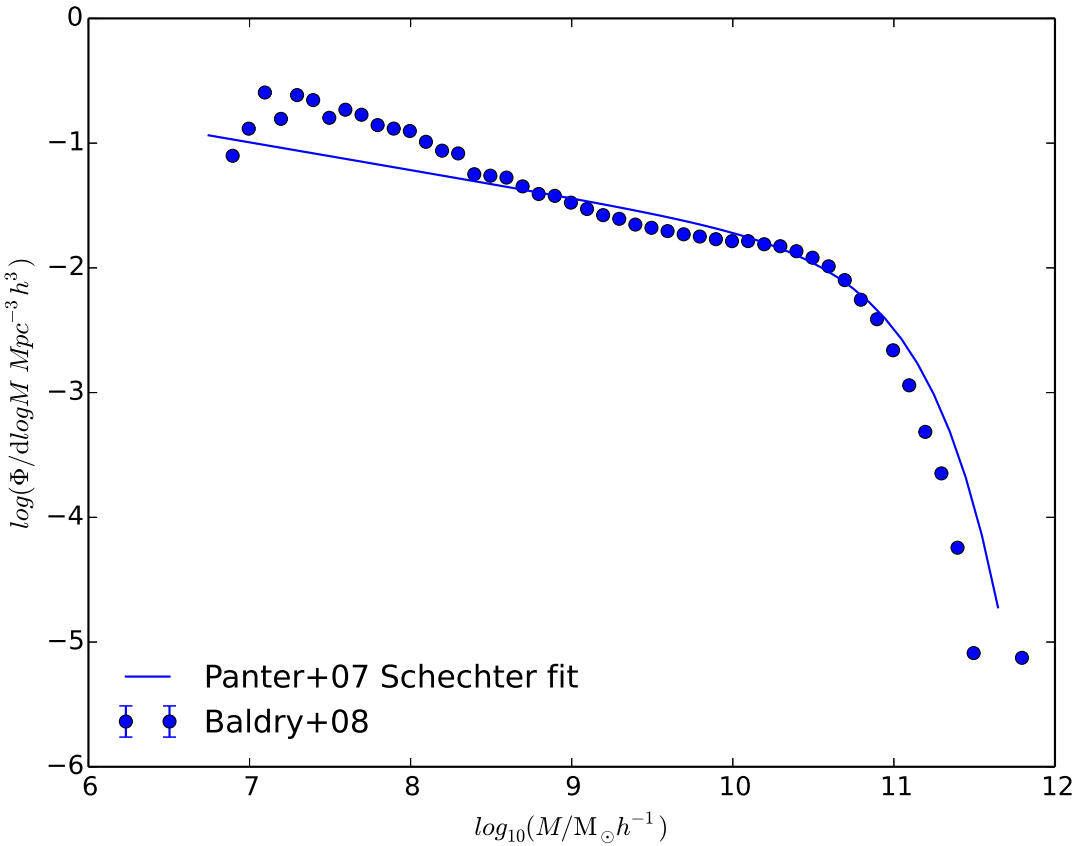
The mass function

Plotting directly the output from the query: mass vs phi



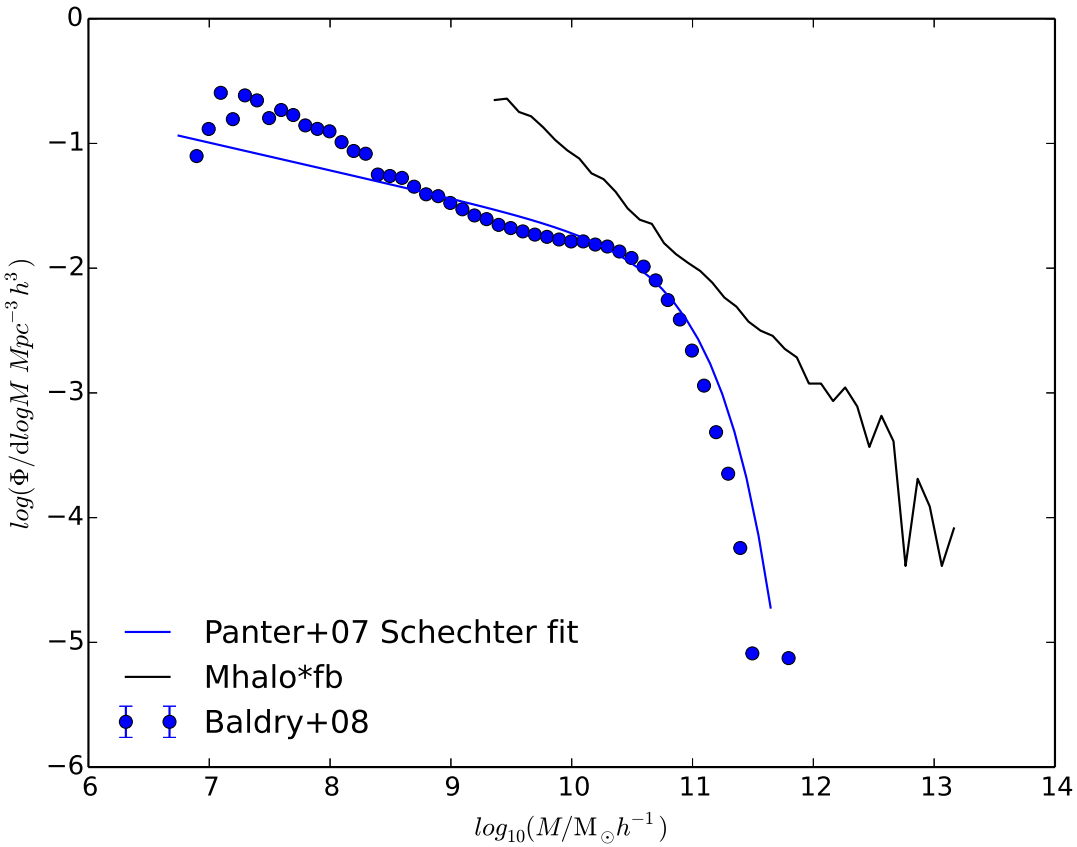
The galaxy stellar mass function

Plotting the galaxy stellar mass function from observations (Baldry et al. 2008) together with the Schechter function derived by Panter et al. 2007:



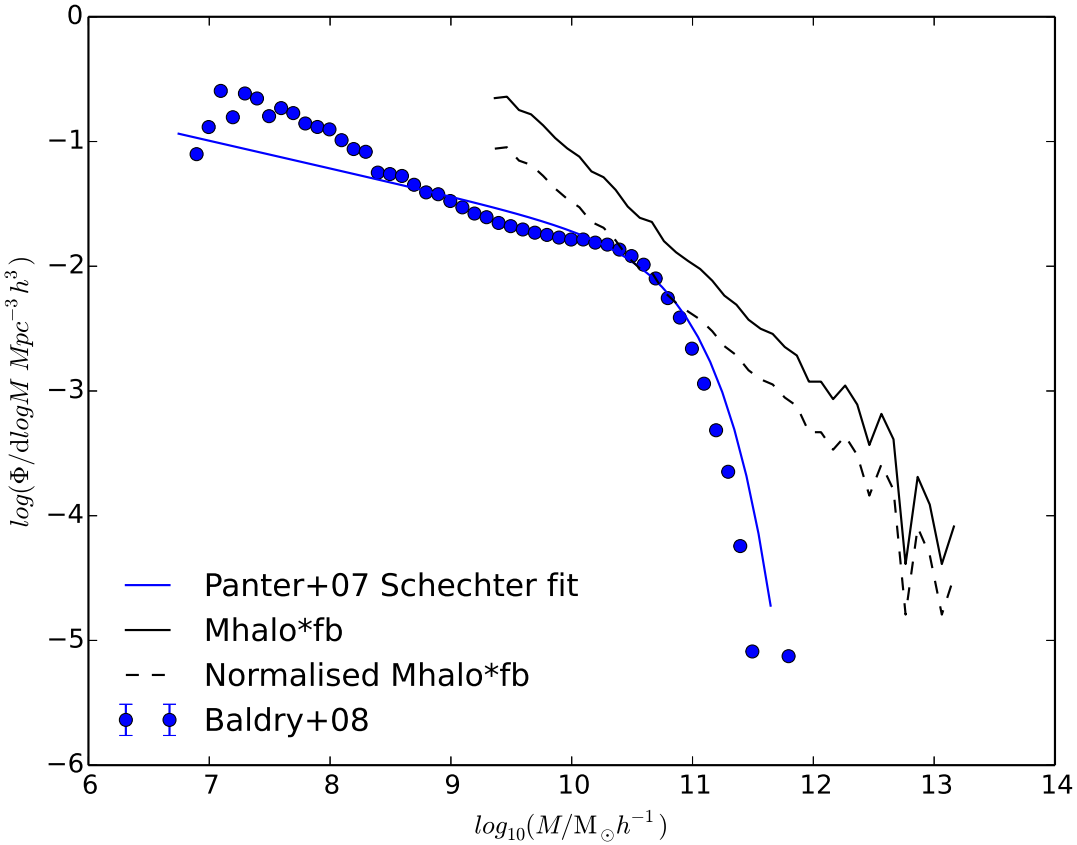
The galaxy stellar mass function

Let's compare the observed the galaxy stellar mass function with that derived from the dark matter mass function (mass and phi from the query) by multiplying it by the baryonic fraction ($M_* = M_{\rm halo} \cdot f_b$)



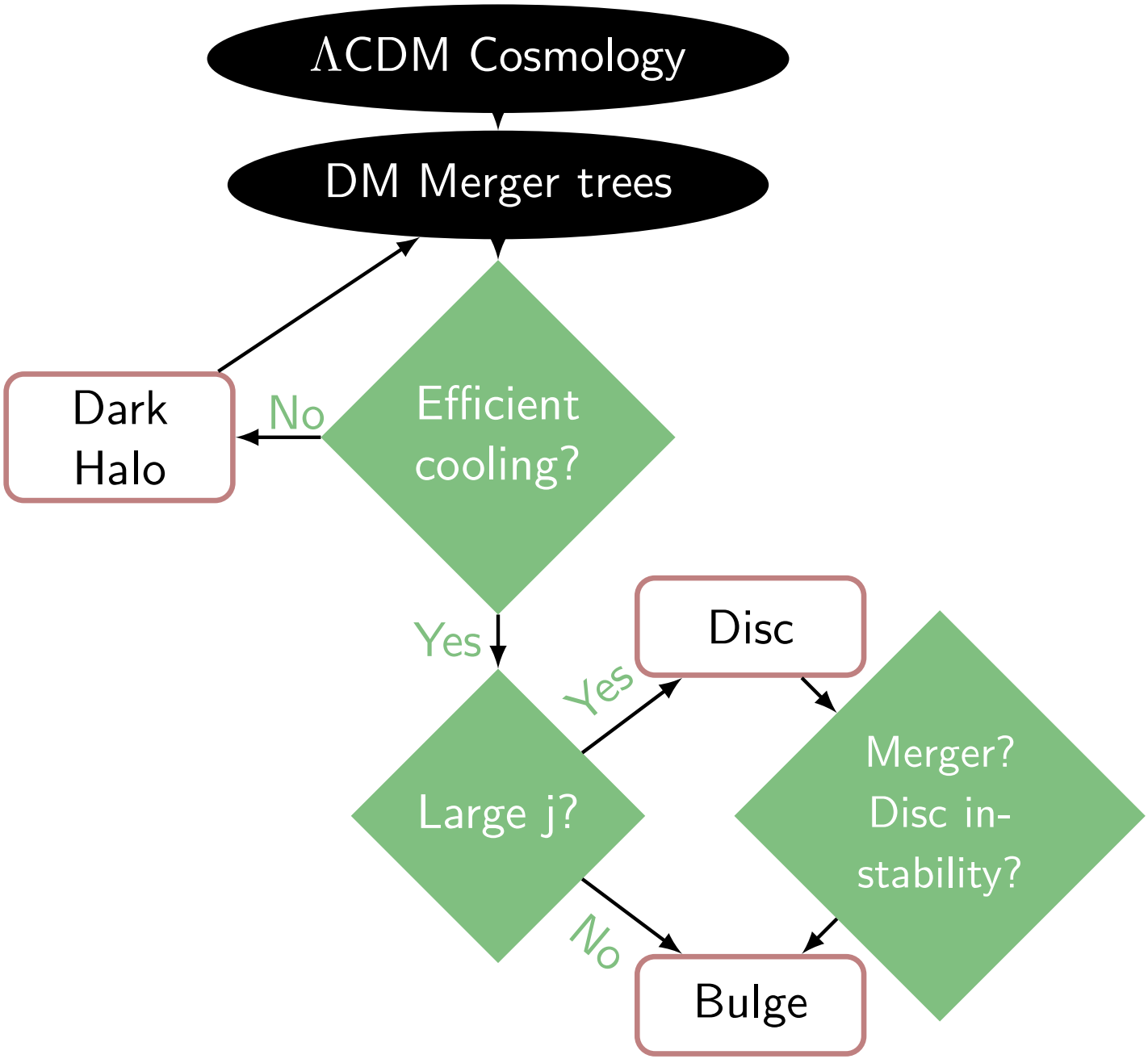
The galaxy stellar mass function

Let's normalized the galaxy stellar mass function around the knee of the observed one ($M_* = N \cdot M_{\rm halo} \cdot f_b$):

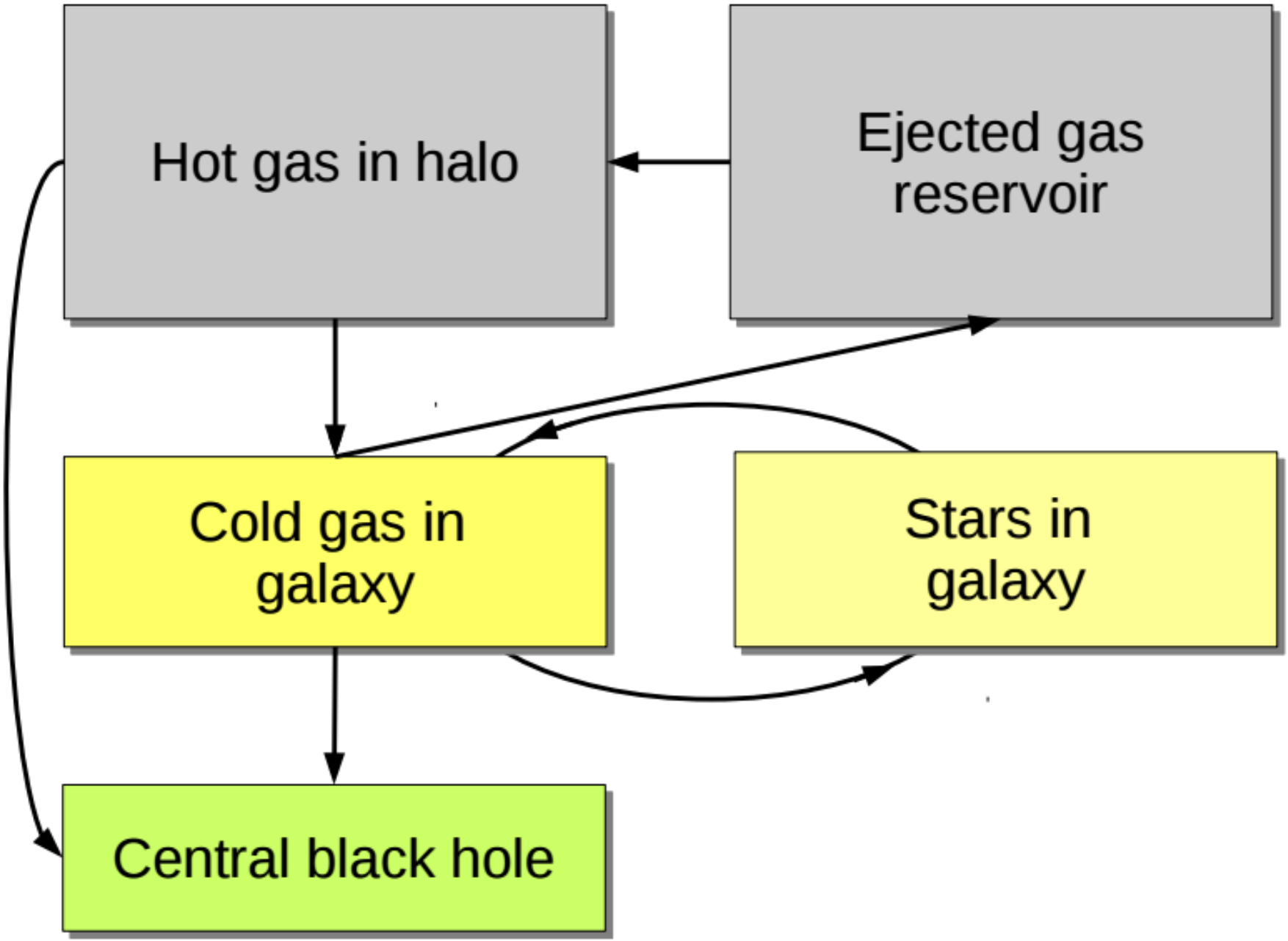


The shapes are still different! We need a better model to connect the luminose matter to the dark one.

Making galaxies in the computer with a semi-analytical model



The model baryonic component in a halo



The semi-analytical approach

Query for getting the stellar mass function

The following query gets the galaxy stellar mass function from the De Lucia et al. 2006 model, which is a comprehensive model of galaxy formation and evolution:

```
select .1*(.5+floor((log10(stellarMass)+10.)/.1)) as
mass,
log10(count(*)/power(62.5,3.)/.1) as phi
from millimil..DeLucia2006a
where snapnum = 63 and stellarMass > 0
group by .1*(.5+floor((log10(stellarMass)+10.)/.1))
order by mass
```

The galaxy stellar mass function

Plotting the result of the previous query, together with the other results: