

Computational Cosmology at the ARI

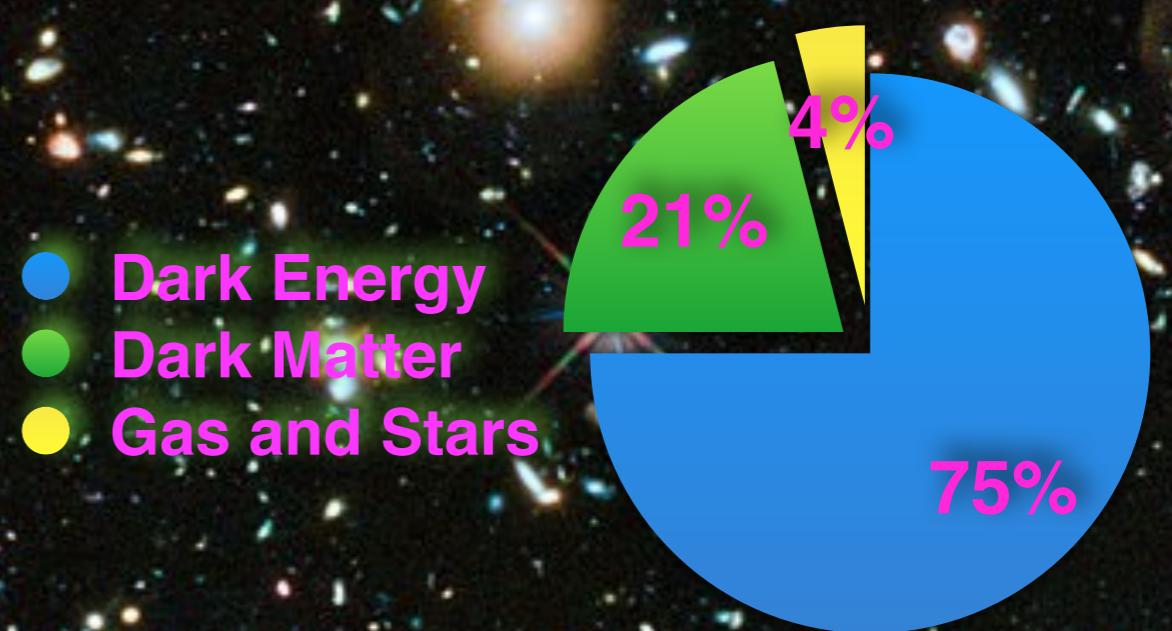
Alex Hill

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Talk Structure

- Introduction to Observational and Computational Astronomy
- The HPC group
- The Work of PhD Students

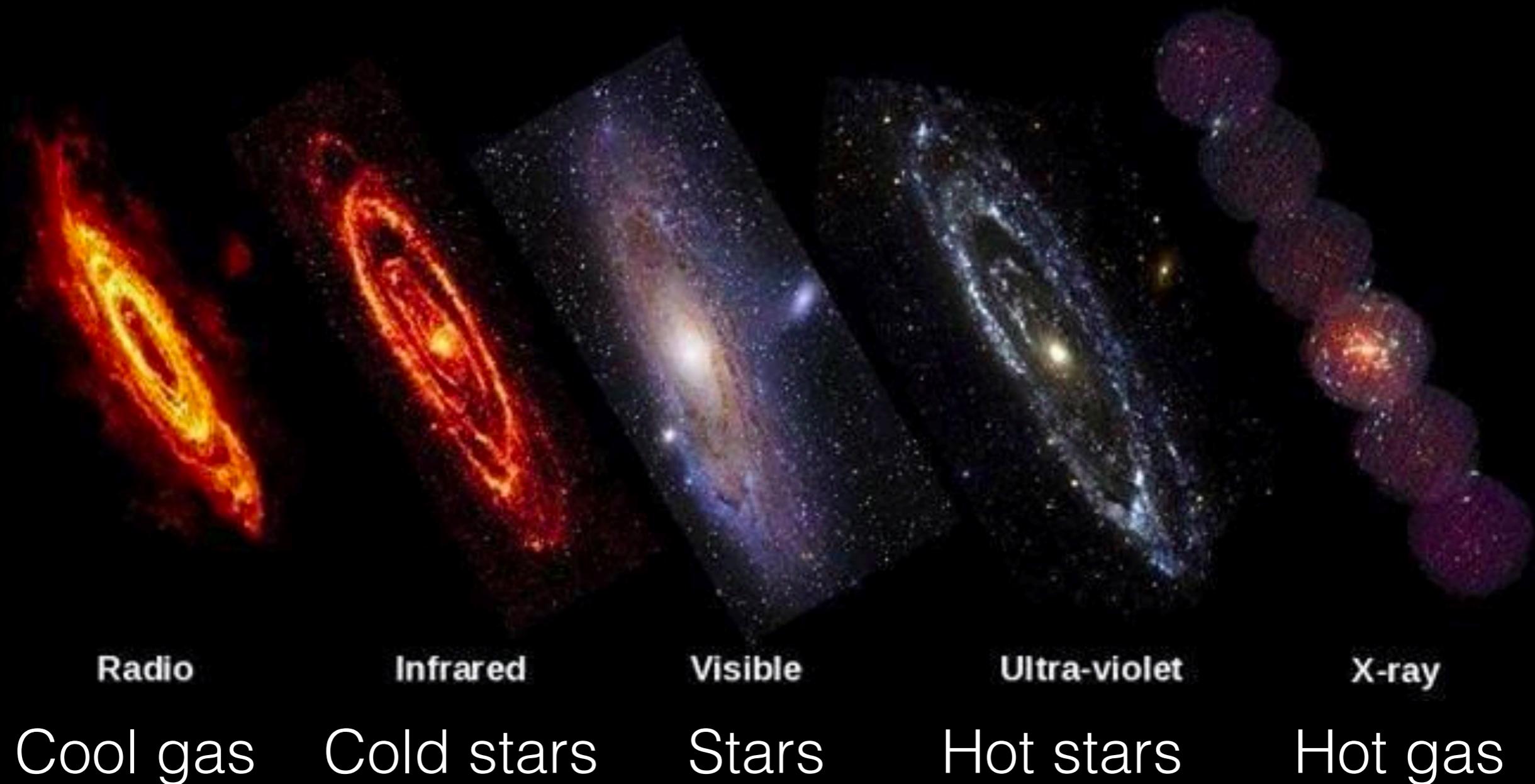
The Universe

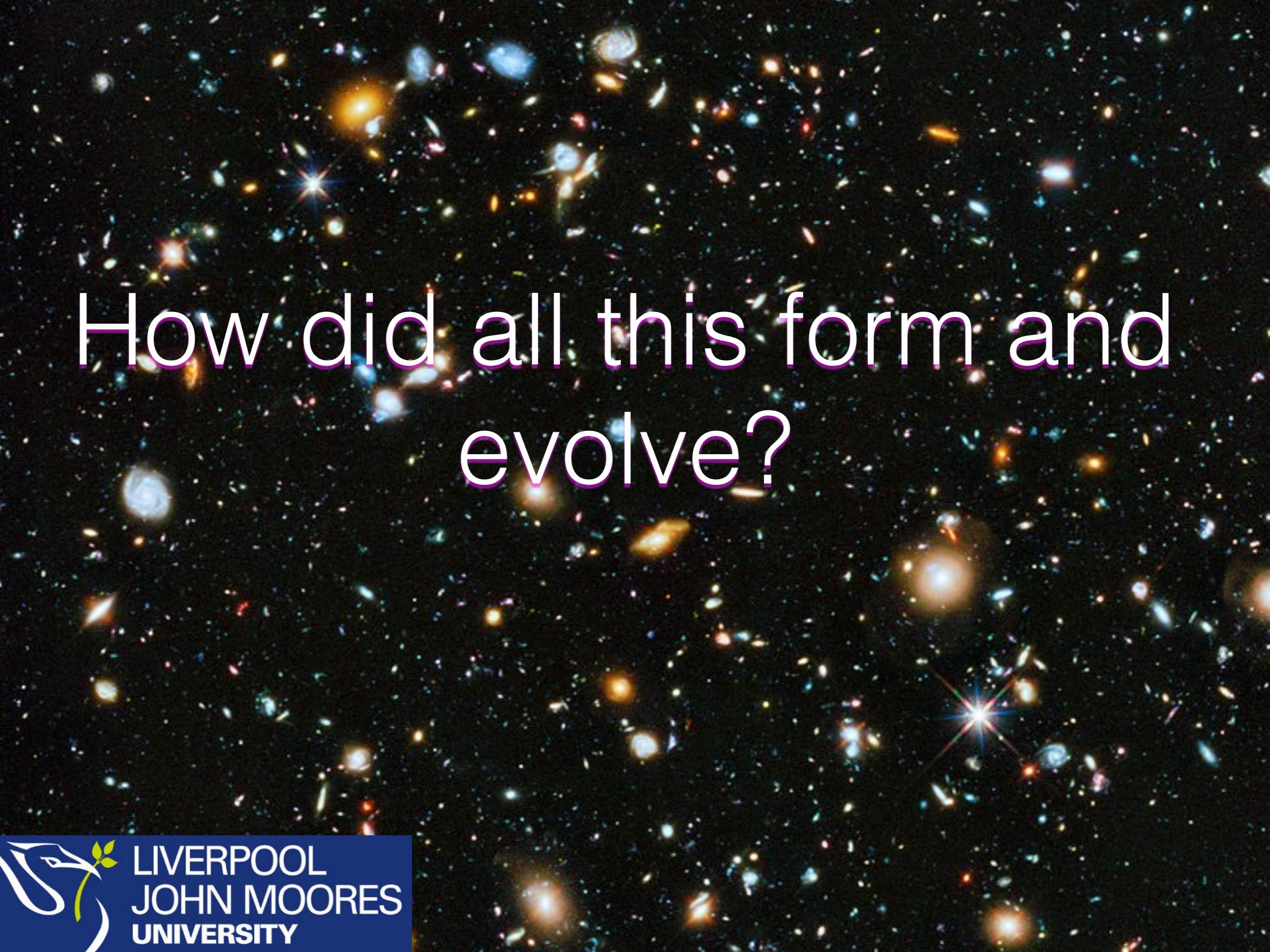


Observational Astronomy



Observational Astronomy

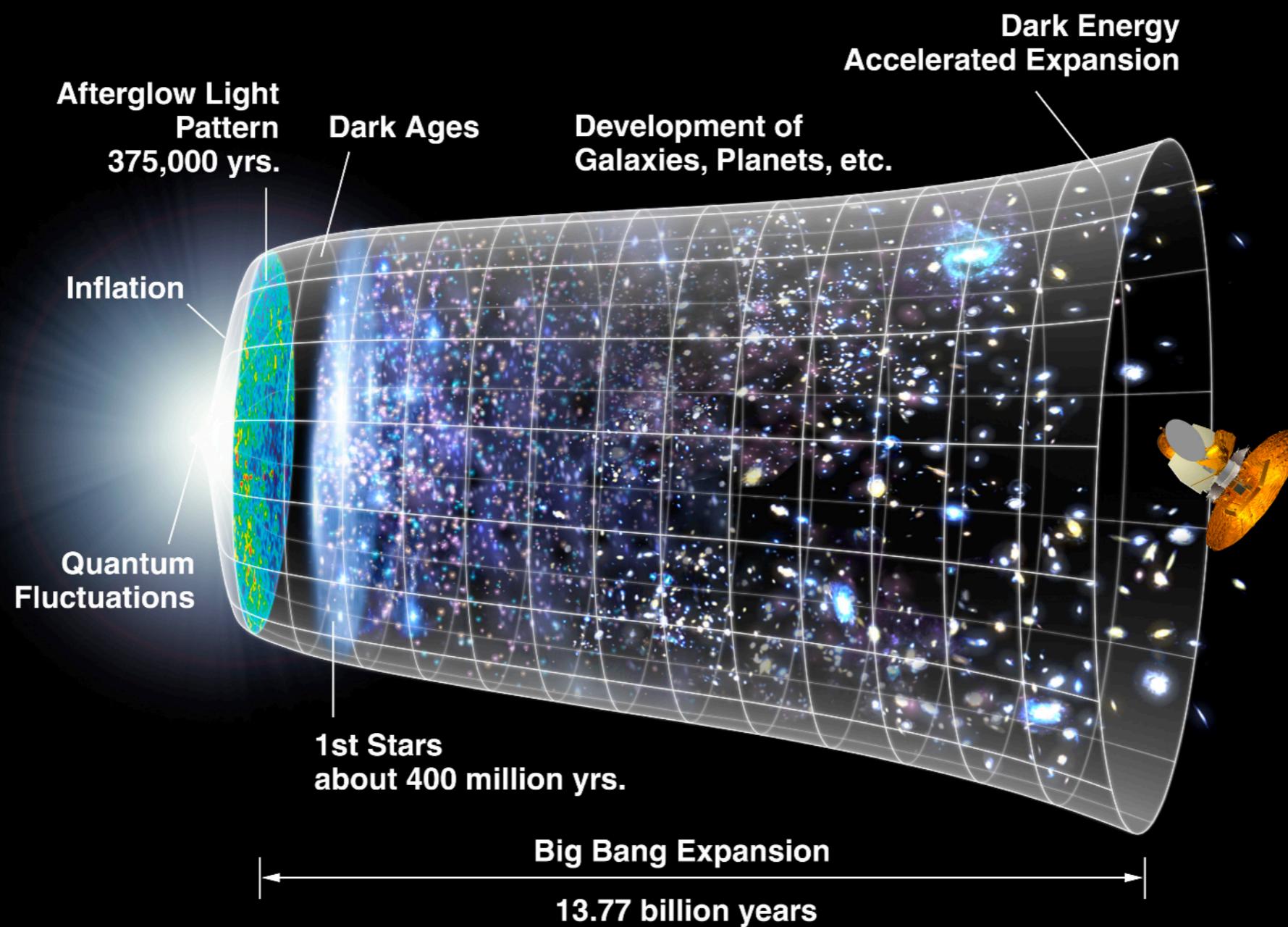




How did all this form and
evolve?

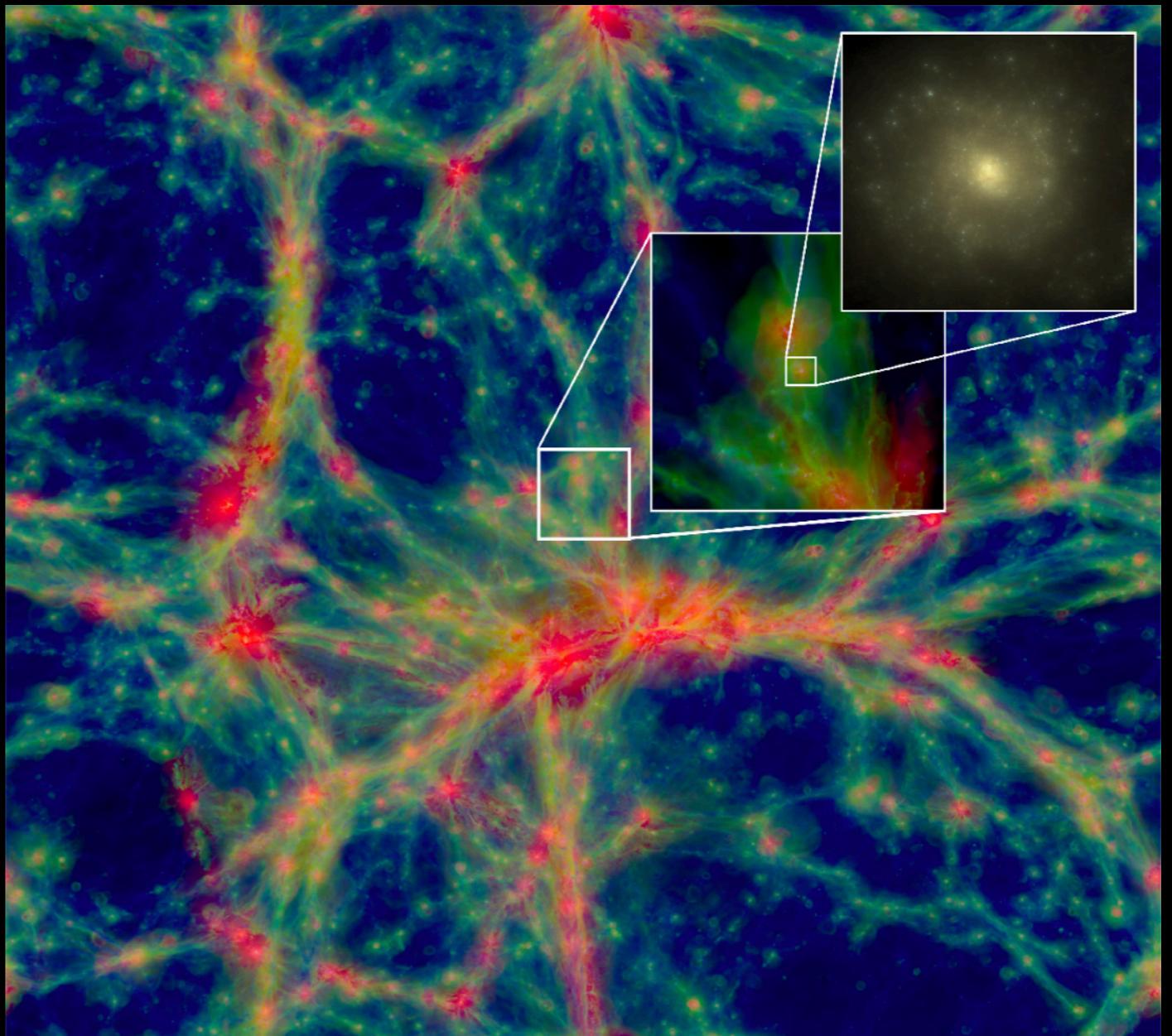
$t \sim 1$ month





Simulations

- Interpretation
- Prediction
- Experimentation



The EAGLE simulations

EVOLUTION AND ASSEMBLY OF GALAXIES AND THEIR ENVIRONMENTS

A project of the Virgo consortium

$z = 19.9$

$L = 25.0 \text{ cMpc}$

Visible components:
CDM

HPC Group



Research Staff



Dr Rob Crain

Galaxy Formation and Evolution

Four PhD Students



Dr Andreea Font

Milky Way and Dwarf Galaxies

Two PhD Students



Dr Ian McCarthy

Large-Scale Structure and Cosmology

Five PhD Students and Two Post-Docs

Simulations Study a Range of Scales

- BAHAMAS - Investigating Dark Energy and Dark Matter on Large Scales
- EAGLE - Studying Galaxy Formation and Evolution
- E-MOSAICS - High resolution zoomed Milky Way-like galaxies from EAGLE

BIGGEST

Bigger

big

Computing Resources

- Local HPC Resources - Five **Dell PowerEdge r815** servers with 320 AMD opteron 2.5 GHz cores and 2.5 TB of RAM. 400 TB of storage
- National and International Supercomputing Facilities - **DiRAC** and **PRACE**



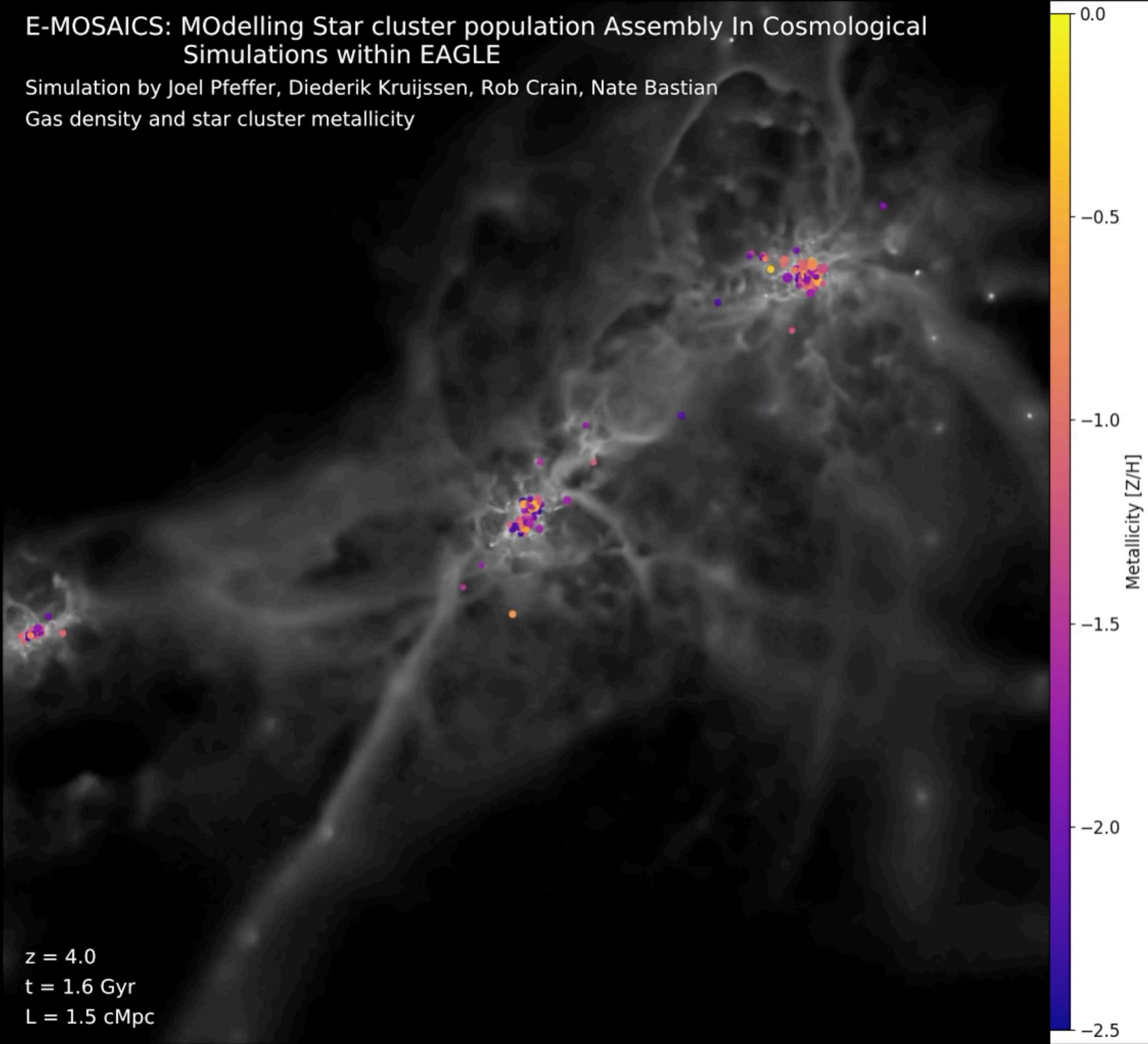




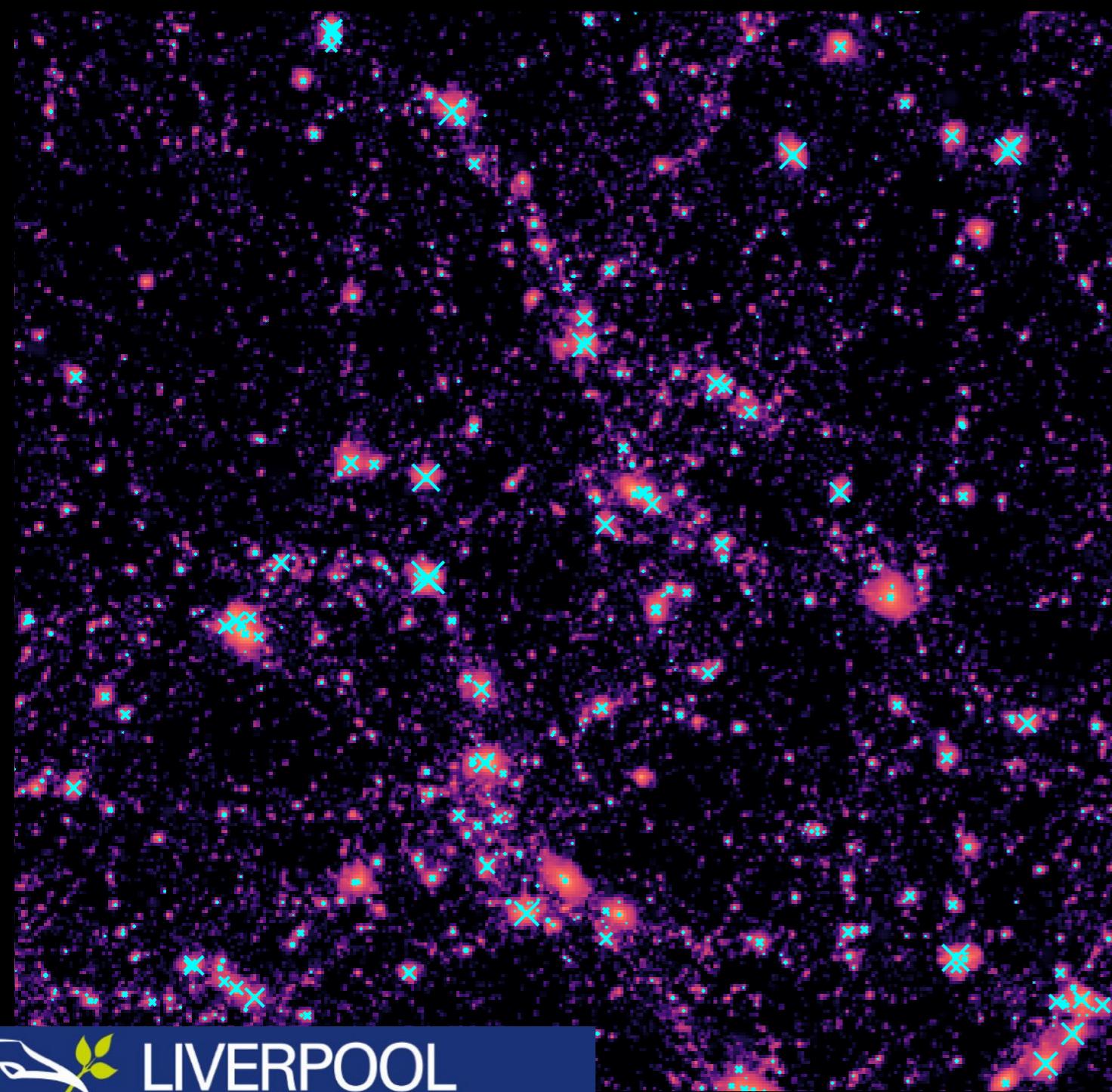
Evolution of Dark Matter Structure in EAGLE

E-MOSAICS: MOdelling Star cluster population Assembly In Cosmological Simulations within EAGLE

Simulation by Joel Pfeffer, Diederik Kruijssen, Rob Crain, Nate Bastian
Gas density and star cluster metallicity

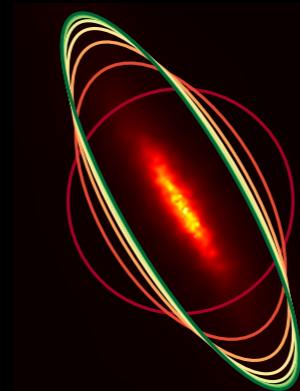


PhD Students

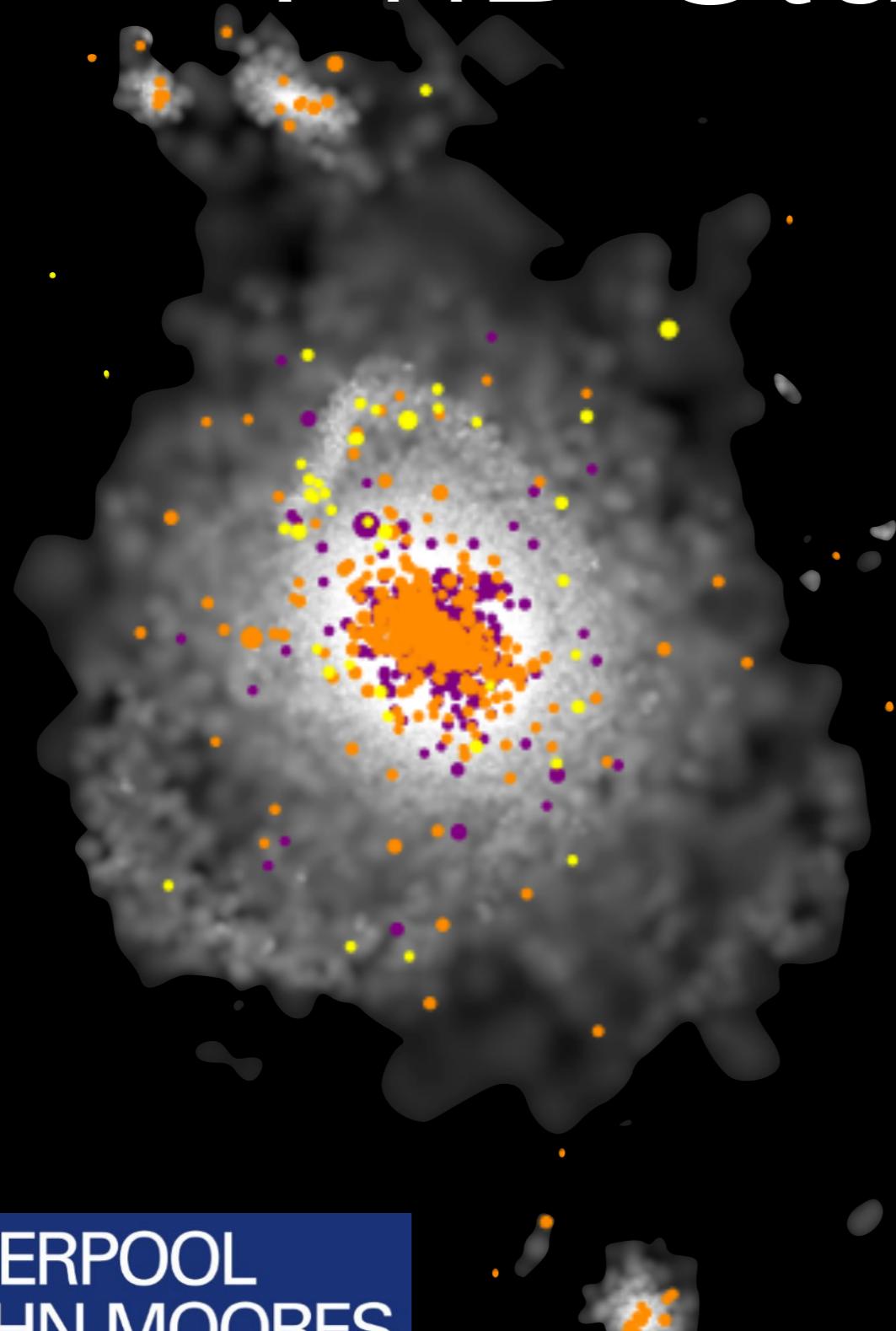


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Intrinsic alignment
of star-forming
galaxies in EAGLE



PhD Students



Meghan Hughes

Using E-MOSAICS to aid our
understanding of how
GCs can be used to infer the
build up of the Galactic halo

PhD Students



Rob Poole-McKenzie

Searching for Dark Matter
Annihilation in EAGLE zooms

Reality Check

- The simulated universe isn't the real universe
- Resolution effects
- Finite resolution and computing time, so approximations and assumptions have to be made
- Calibrated to certain observed relationships, not derived from first principles

Questions