

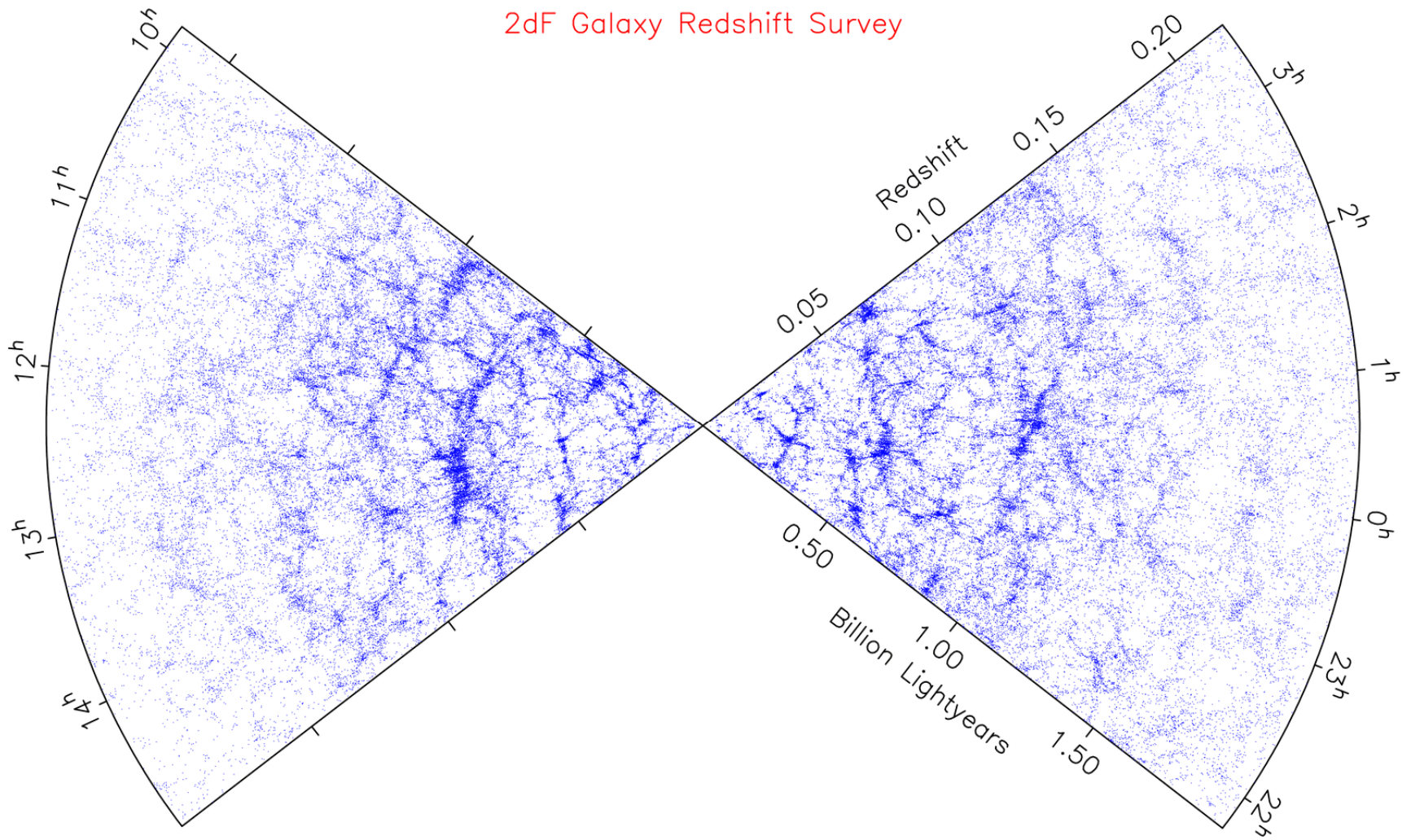
---

# Chapter 8

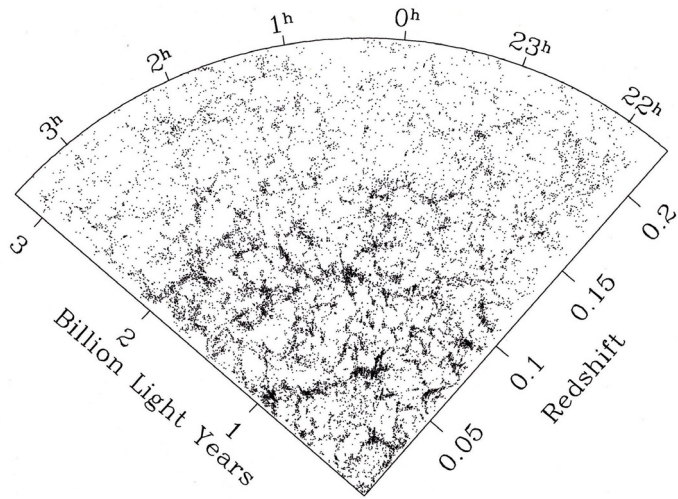
## Structure Formation

# Galaxy distribution

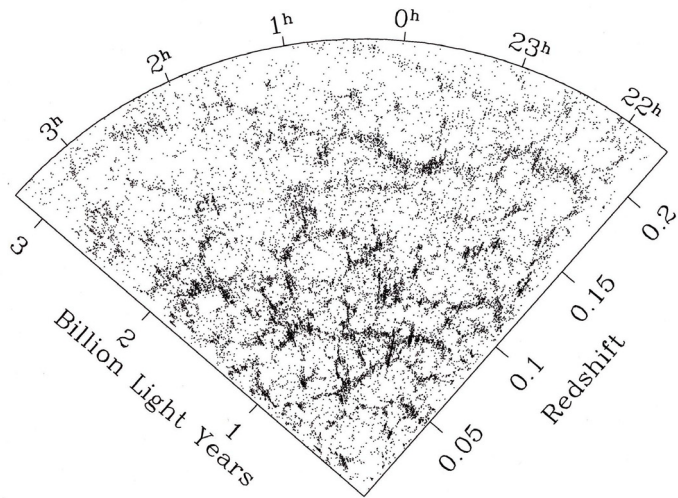
2dF Galaxy Redshift Survey



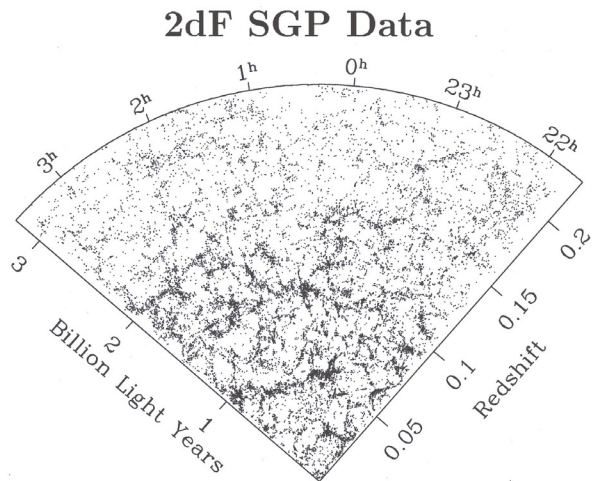
# Galaxy distribution



**Simulated and observed  
galaxy distributions:  
which is which?**



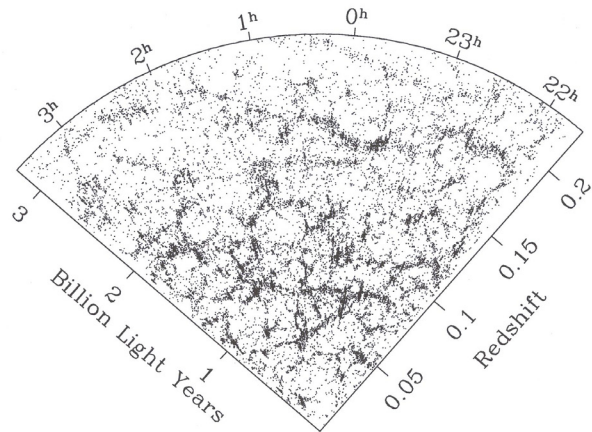
# Galaxy distribution



2dF Galaxy Redshift Survey: May 2000

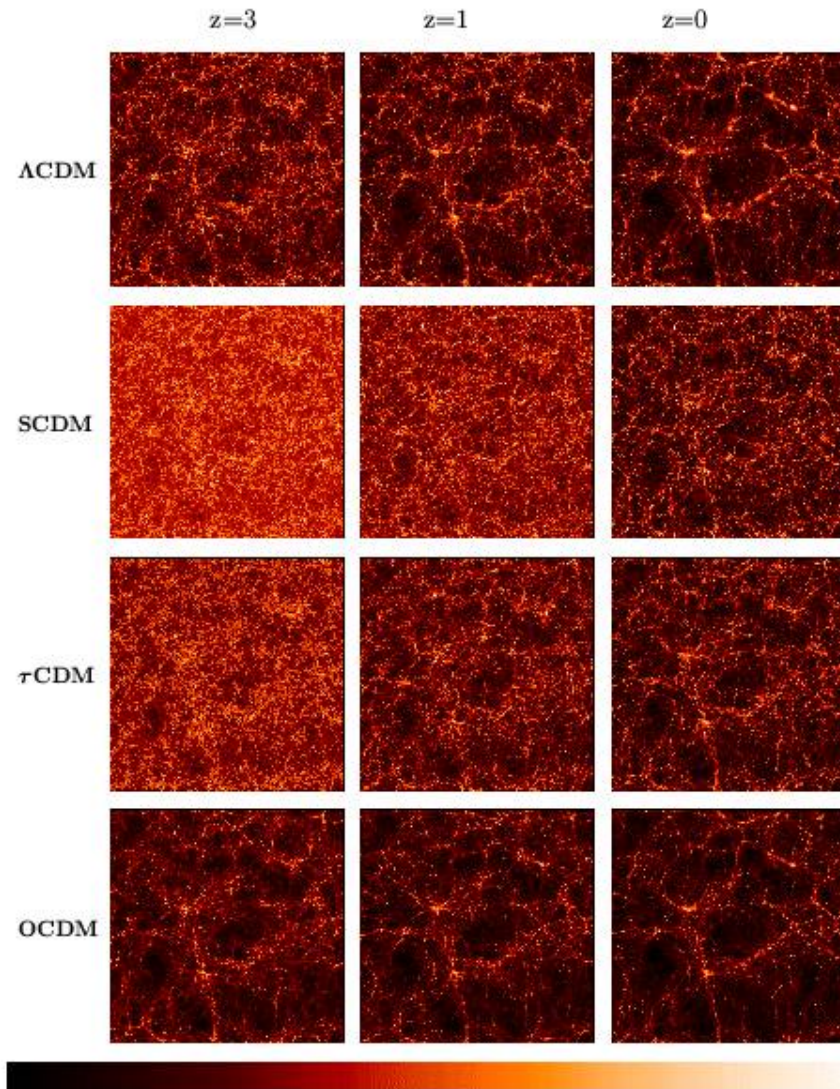
24,542 Galaxies (3° wide slice in dec)

$\Lambda$ CDM Mock Catalogue



... the answer

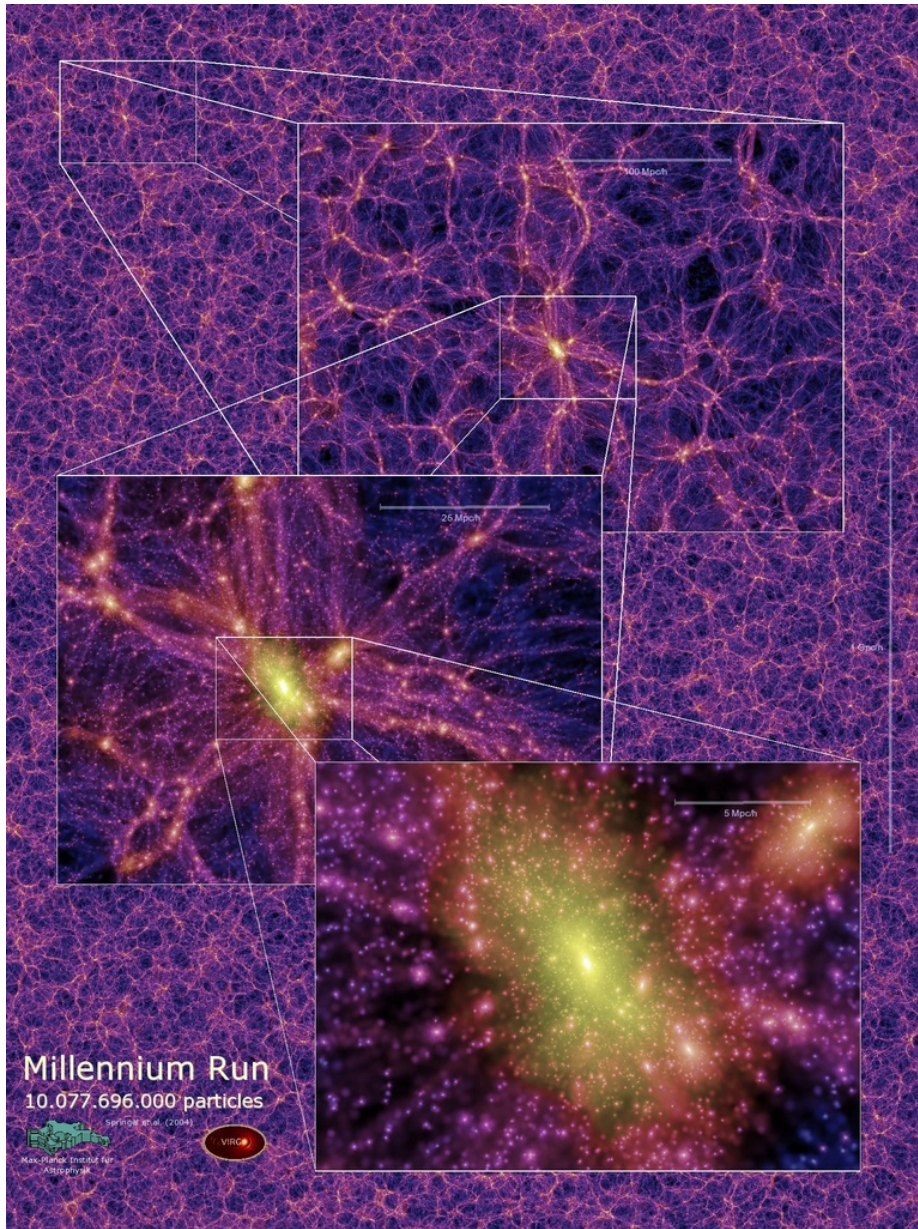
# Numerical $\Lambda$ CDM simulations



**Simulated large-scale structure for different cosmologies**

The VIRGO Collaboration 1996

# Numerical $\Lambda$ CDM simulations



## The Millennium simulation

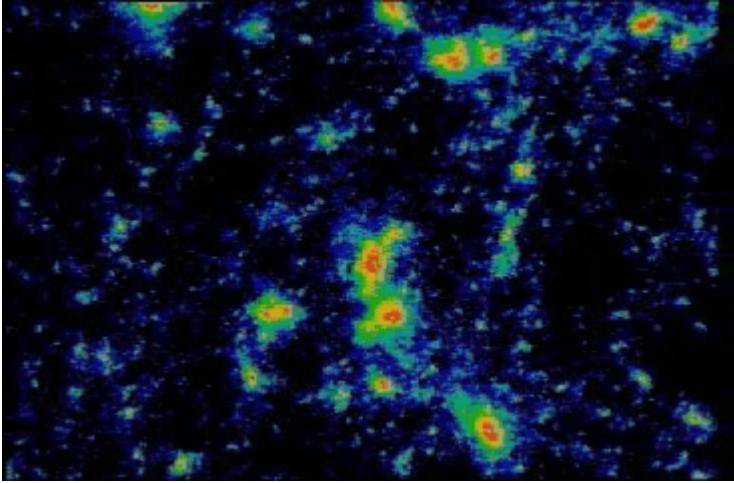
# Numerical $\Lambda$ CDM simulations



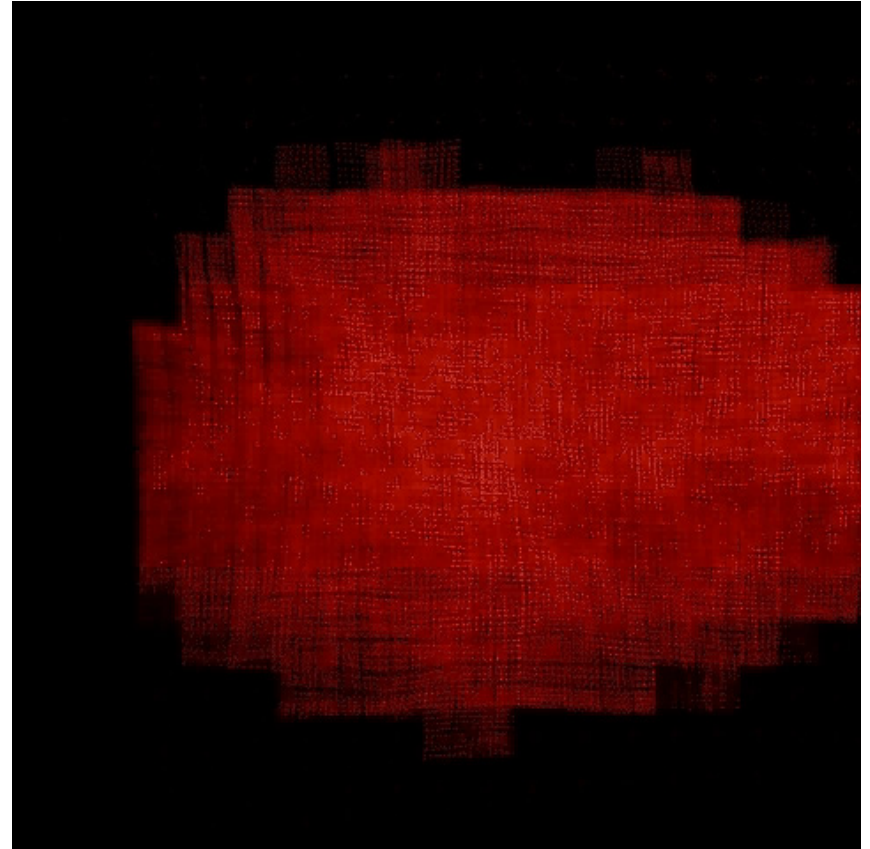
Computational efforts ...

# Numerical $\Lambda$ CDM simulations

## Movies



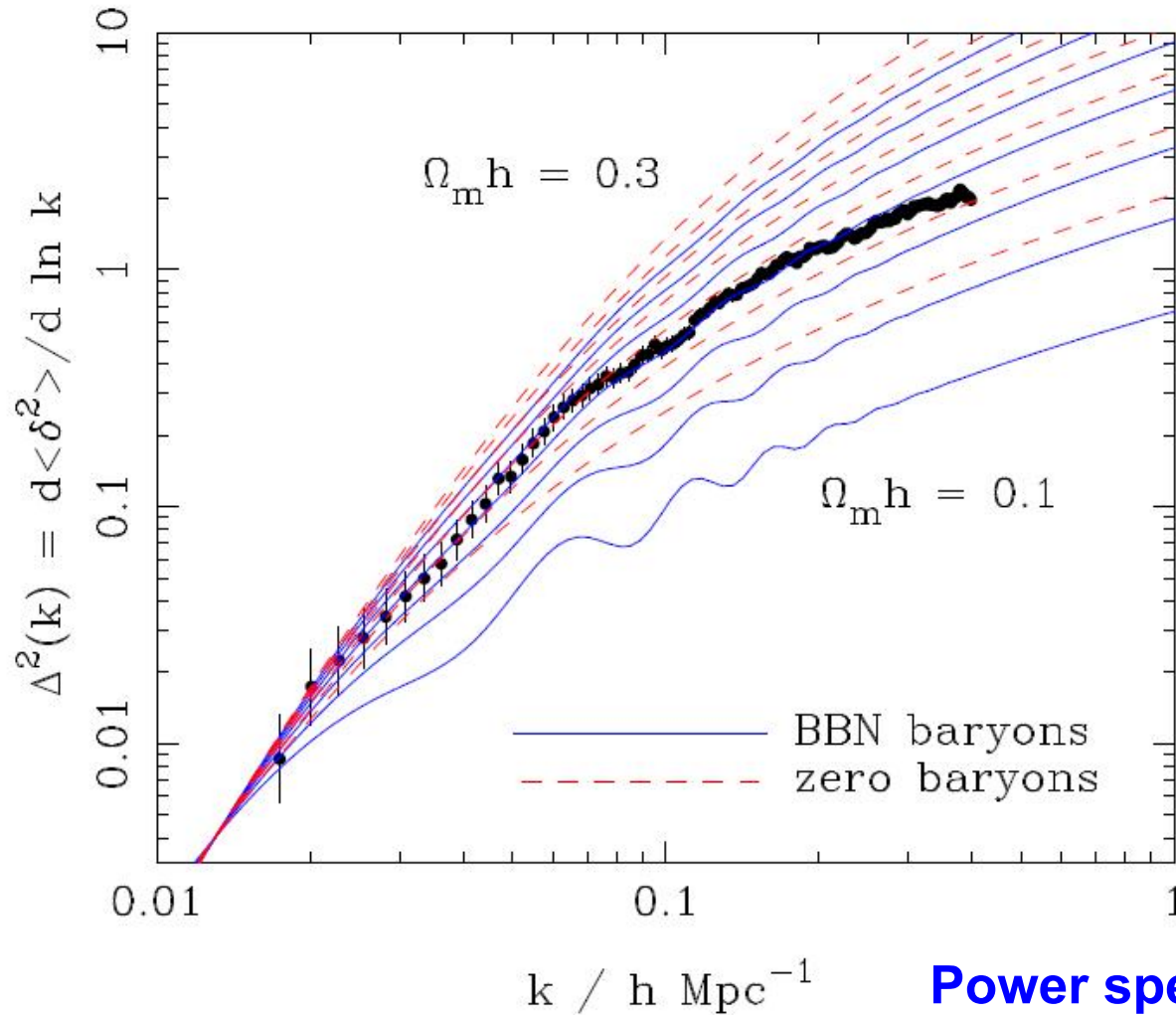
**cluster**



**large galaxy**

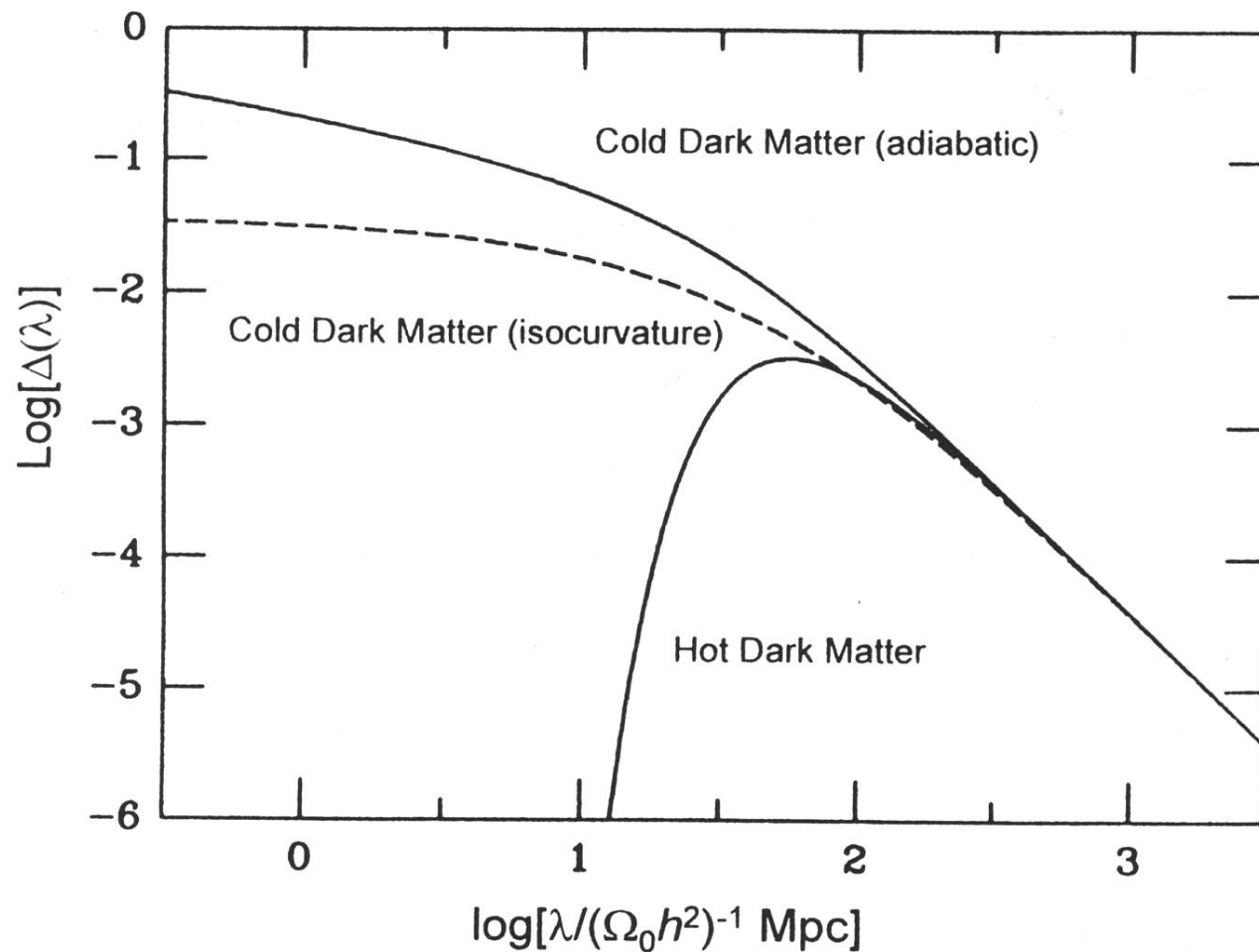


# Simulations and observations



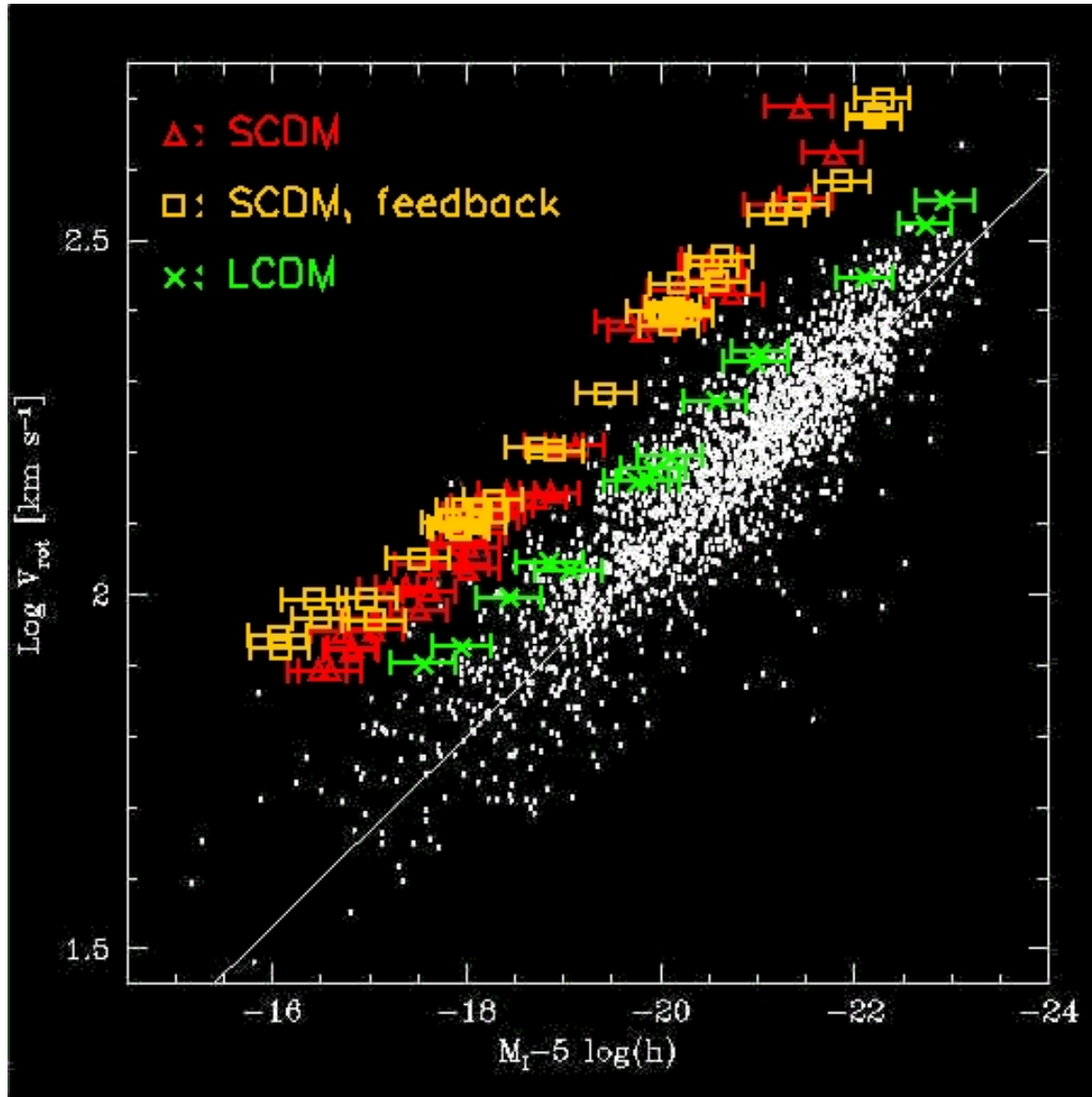
**Power spectrum of galaxy distribution is accurately reproduced by simulations**

# Simulations and observations



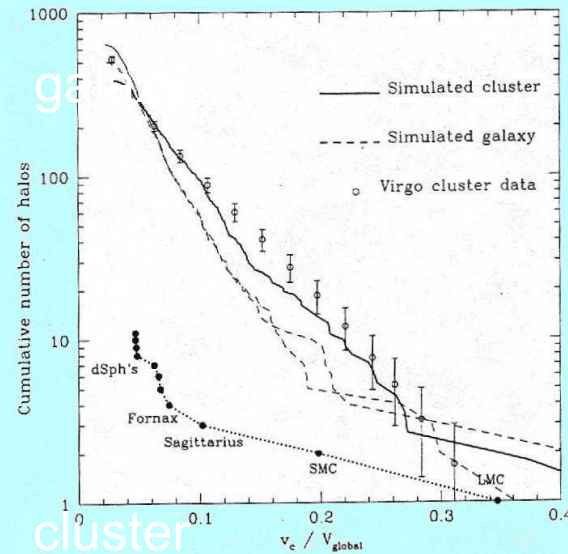
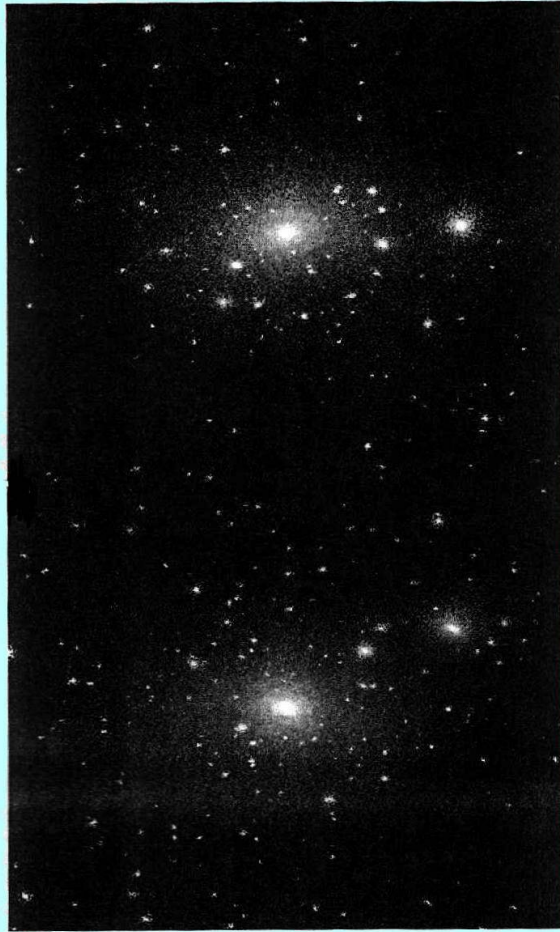
**hot dark matter is out!**

# Problems with $\Lambda$ CDM



Tully-Fischer relation is offset

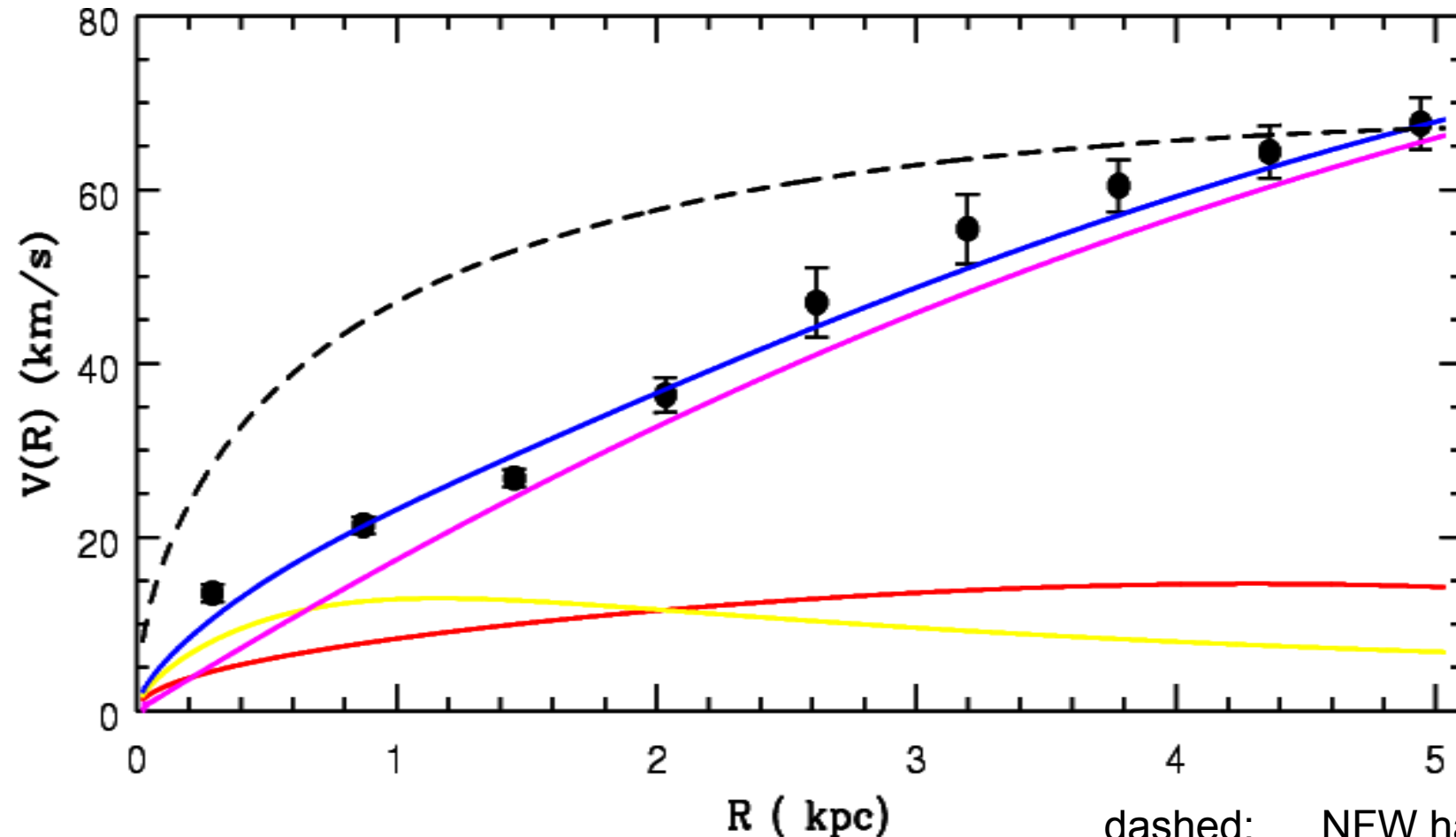
# Problems with $\Lambda$ CDM



**Milky Way possesses  
too few satellite halos**

**(“missing satellites”)  
works for Virgo Cluster**

# Problems with $\Lambda$ CDM



**Rotation curve of a dwarf galaxy:  
NFW profile overpredicts central densities  
of DM in galaxies ('cusp problem')**

dashed: NFW halo  
yellow: stars  
red: gas  
magenta: Burkert halo  
blue: total

# Web sites for numerical simulations

---

<http://www.mpa-garching.mpg.de/~volker/gadget/index.html>

<http://www.mpa-garching.mpg.de/galform/millennium>

<http://www.virgo.dur.ac.uk/new/index.php>

<http://www.aip.de/People/MSteinmetz/Movies.html>