

# Dark Matter in the Solar Neighborhood



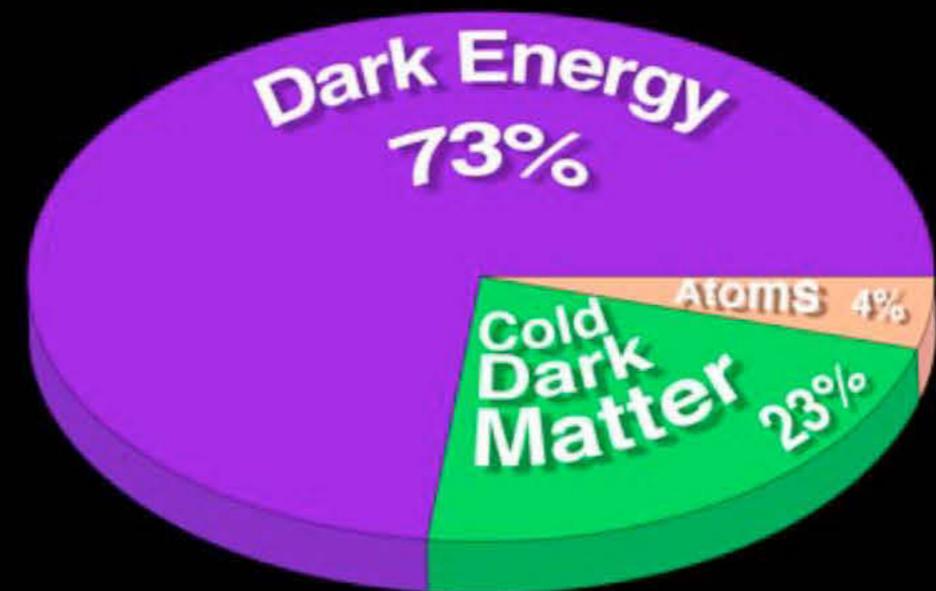
Adam Rivas  
August 1st, 2012

# Outline

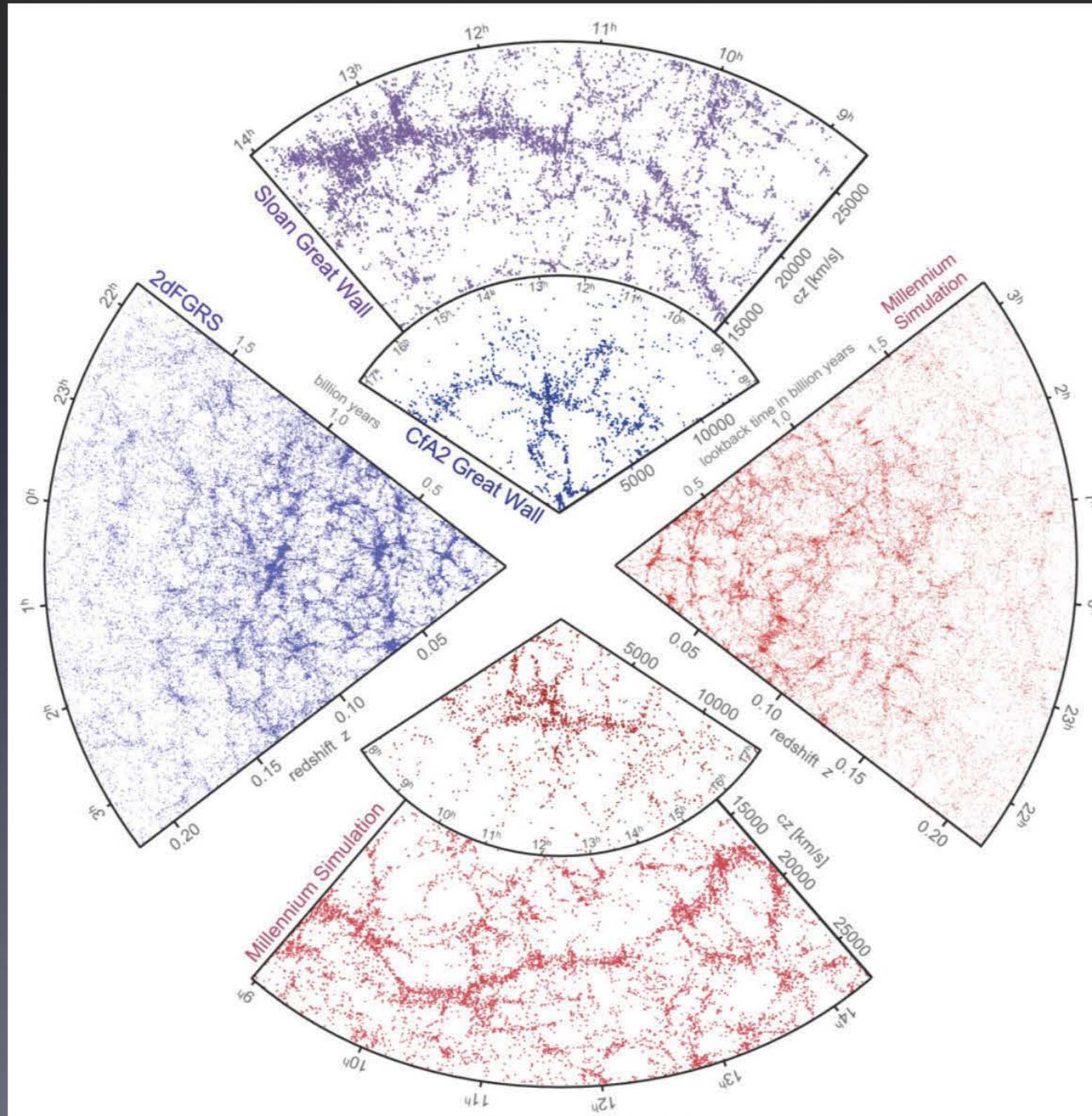
- Dark Matter: What do you know about it?
- Moni Bidin's claim on Dark Matter
- My results
- Why I got the results I did

# What is dark matter?

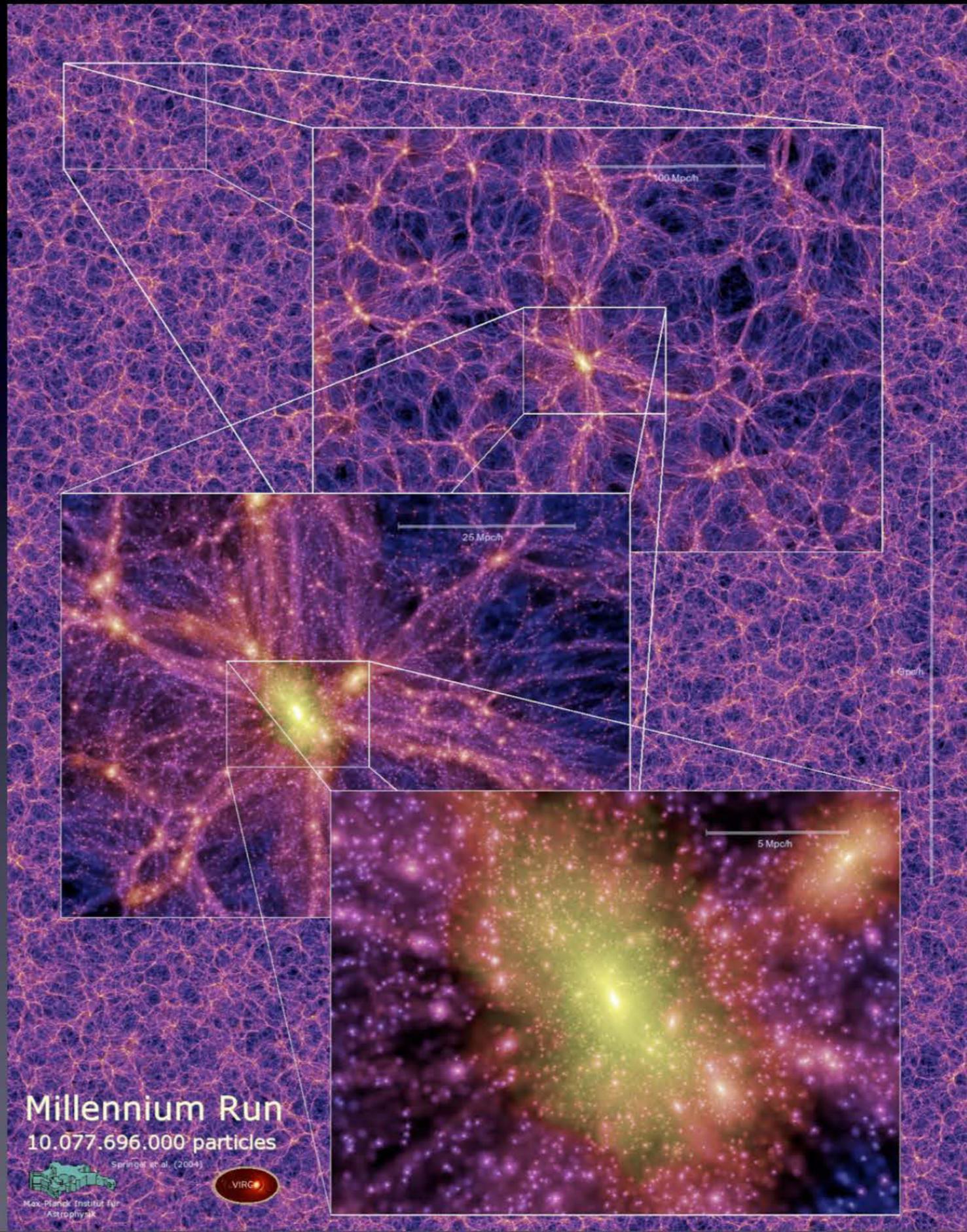
- 85% of the mass in galaxies and clusters of galaxies are made up of unknown dark matter component.
- 23% of mass-energy
- Guess it is a WIMP/axion
- People trying to detect it
- A big mystery



# Dark Matter Distribution

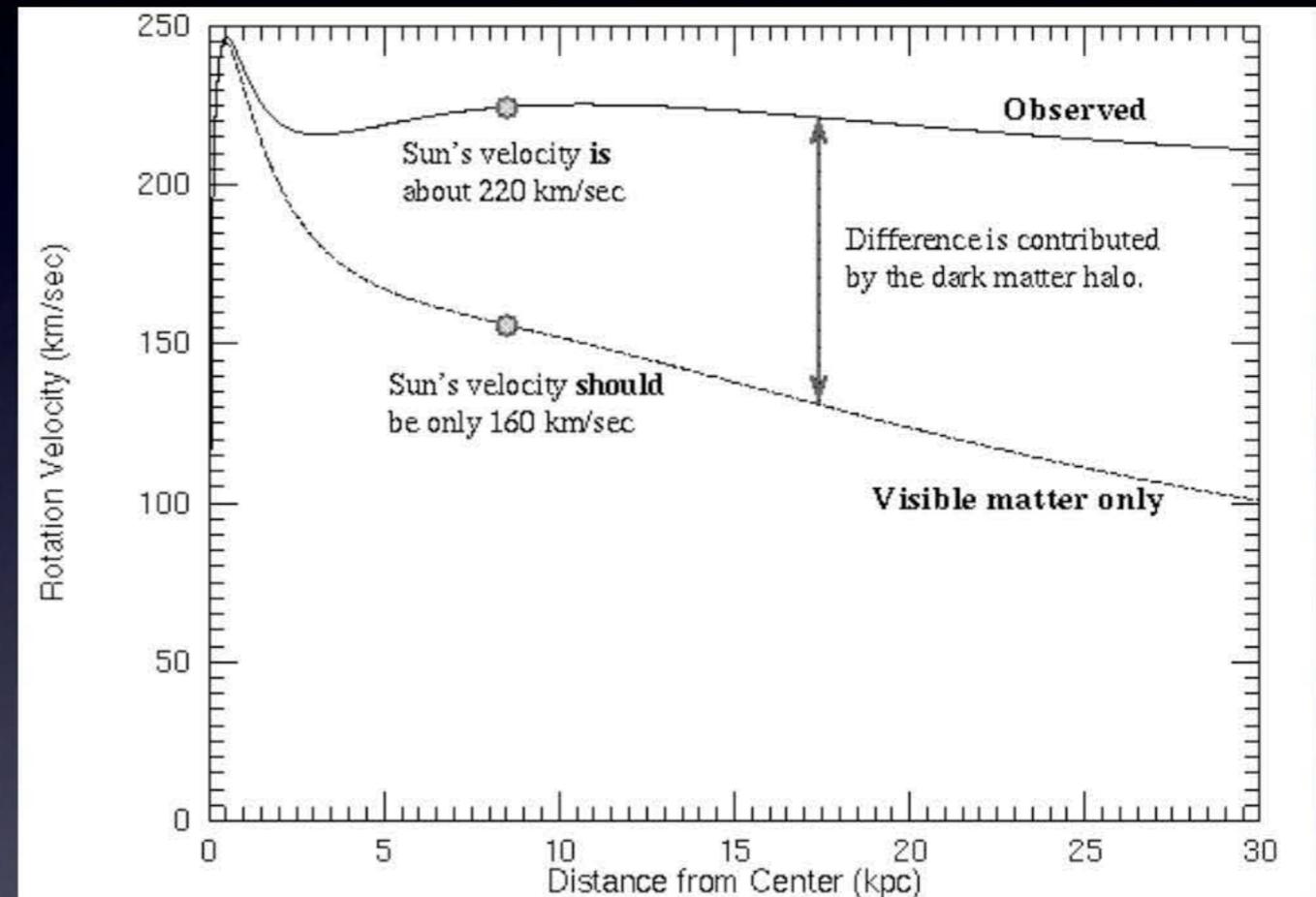


- This is a simulation of how dark matter is distributed



# Why do we believe in it?

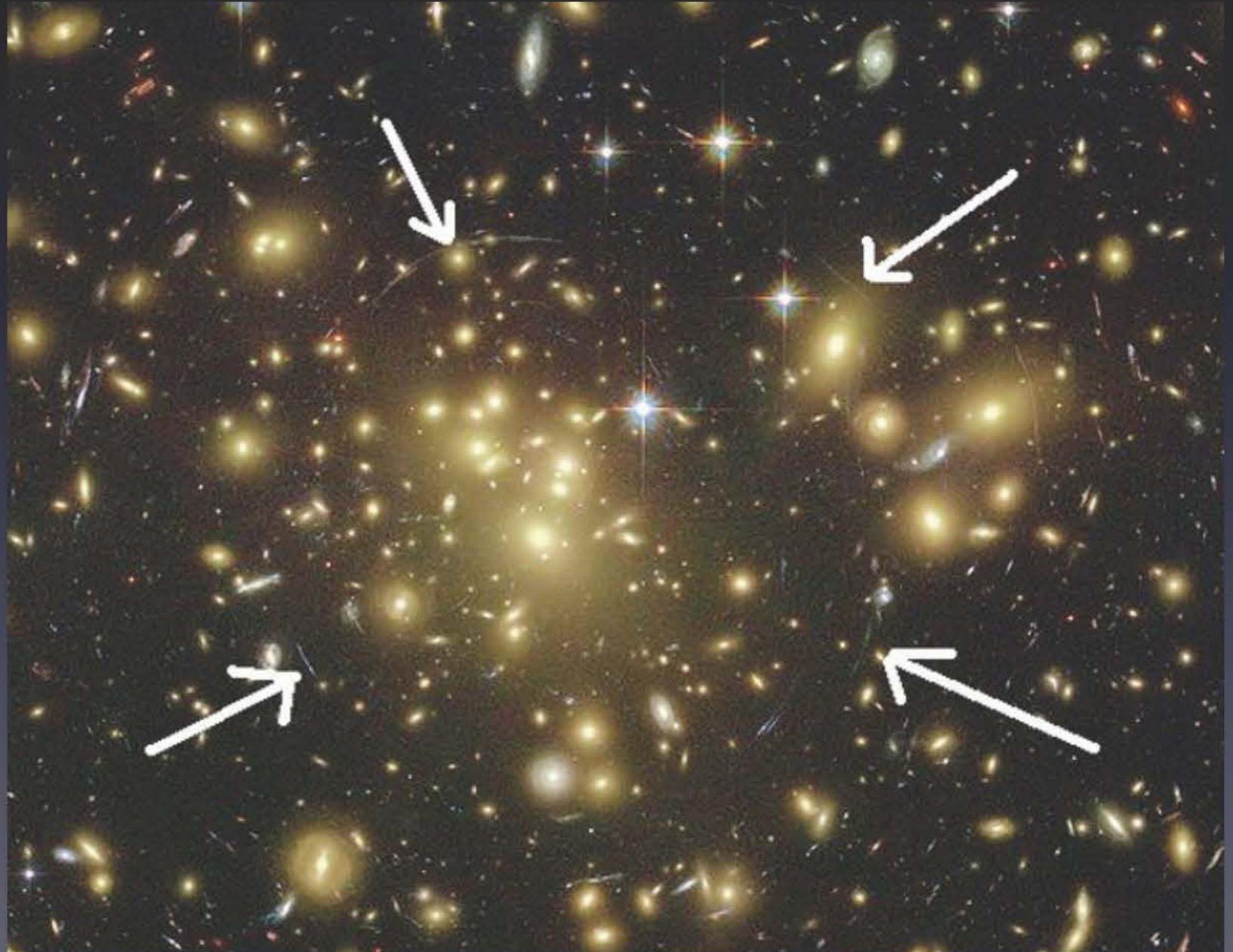
- Rotational curves
- Gravitational lensing
- Hot gas in clusters
- ...



The gravity of the visible matter in the Galaxy is not enough to explain the high orbital speeds of stars in the Galaxy. For example, the Sun is moving about 60 km/sec too fast. The part of the rotation curve contributed by the visible matter only is the bottom curve. The discrepancy between the two curves is evidence for a **dark matter halo**.

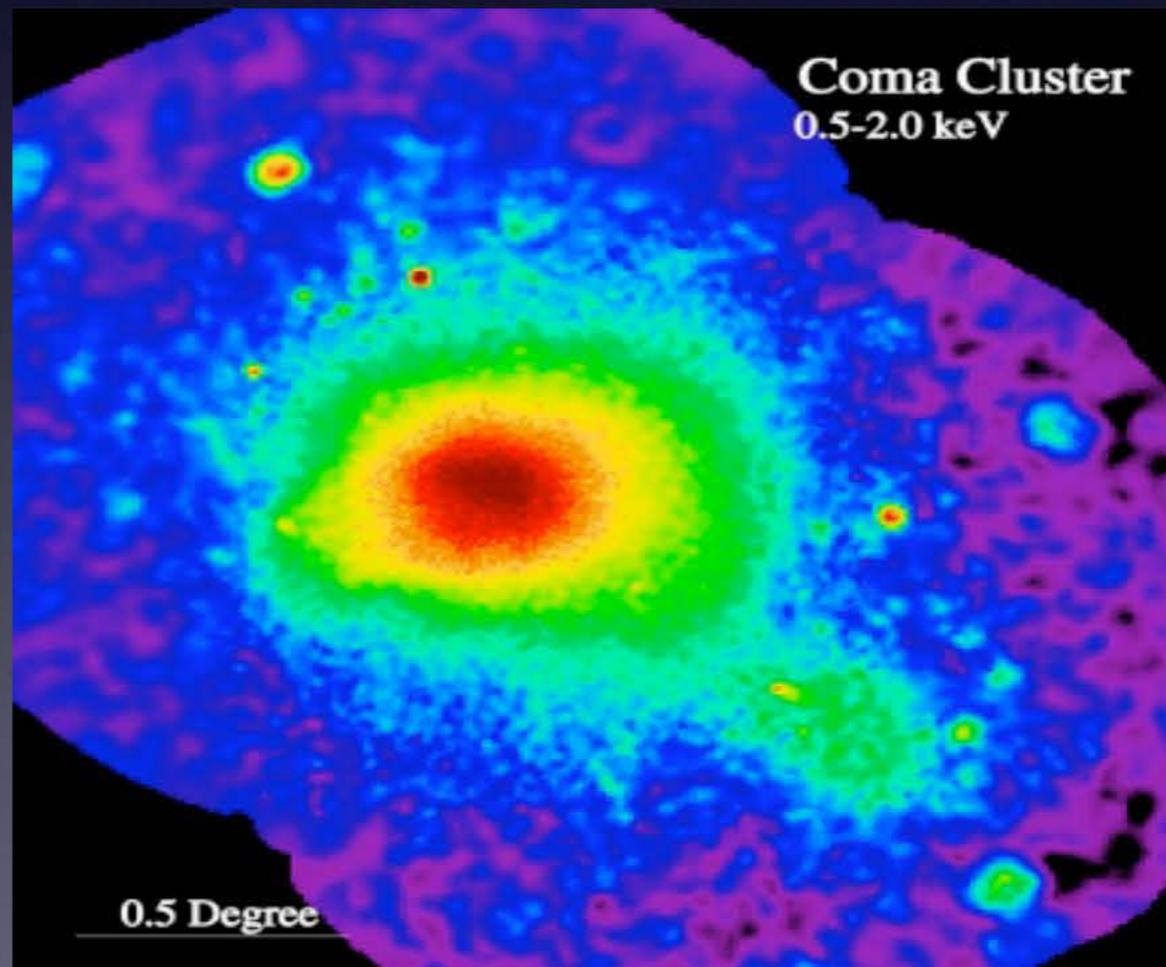
# Gravitational Lensing

- Dark Matter bends the light coming from galaxy clusters
- Distorts the light to look like thin arcs instead of circular shapes



# Hot gas in clusters

- Without dark matter, gas wouldn't be effected by gravity enough to stay together in clumps and it would evaporate



# Measuring mass with gravity

- Can calculate mass of sun with position/velocity of earth
- Galaxies have stars which have velocity
- Can calculate mass of galaxy with position/velocity of stars



# Moni Bidin's method



- Combines two equations to form a complex method to calculate total surface mass density
- Makes 10 assumptions in order to simplify the equation

# Big buzz in astrophysicist community

Science **NOW**

UP TO THE MINUTE NEWS FROM SCIENCE

Has Dark Matter gone missing?

**NewScientist**

Nearby Dark Matter Mysteriously Missing



Dark Matter  
Density Near Earth?



Serious  
Blow to  
Dark  
Matter  
Theories?



**NATIONAL  
GEOGRAPHIC™**

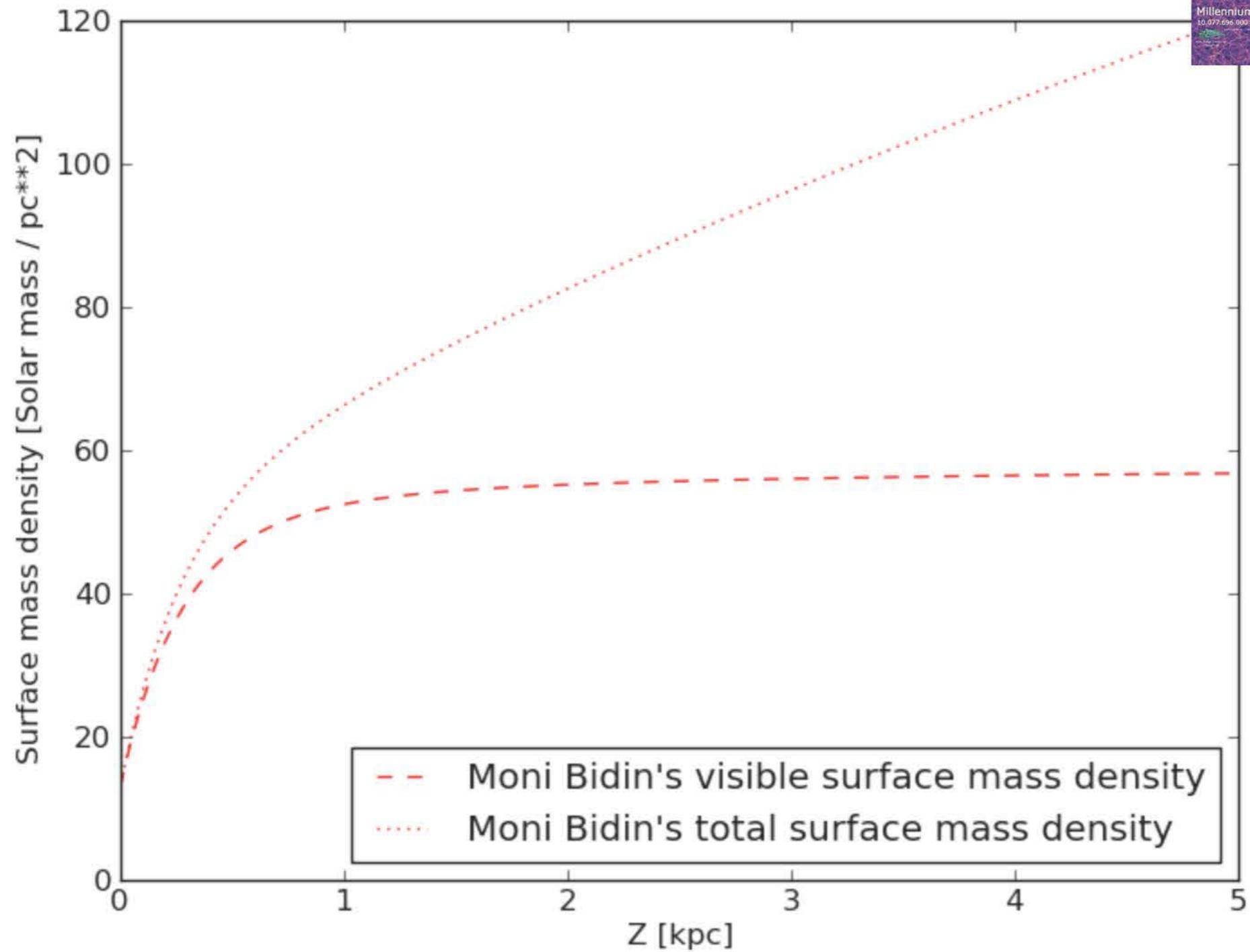
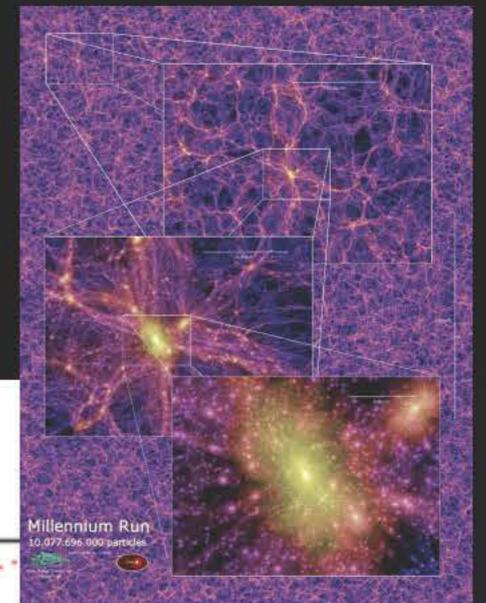
Dark Matter is  
Missing in the Sun's  
Neighborhood?

# What we did

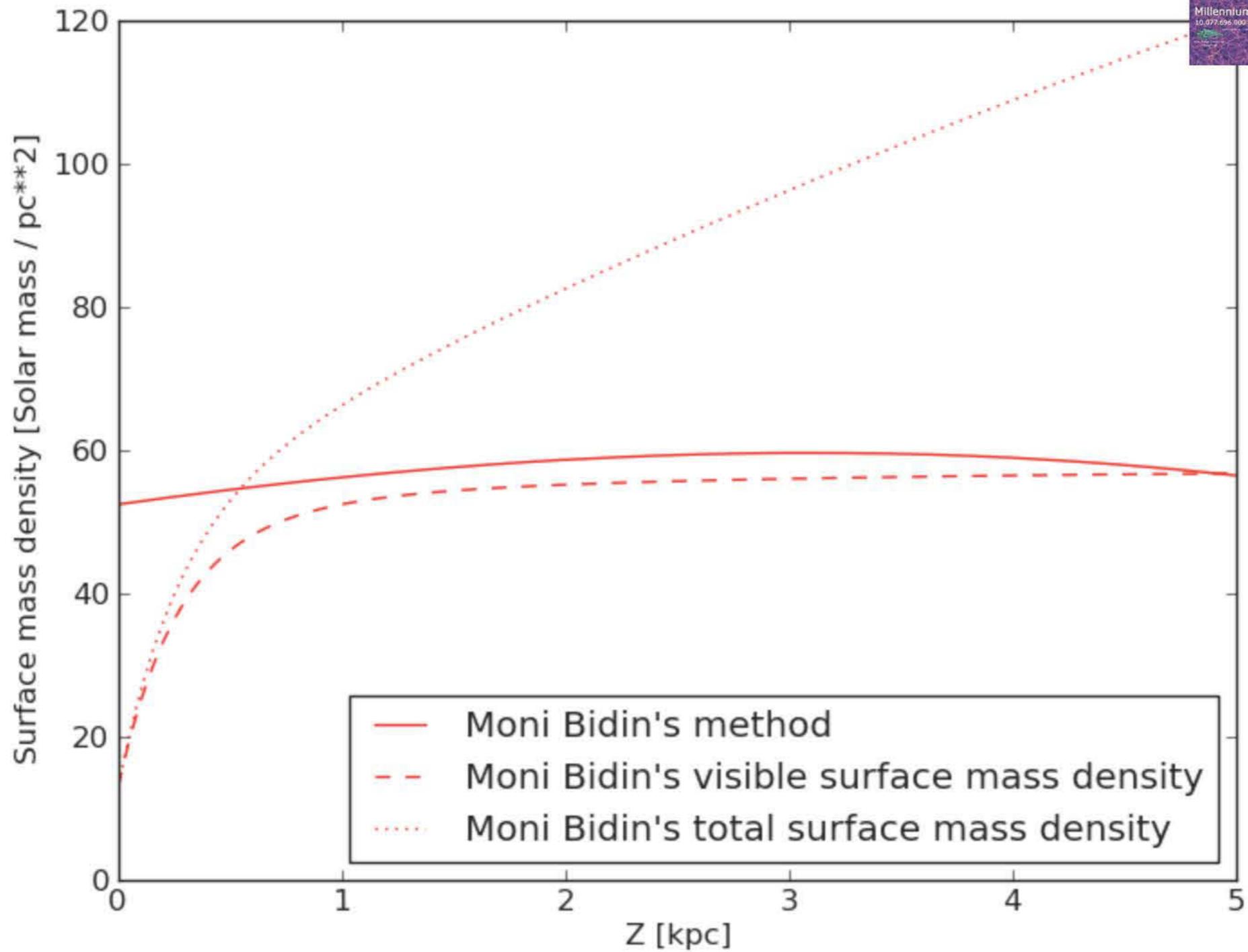
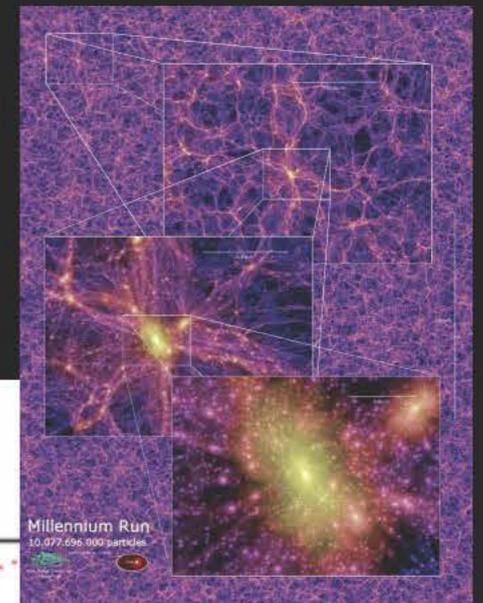
- Used low/high resolution simulations in order to graph the surface mass density in the solar neighborhood
- Test the assumptions
- Evaluate his claim and understand why he was right or not



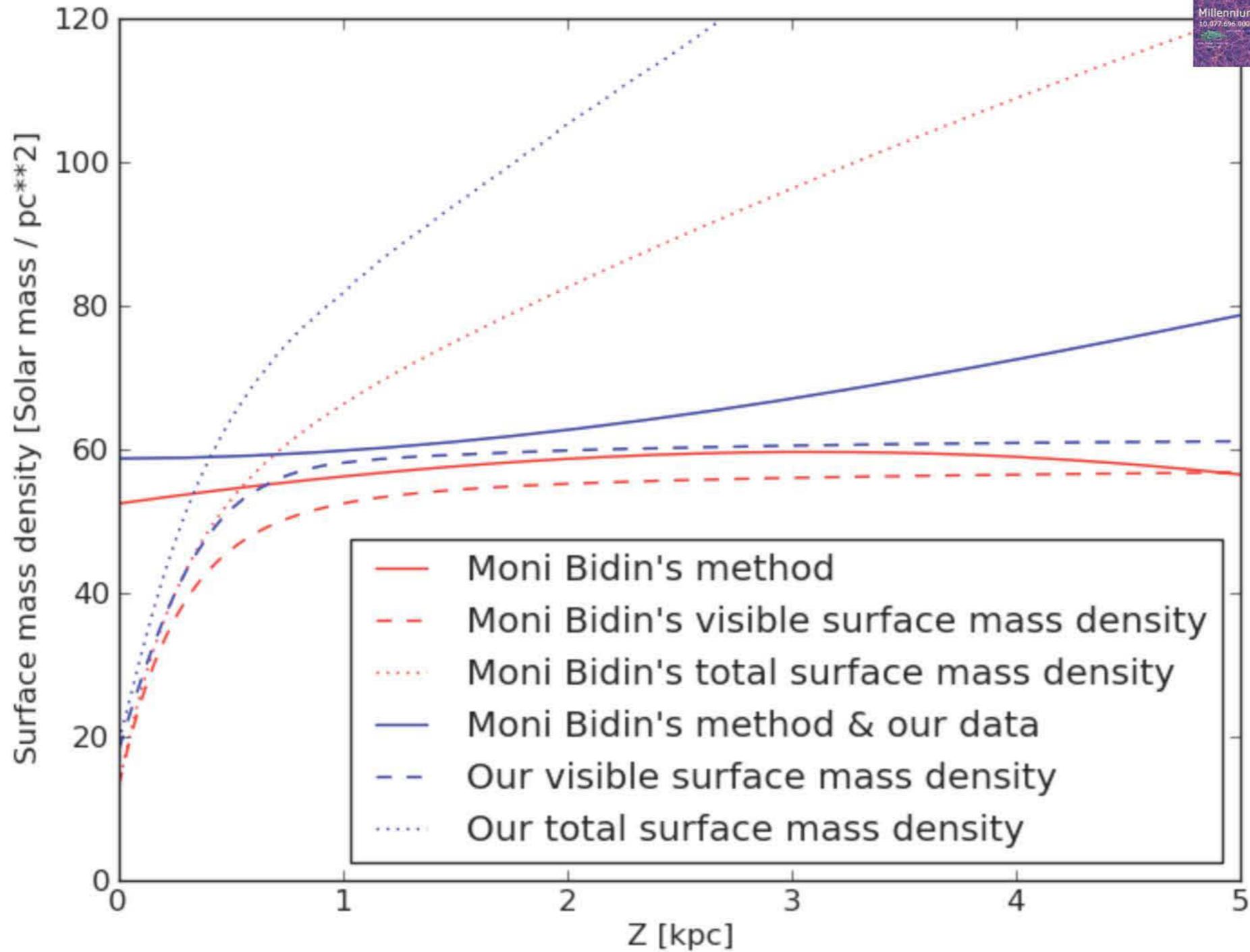
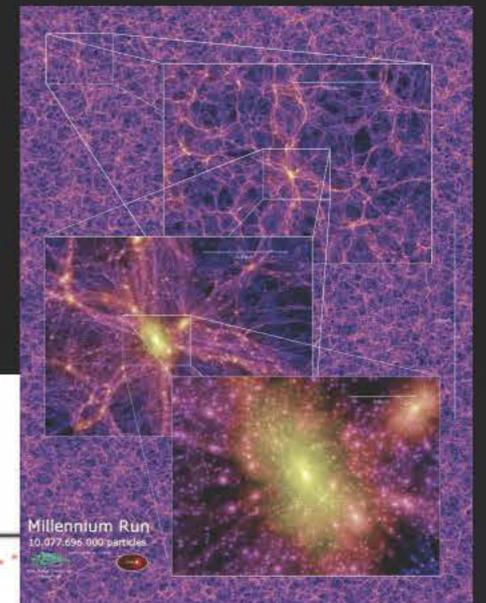
# Results



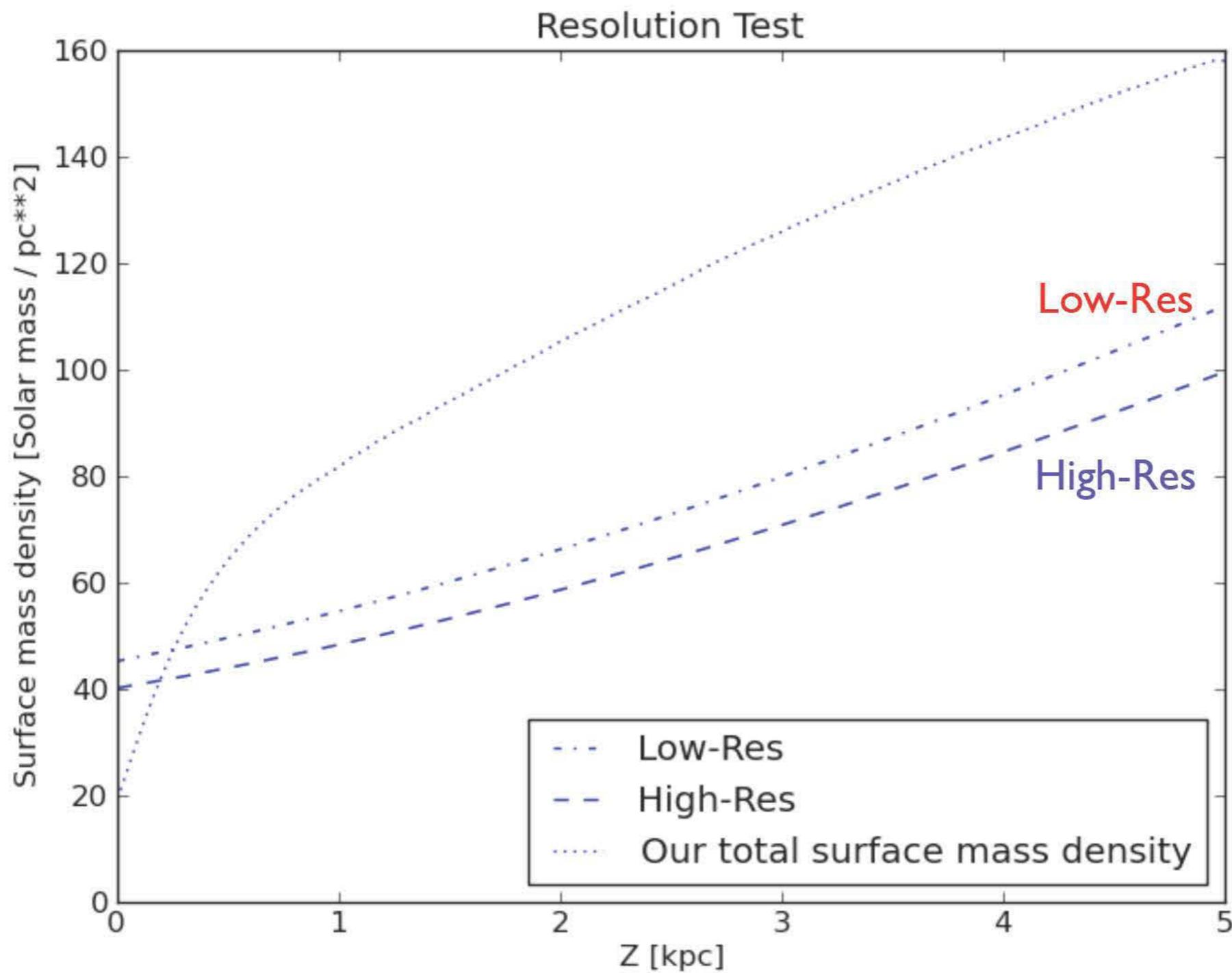
# Results



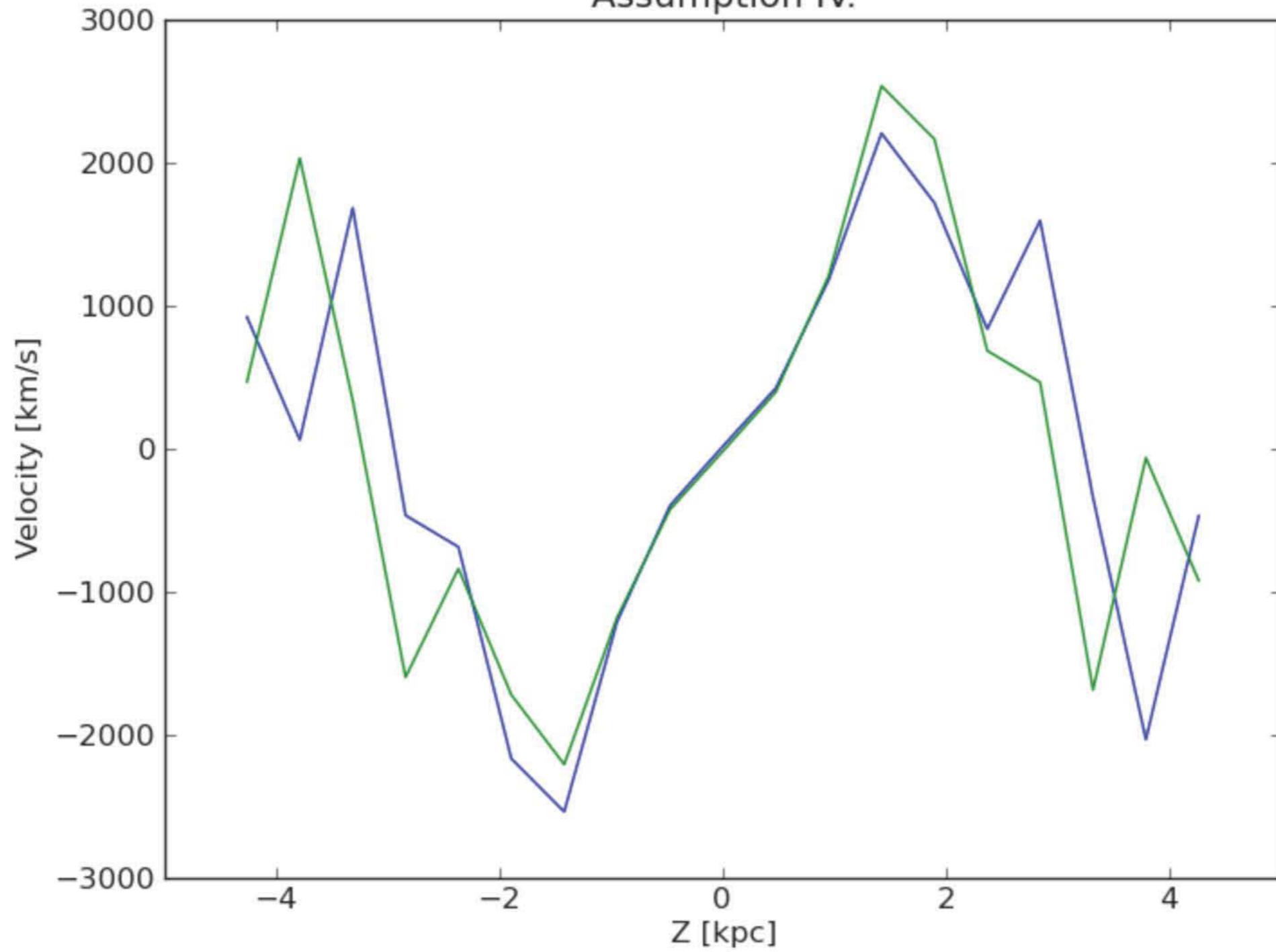
# Results



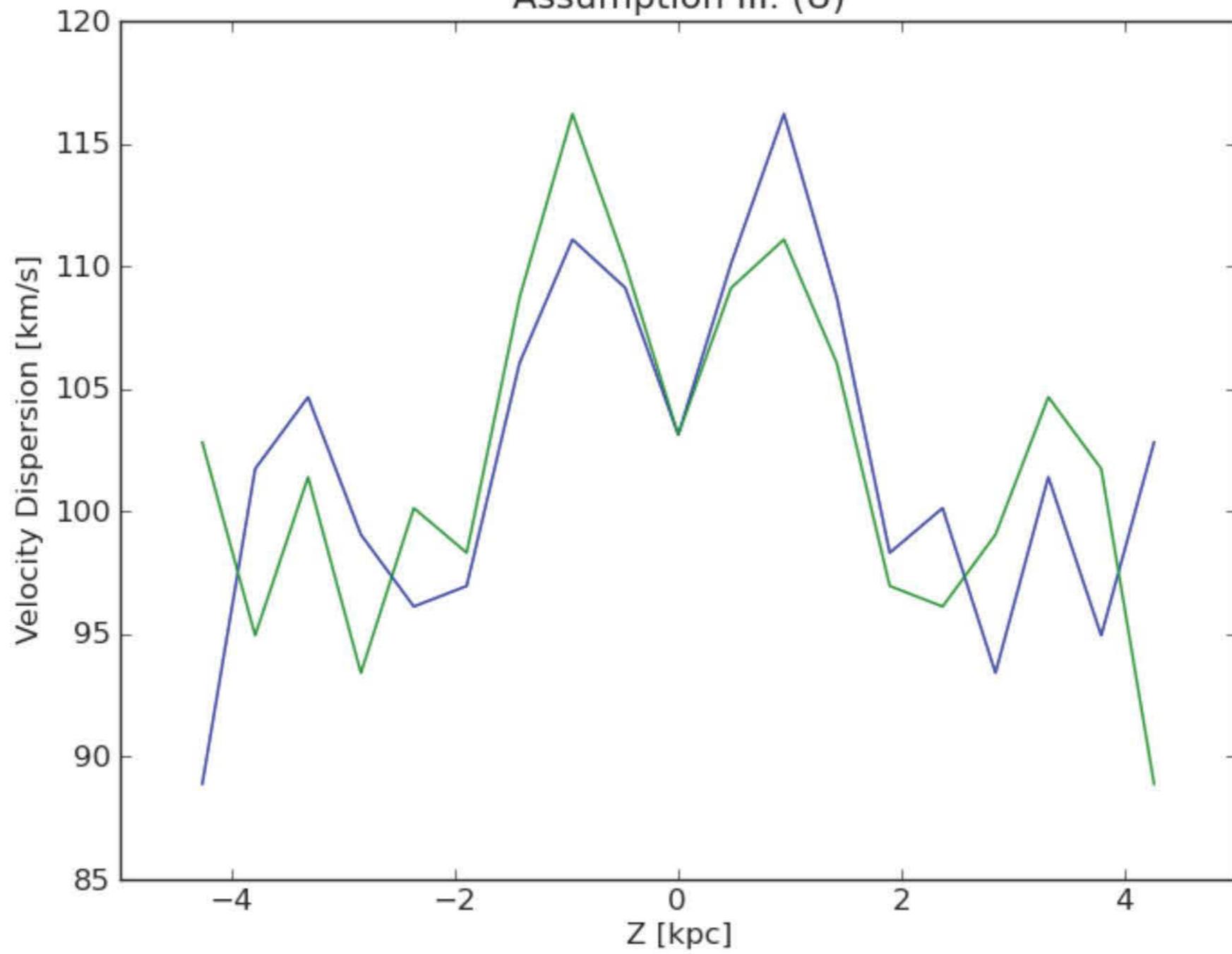
# Resolution Study



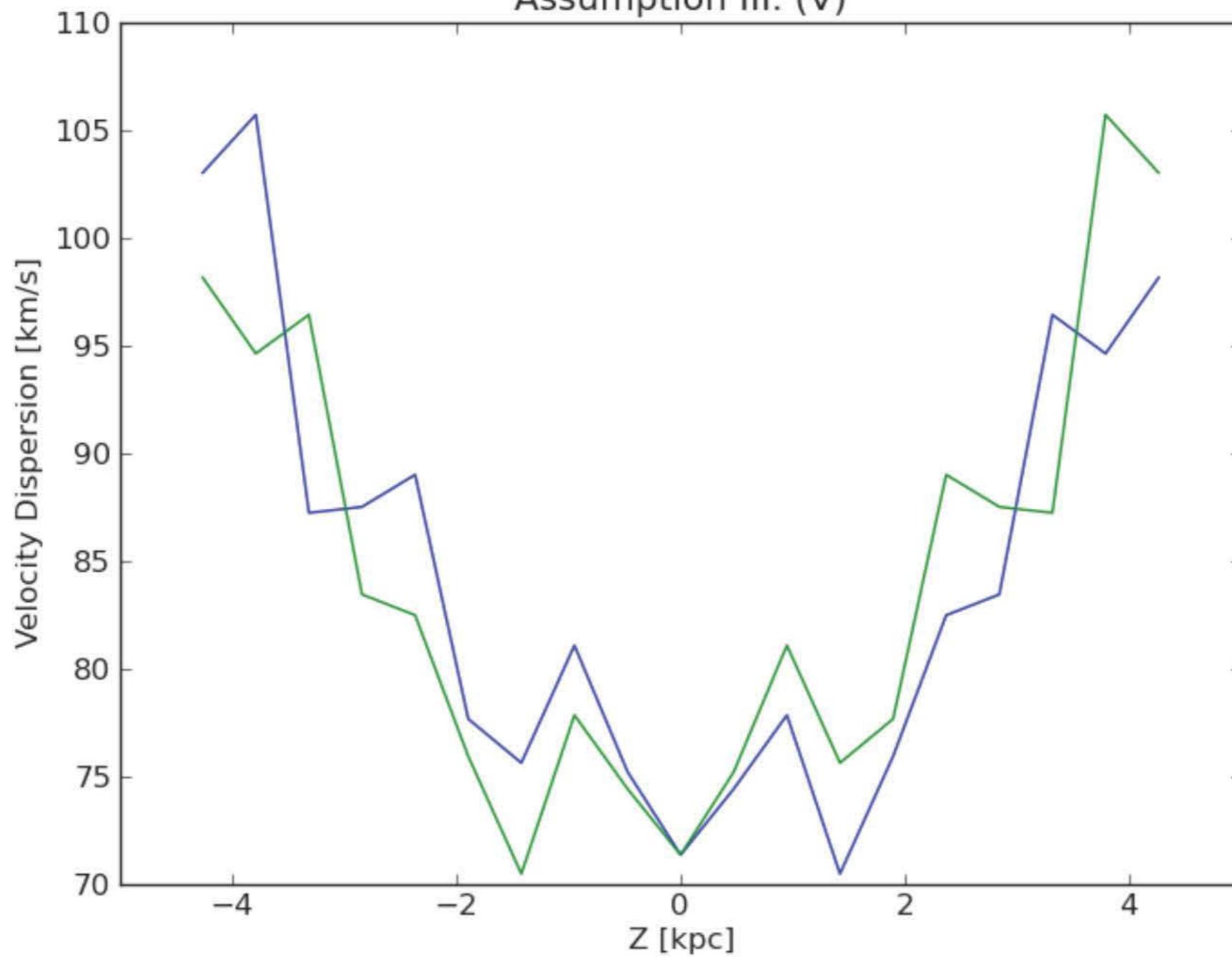
Assumption IV.



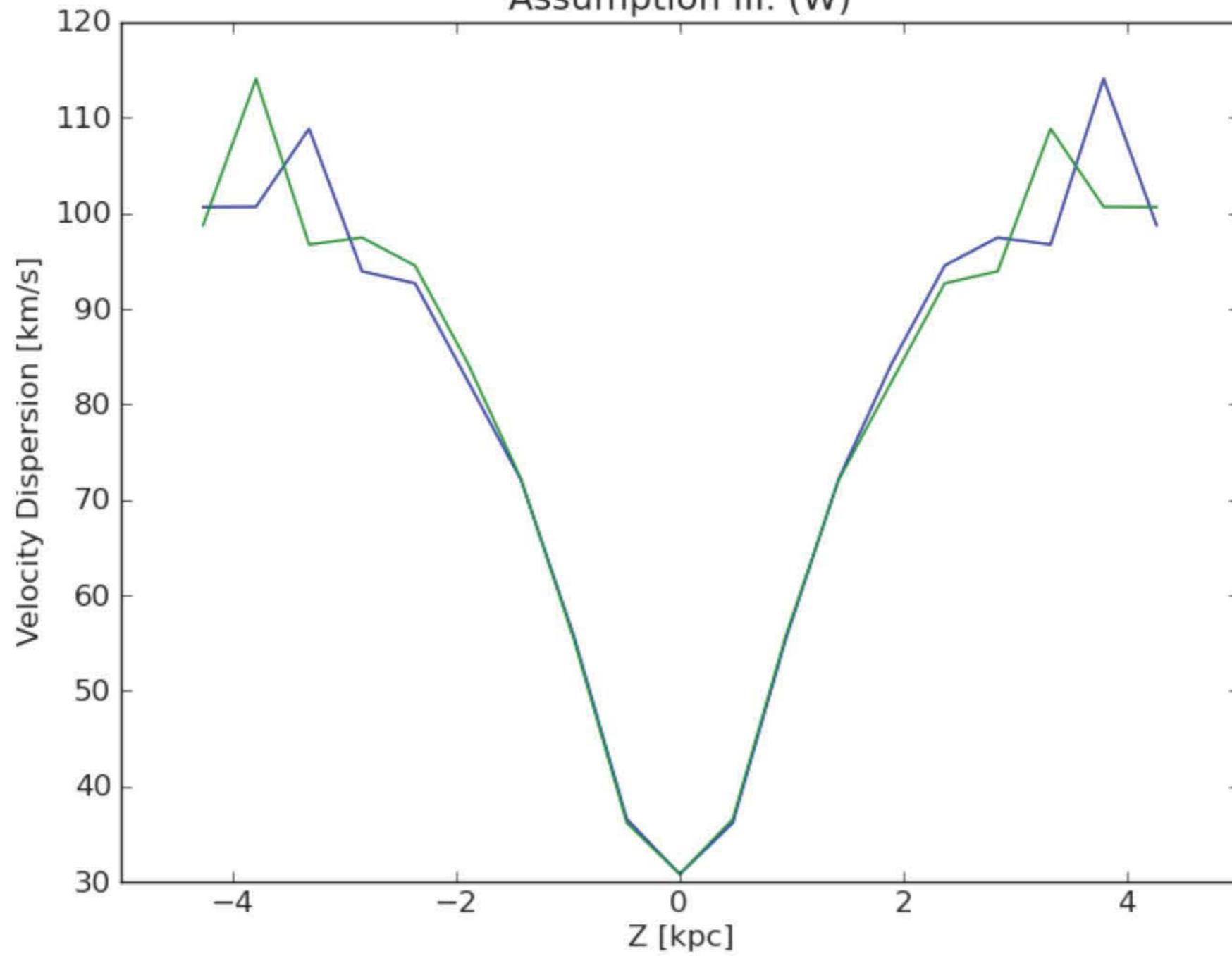
Assumption III. (U)

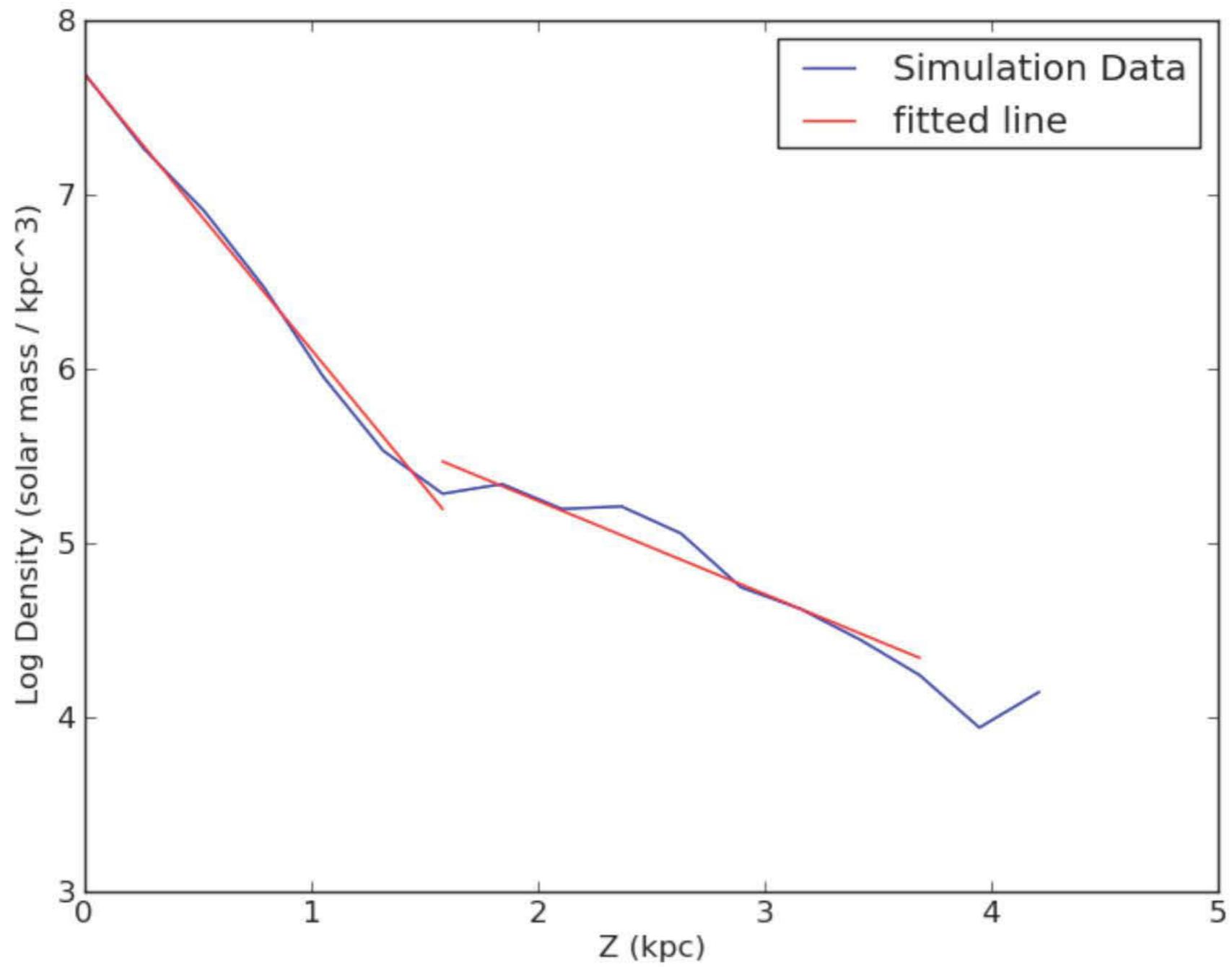


Assumption III. (V)



Assumption III. (W)





# Conclusion

- Very important topic to further investigate
- Moni Bidin's method is wrong
- Not all of the assumptions hold up to be true

