

A decorative header image showing a complex network of glowing purple and red filaments, representing the cosmic web or galaxy filaments.

The Formation of Planes of Satellite Galaxies

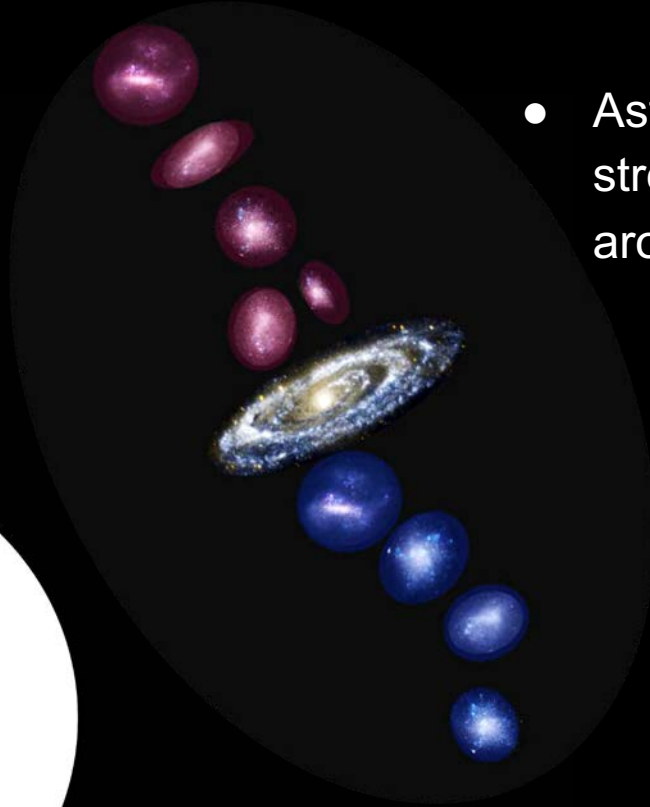
Resolving a Small Scale Tension with our Model of
Cosmology

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Susan Kassin, Angela Wroblewski, Christophe Pichon, Yohan Dubois, Sukyoung Yi

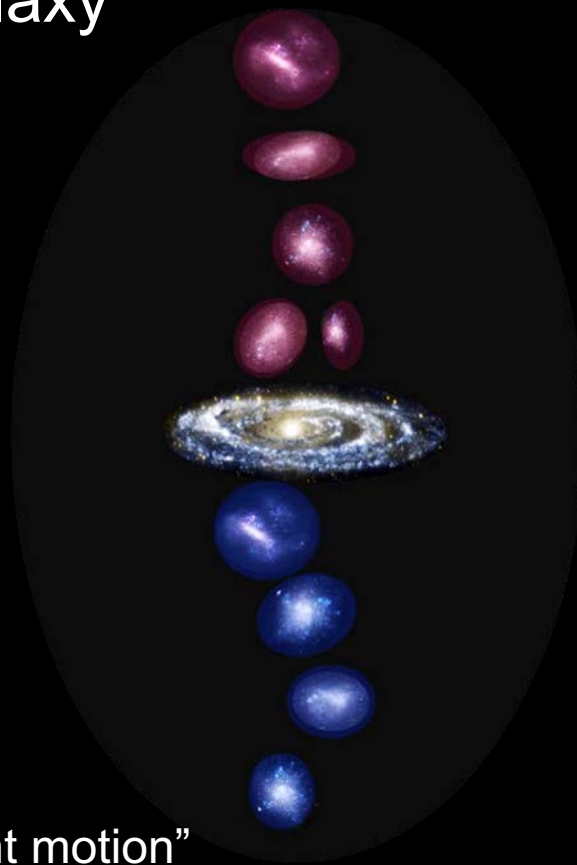
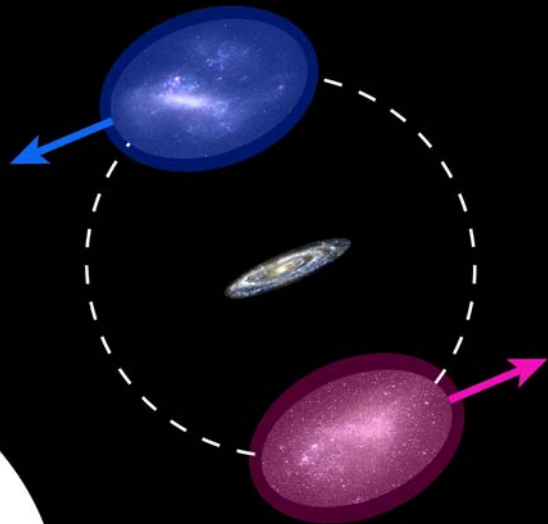
We Observe Planes of Satellite Galaxies in Local Universe

- Astronomers have long observed thin streams of satellite galaxies orbiting around other nearby galaxies.



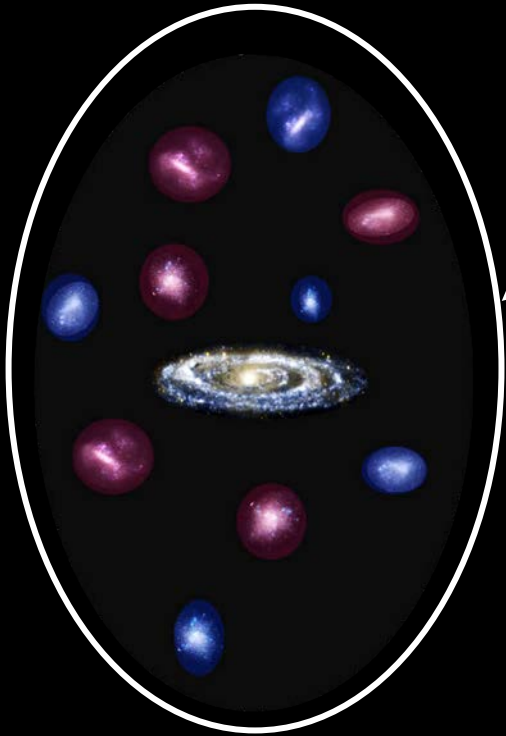
Galaxy Images adapted from NASA ESO

Most satellites in a plane orbit their host galaxy
in the same direction



“Coherent motion”

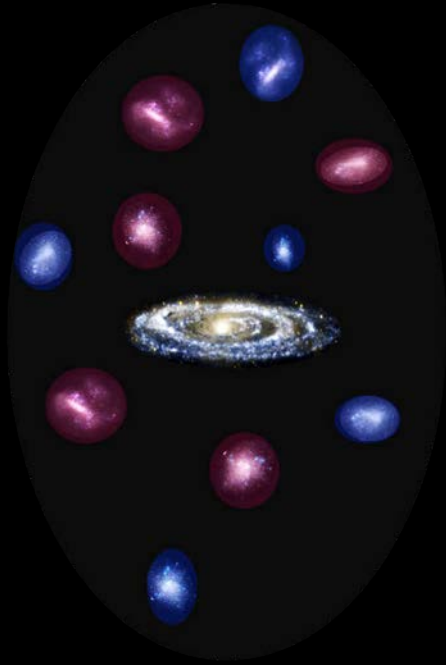
Most simulations of the Universe struggle to find similar planes



Prediction from simulations:

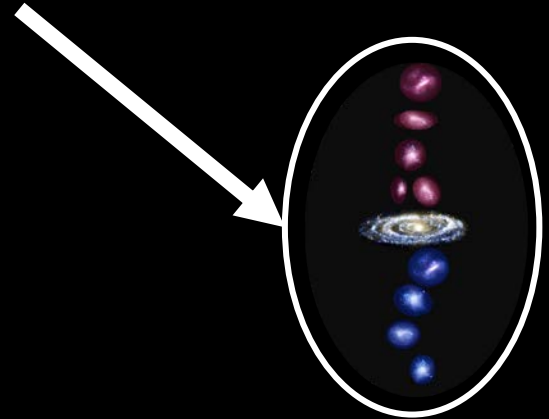
Satellites have much more random orbits around the central galaxy.

Most simulations of the Universe struggle to find similar planes

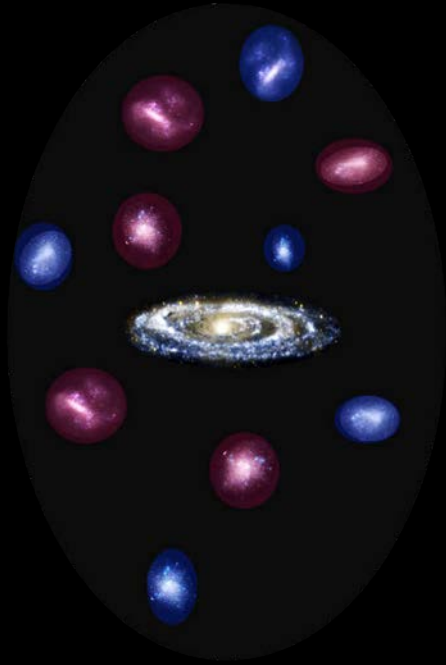


prediction from simulations:

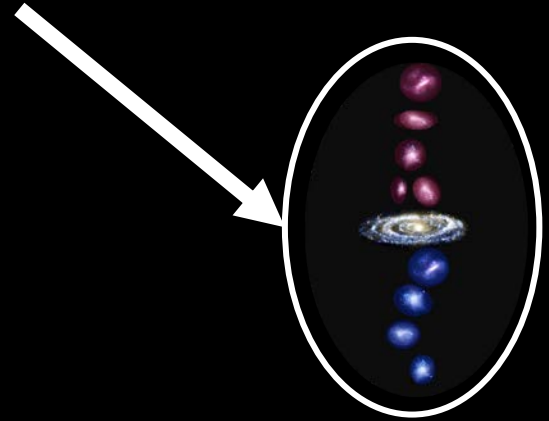
Less than 2% of simulated Milky Way type galaxies have planes



Most simulations of the Universe struggle to find similar planes



Is our model for gravity wrong??



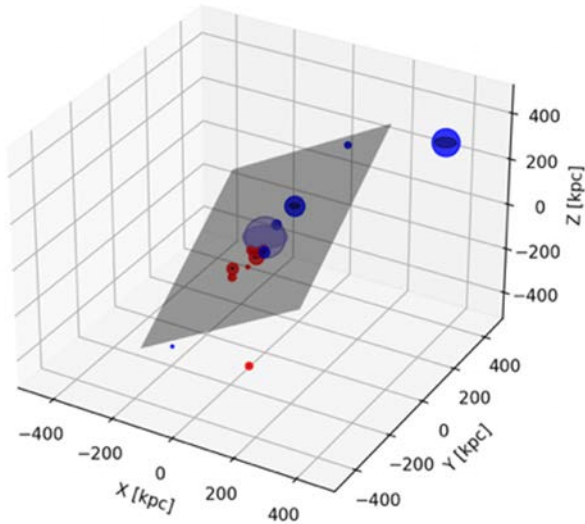
What if we use a next-generation simulation that resolves fine details over a large volume of the Universe?

New Horizon Simulation
(Dubois et al. 2018)



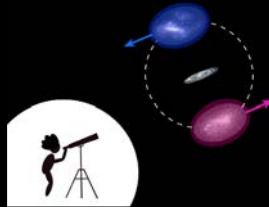
New Result:

We Find Planes of Satellite Galaxies in the New Horizon Simulation!!



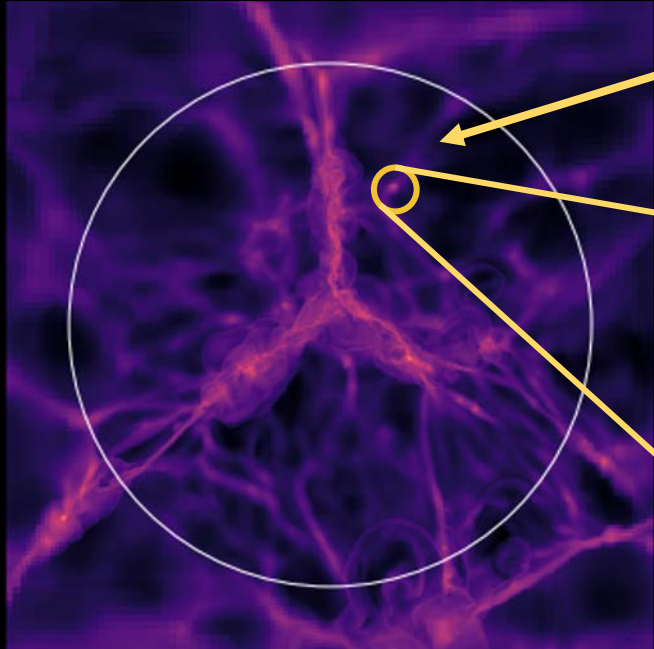
We find planes of satellites in about ~ 30% of Milky Way type galaxies!

- satellites do orbit their central collectively
- Enough to explain why we see so many in the very nearby Universe.



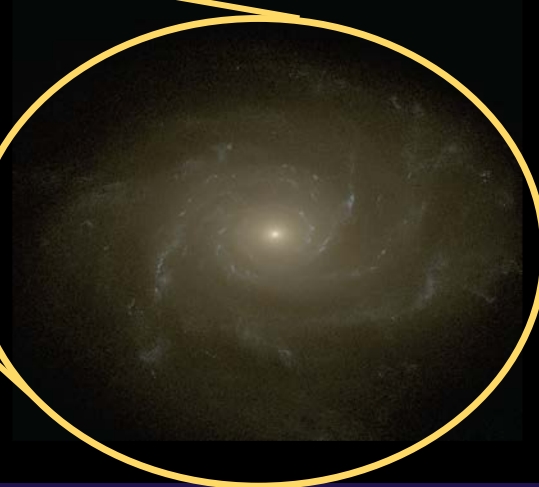
So what's different in this simulation?

New Horizon, Dubois+2020



one galaxy

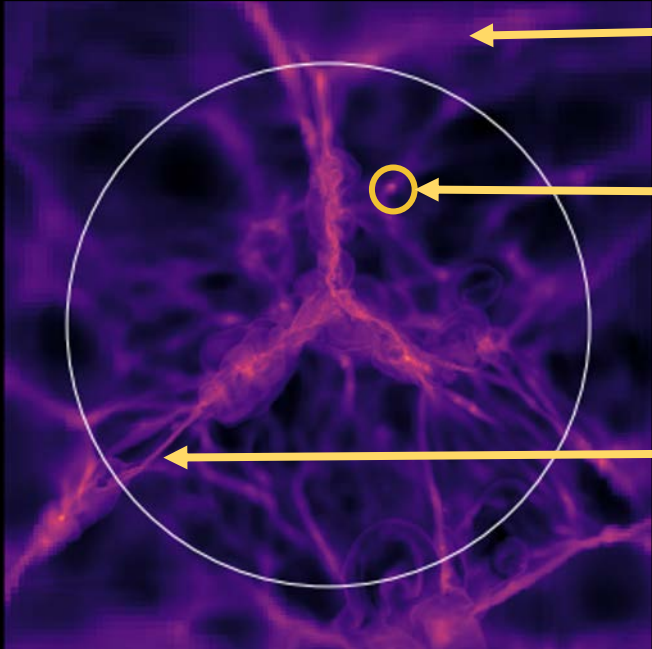
- We have very high resolution!
We have a lot of details..



— Cosmic gas

So what's different in this simulation?

New Horizon, Dubois+2020



Low resolution environment

one galaxy

Thin stream
"cosmic filament"

**We have very high resolution!
We have a lot of details..**

**... not just in galaxies but also
in their cosmic environment.**

Conclusion:

- We do not need to modify our model of gravity
- We need to better understand the fine interactions between future satellite galaxies and the cosmic environment they are born in.....

Stay tuned!

Contacts



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