

Siddhant Mishra-Sharma (MIT/AI FI) Summer School

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Sinulators

$$x \sim p(x)$$

Simulators are ubiquitous: they prescribe a way to sample from the data distribution

Collider data

particles $\sim p(\text{particles})$

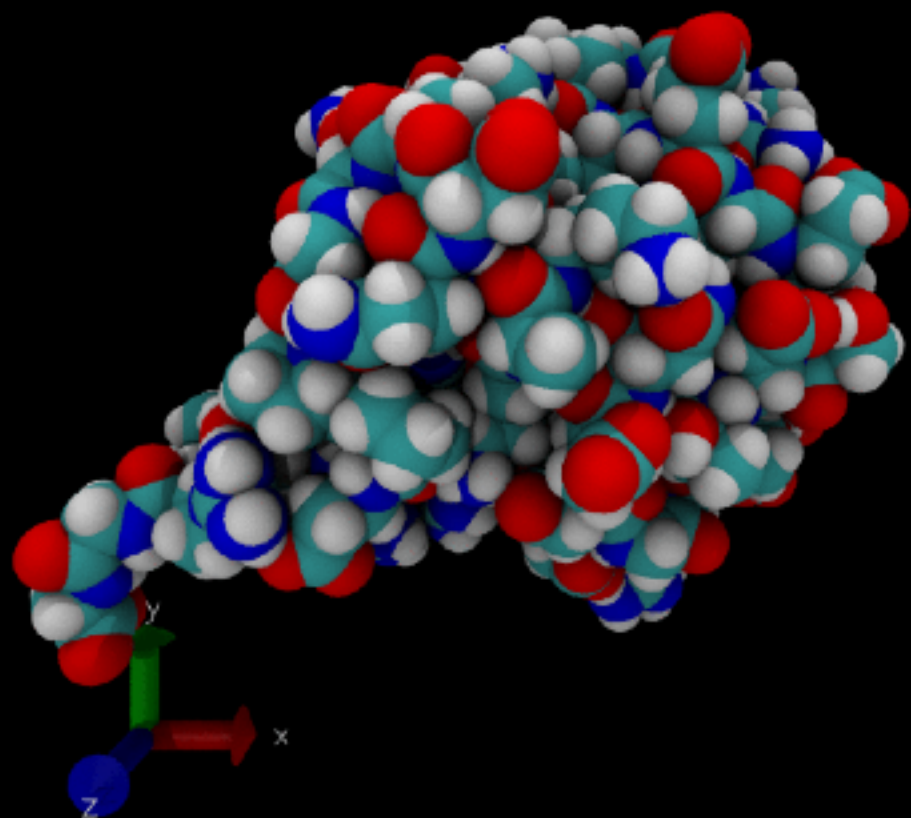


Cosmology data

particles $\sim p(\text{particles})$

Molecular dynamics

configurations $\sim p(\text{configurations})$



[C. Cesaroni with ATLAS]


[Aquarius simulation]

[E. Cances et al]

$z = 30.3$

$T = 0.10 \text{ Gyr}$

500 kpc

A visualization of the cosmic web at a redshift of $z = 30.3$ and a time of $T = 0.10 \text{ Gyr}$. The image shows a complex network of dark purple and blue filaments and nodes against a black background, representing the distribution of matter in the early universe. A scale bar at the bottom center indicates a length of 500 kpc.



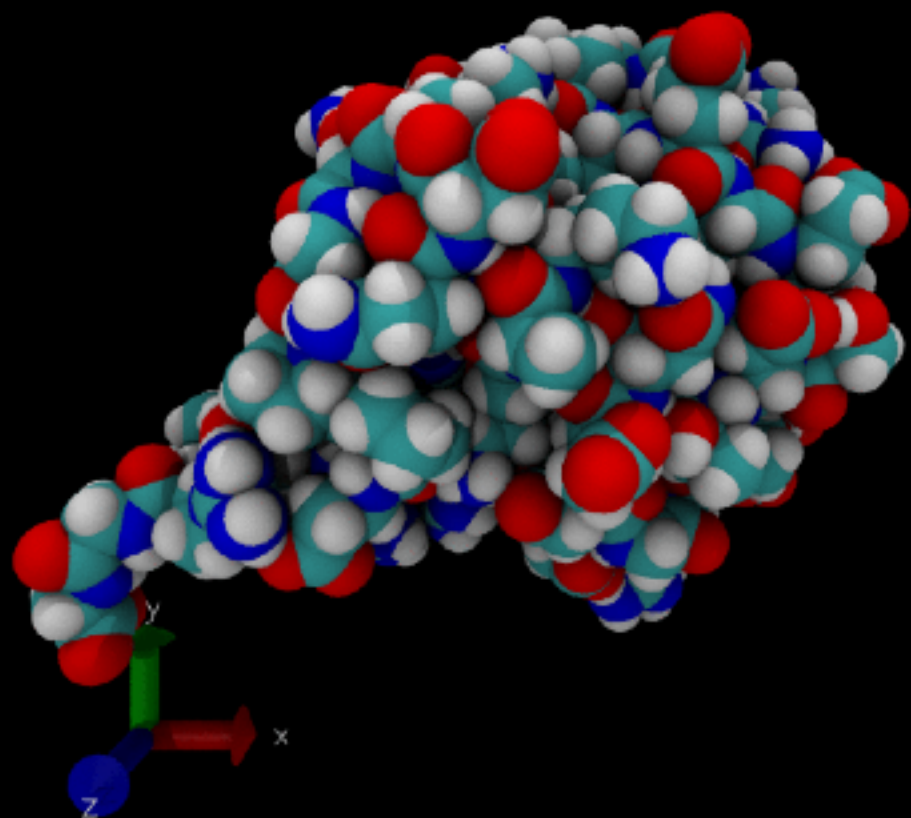


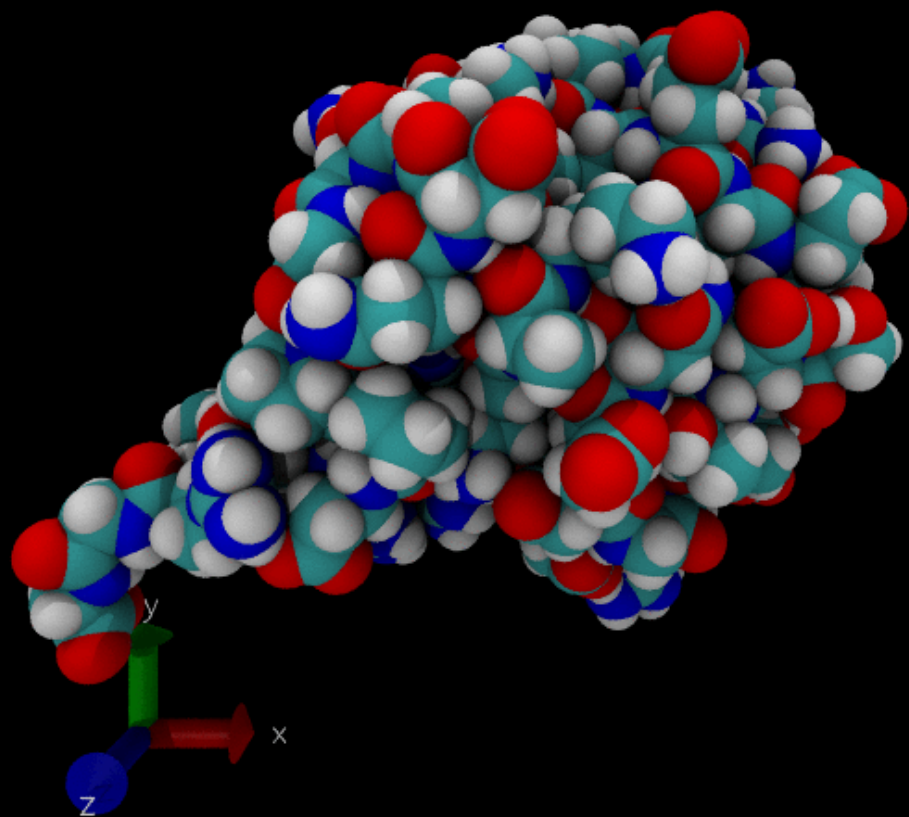
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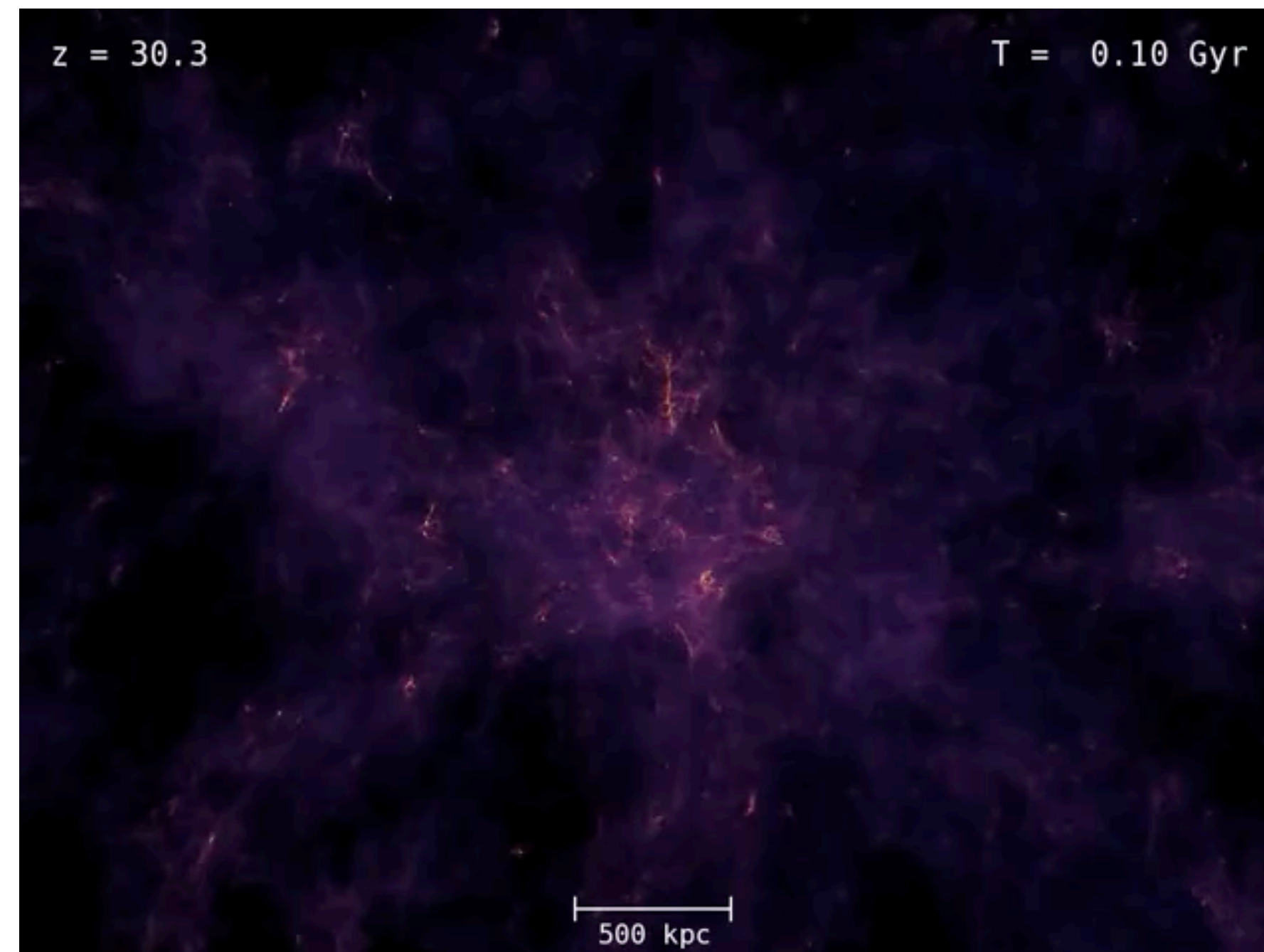
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[C. Cesarotti with ATLAS]

Cosmology data

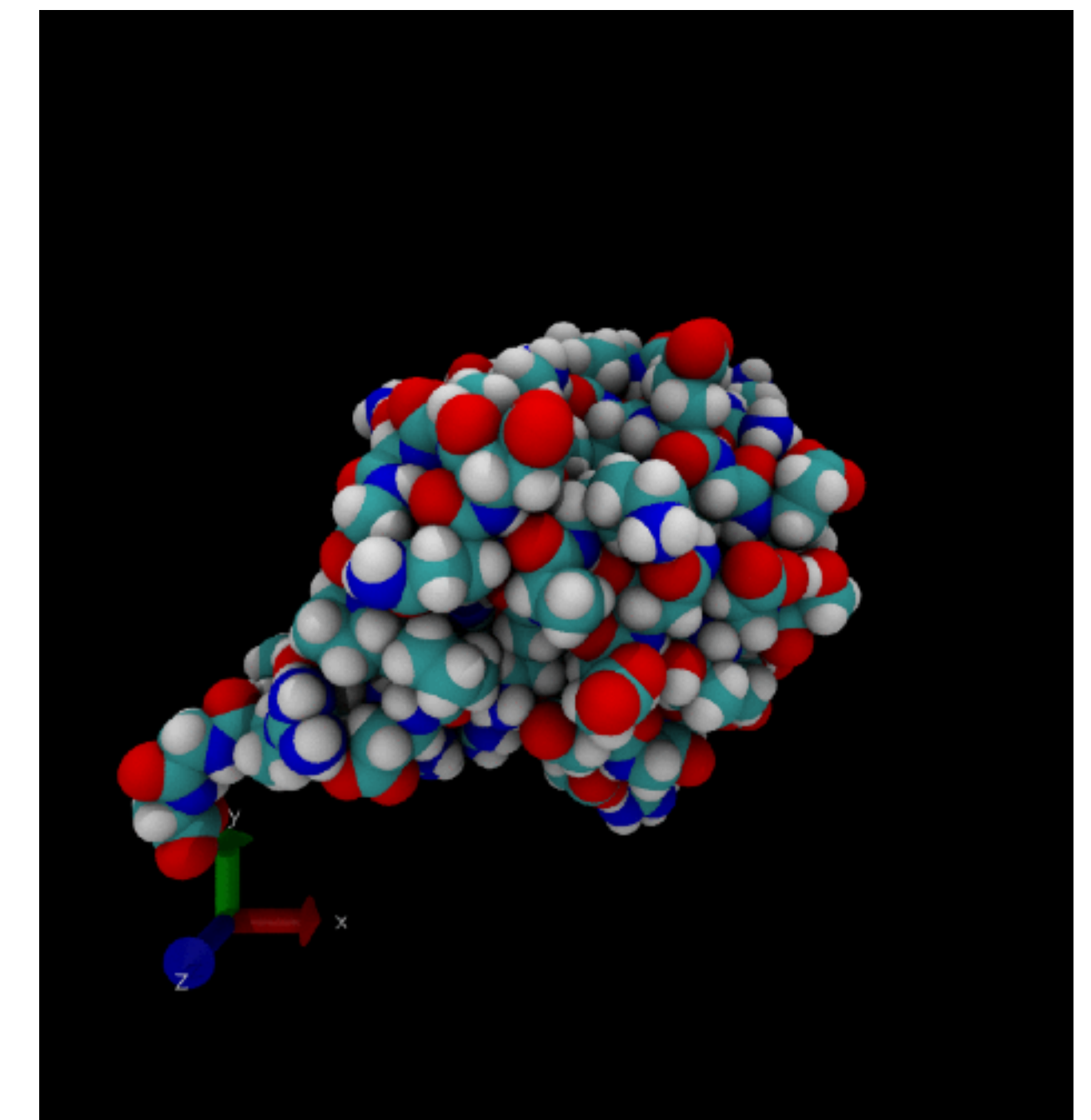
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[Aquarius simulation]

Molecular dynamics

configurations $\sim p(\text{configurations})$



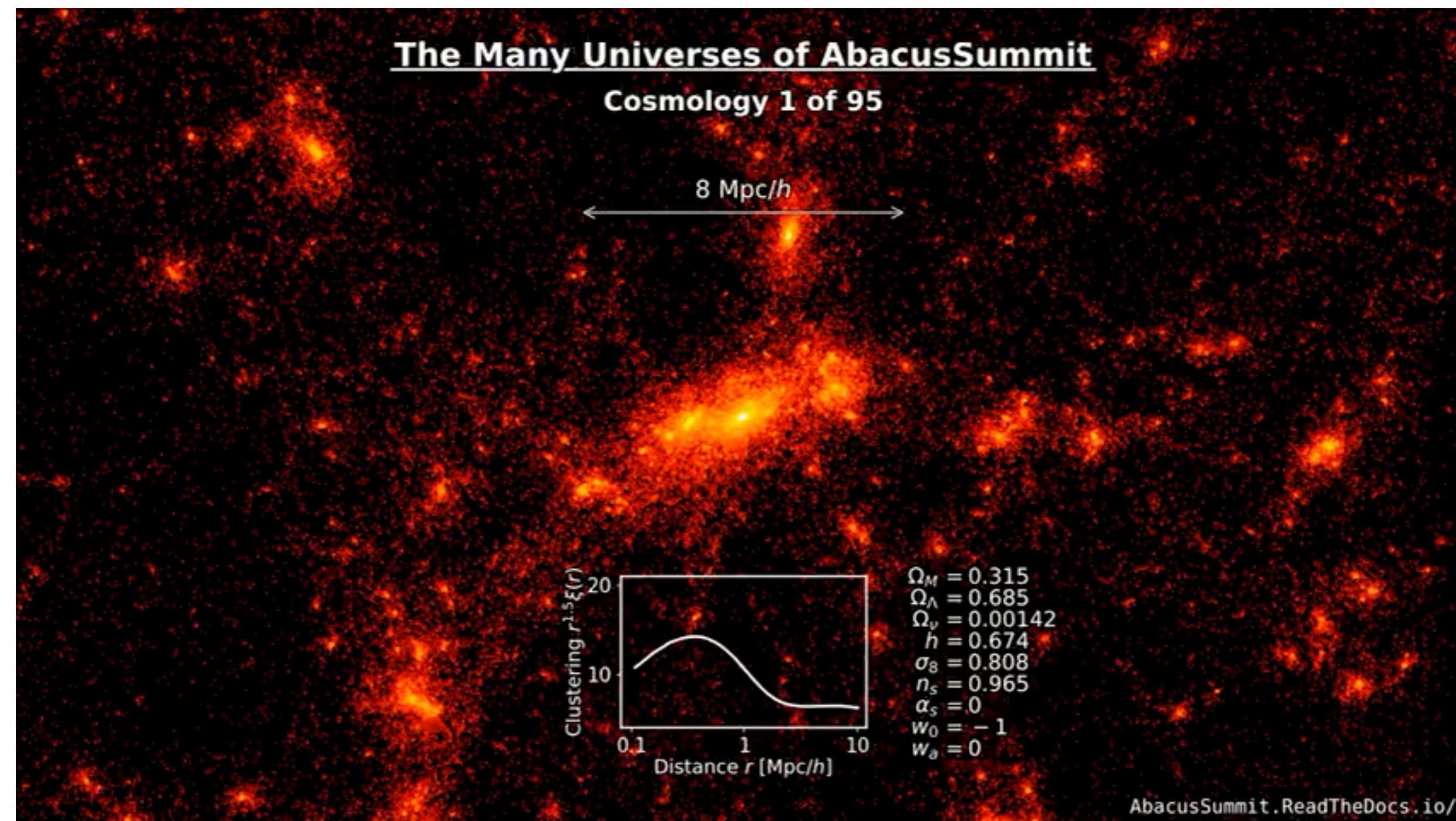
[E. Cancès et al]

Conditional simulators

Conditional simulations *sample from the likelihood* $p(x \mid \theta)$

Cosmology data

particles $\sim p(\text{particles} \mid \{\Omega_m, \sigma_8\})$



[Abacus Summit]

$$x \sim p(x; \mathcal{M})$$

Model

or

$$x \sim p(x \mid \theta)$$

Model
parameters