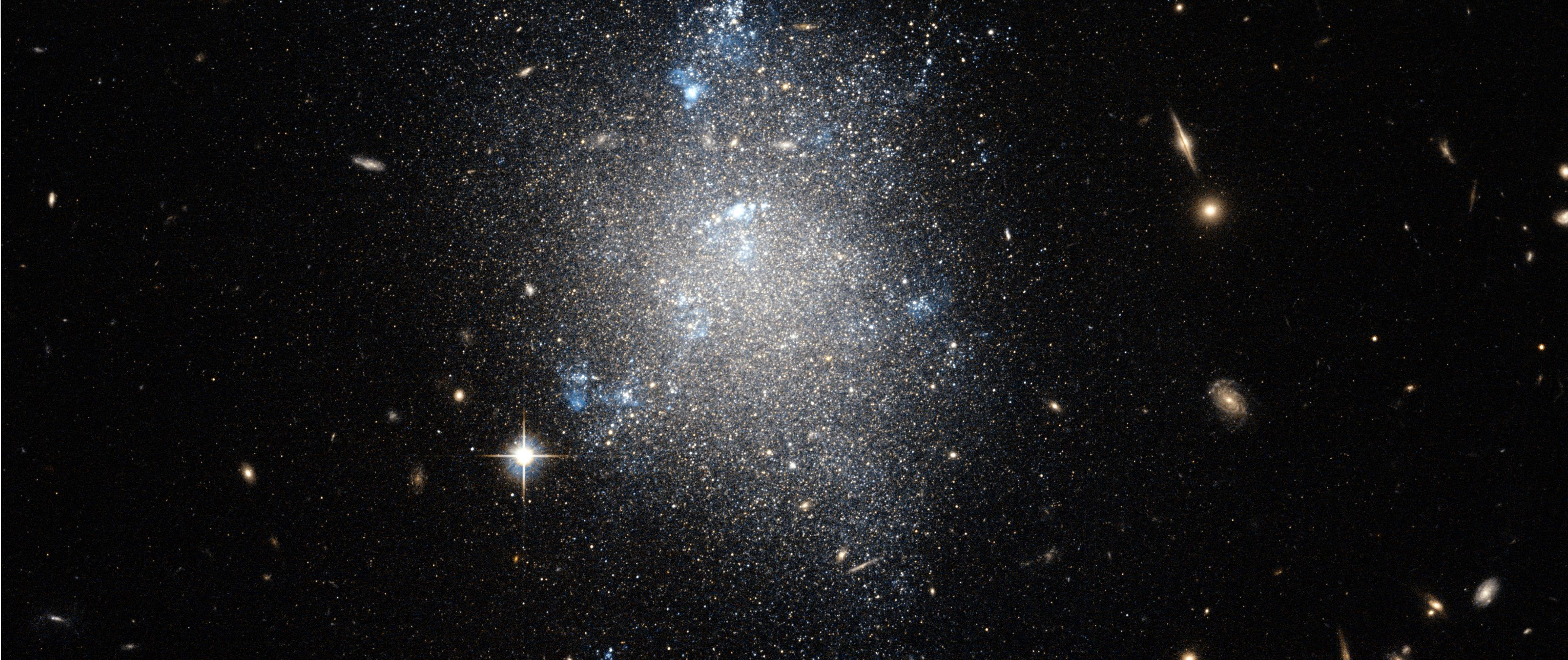
Illuminating the Faintest Galaxies: Dwarf Galaxies as Probes of Dark Matter, Feedback, and the First Stars



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Getting the slides

Session

Illuminating the Faintest Galaxies: Dwarf Galaxies as Probes of Dark Matter, Feedback, and the First Stars

#49
10 Jul 2025, 09:00
TLC033

Description

Organisers: Alejandra Aguirre-Santaella, Shaun Brown, Ting-Yun (Sunny) Cheng, Jessica Doppel, Isabel Santos-Santos, Joaquin Sureda

Dwarf galaxies are the most numerous yet faintest type of galaxy in the Universe. As the most dark matter dominated systems in our Universe they offer a powerful laboratory to probe the nature of this elusive form of matter and search for potential decay signals. Their observed abundance and distribution can place strong constraints on different dark matter models.

Dwarf galaxies also serve as powerful tools for exploring the limits of galaxy formation, as they form in the smallest haloes. Their shallow potentials provide an excellent testing ground for feedback processes, such as supernovae, stellar winds, and AGN feedback. At the faintest end of the luminosity function, ultra-faint dwarfs are believed to be relics from the epoch of reionization, providing insights into the physics of reionization, the first stars, and early galaxy formation.

In the local Universe, dwarf galaxies offer the most detailed studies of stellar populations, kinematic analyses, and chemical abundances. These observations are critical benchmarks for validating and refining predictions from cosmological simulations. Upcoming facilities and surveys such as Euclid, LSST, Roman, WEAVE, 4MOST, SDSS-V, SKA, CTA and MeerKAT, will soon provide deeper and higher resolution observations for countless more dwarf galaxies, revolutionising our view of the Universe in the low-mass regime.

This session aims to foster interdisciplinary discussion and collaboration between observers and theorists working on dwarf galaxies from the classical to the ultra-faint regime. As a world leader in dwarf galaxy science the UK is well placed to fully exploit this new wealth of data.

Presentation materials

NAM dwarf galaxy session intro.pdf

Discussion instructions

- Get into groups of 5/6 (ish). Try to find some people you don't know.
- Introduce everyone; name, topic, theory/observations.
- Nominate someone to take notes here.
- Decide on an open question to try and decide how we're going to answer it in the next 5-10 years.

Open questions

(1) Core-Cusp problem and diversity of rotation curves in dwarf galaxies.

(2) Diversity of morphology and sizes of dwarf galaxies in the field.

(3) How do we connect high redshift ($z>6$) galaxy formation to local dwarf galaxies.

(4) Assuming LCDM is true, how do we find/detect dark haloes.

(5) Are dwarf galaxies and star clusters completely distinct objects? How do we decide/distinguish between them

(6) What drive the mass metallicity relation, including the floor and scatter.

Categories

(1) We have good observations and theoretical models. Just need to communicate our results better.

(2) We have the observations, but the theoretical predictions are missing.

(3) Clear consensus on the theoretical predictions, but we lack the observations.

(4) We are lacking both good theoretical predictions and observations. No clear way forward on this issue.

(5) Or standard models of cosmological galaxy formation cannot be saved, we must burn it all down and start again.