

Simulating

Everything

(down to mass resolution)

Everywhere

(down to spatial resolution)

All at Once

(as fast as supercomputers compute)

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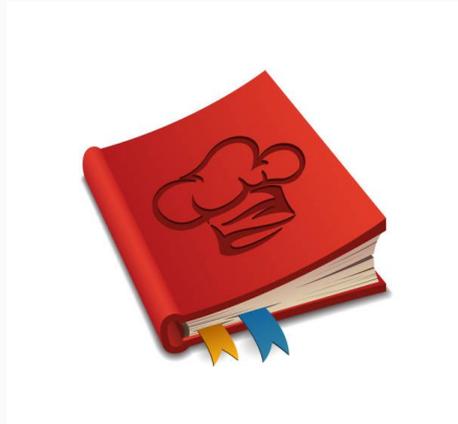


How to simulate the universe i.e. How to make bagels



ingredients

+



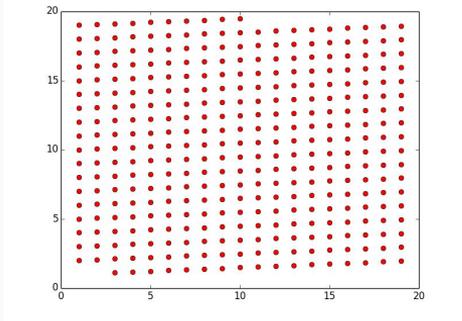
recipe

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Extreme-scale cosmology simulations

Dark matter particles
(85% of all matter)



ingredients

Physics

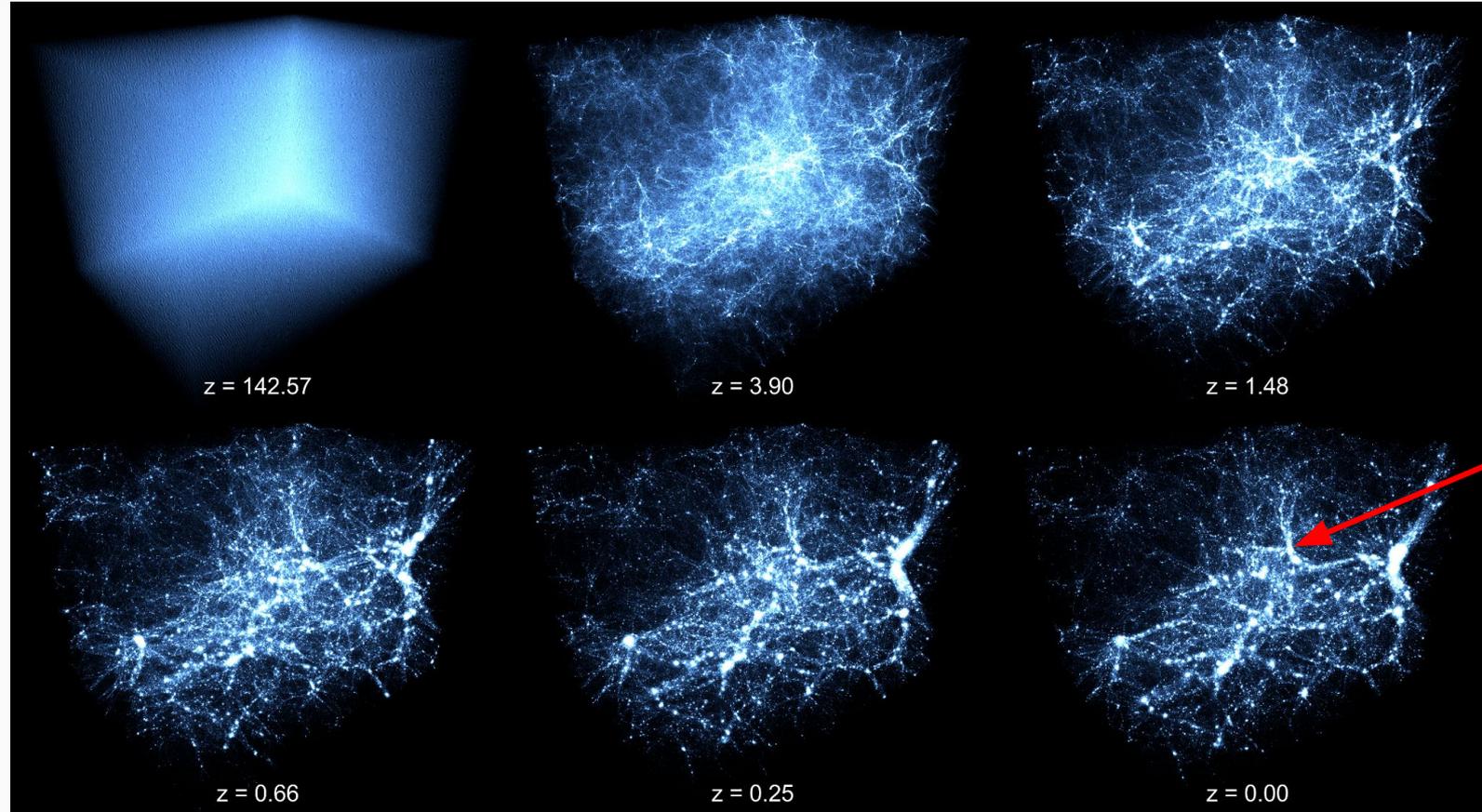
$$+ \quad F_g = \frac{G M_1 M_2}{R^2} \quad =$$

recipe

Extreme-scale cosmology simulations

Farpoint Simulation

2 trillion particles ($7 \times 10^7 M_{\odot}$ mass res.)
(5 billion lightyears)³ box (4000 ly spatial res.)



Halos: dense areas of dark matter in which galaxies form

Galaxy formation simulations

Physics

- Dark matter
- Stars
- Gas (ISM and CGM)
- Black holes

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- Stellar feedback (e.g. supernovae, radiation)
- Star formation
- Supermassive black hole accretion/feedback

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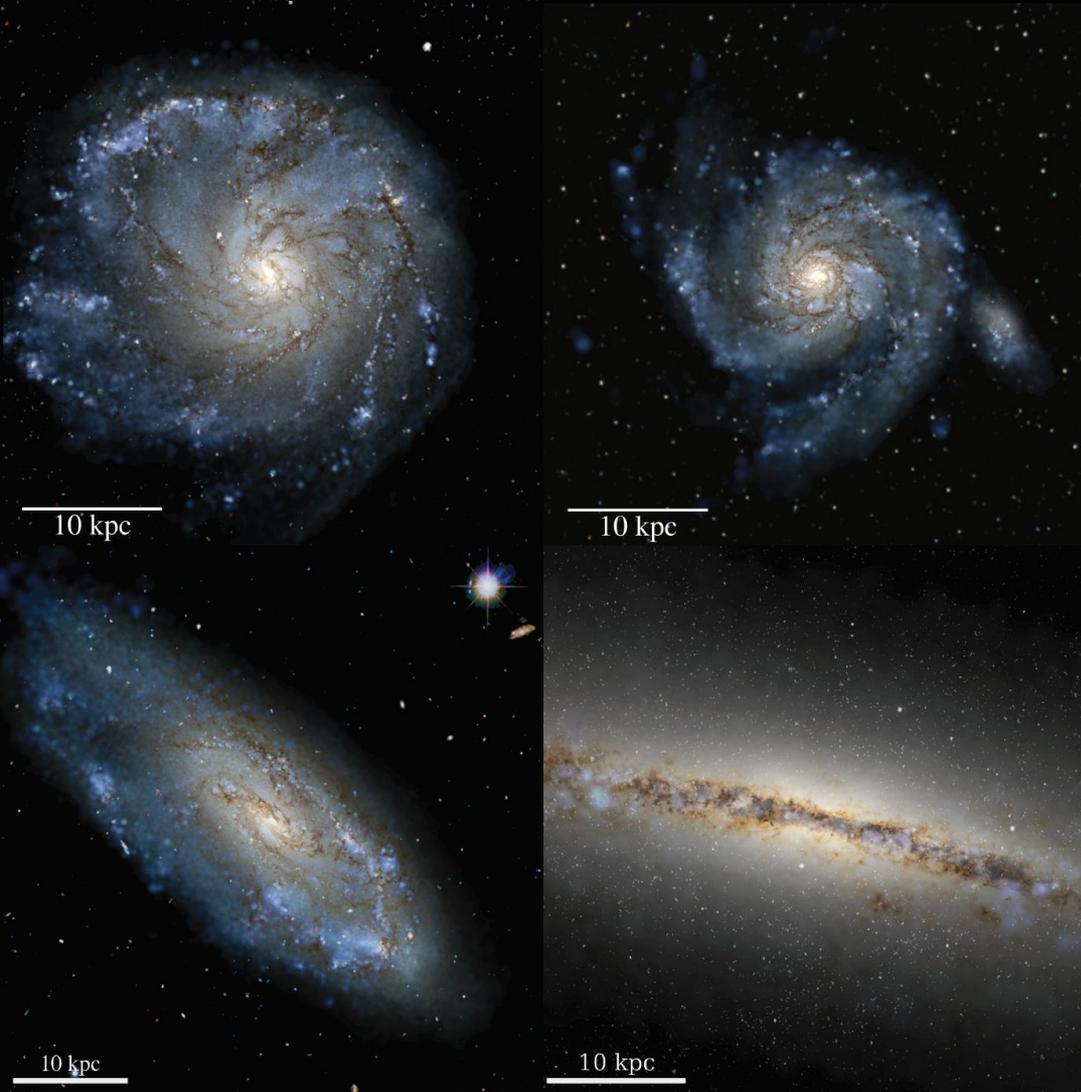
ingredients

recipe

FIRE simulations

7000 M_{\odot} mass resolution

30 ly spatial resolution (MW-mass galaxy)



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Massive galaxy formation with

Why do galaxies stop forming new stars once their mass becomes larger than a certain mass?

How do supermassive black holes affect their host galaxies?

How do supermassive black holes affect CGM?

