International Centre for Radio Astronomy Research

The Distant Universe

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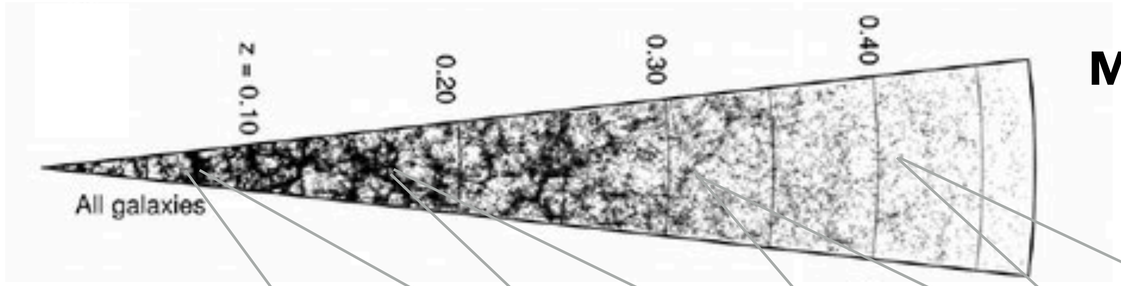
Department of **the Premier and Cabinet**
Office of Science

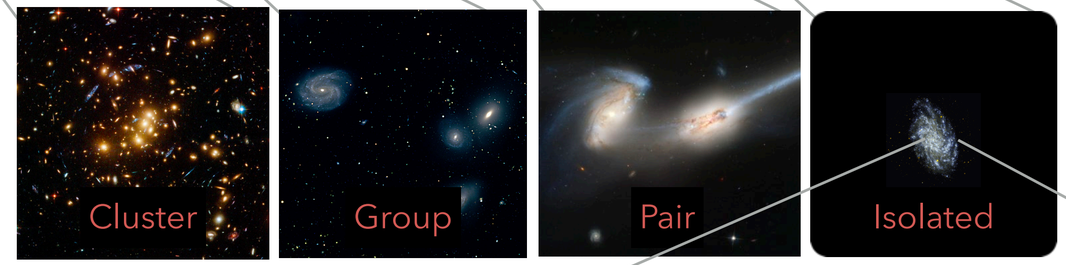
Mapping The Universe

The baryonic properties (stars, gas, dust), dynamics, locations, environments and dark matter halos of millions of galaxies, spanning over half the age of the Universe



Map out Large-Scale Structure of the Universe

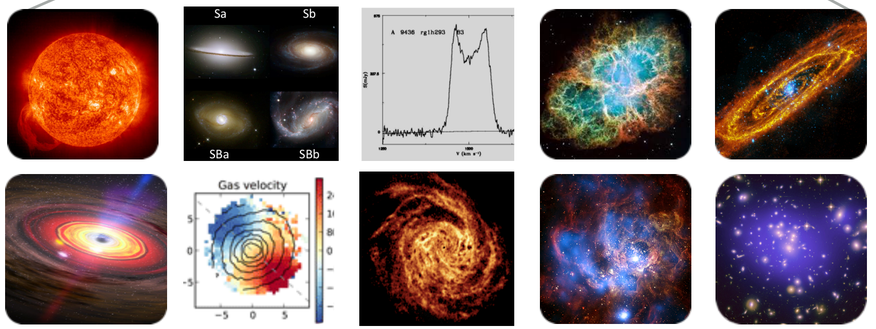
Dark Matter structure/distribution, galaxy locations, evolution of structure as the Universe grows (cosmology)



Parameterise galaxy environments

Dark Matter halo mass, galaxy distributions, galaxy interactions

The evolution of galaxies and structure over the history of the Universe



Measure galaxy properties

Stellar mass, gas mass, DM mass, SFR, SFH, AGN, structure/morphology, kinematics, dust content, metallicity….

Observe ➜ Analyse ➜ Model ➜ Repeat

We lead large (>1M) galaxy surveys

GAMA

sami galaxy survey

DEVILS

CHILES
COSMOS HI LARGE EXTRAGALACTIC SURVEY

DINGO

KROSS

WAVES
wide area vista extragalactic survey

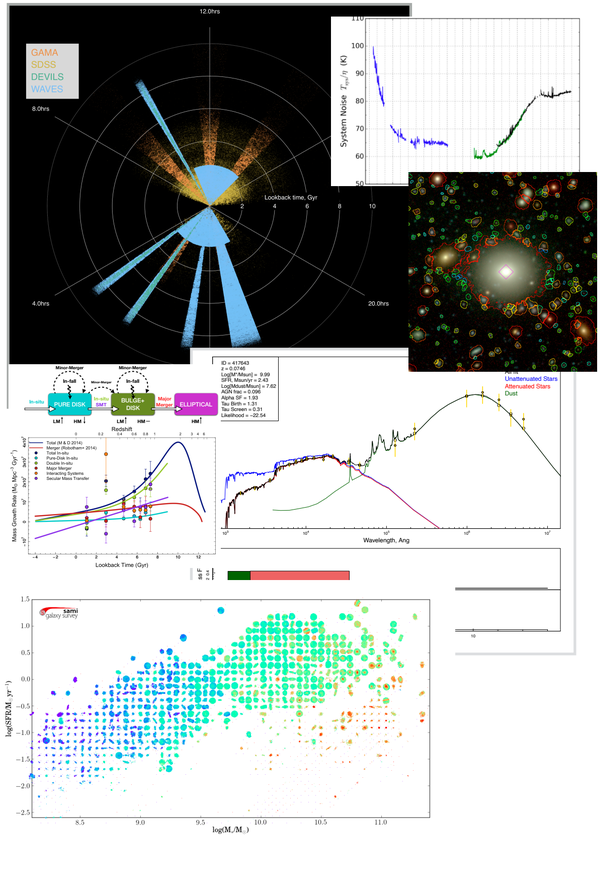
4MOST

Hector

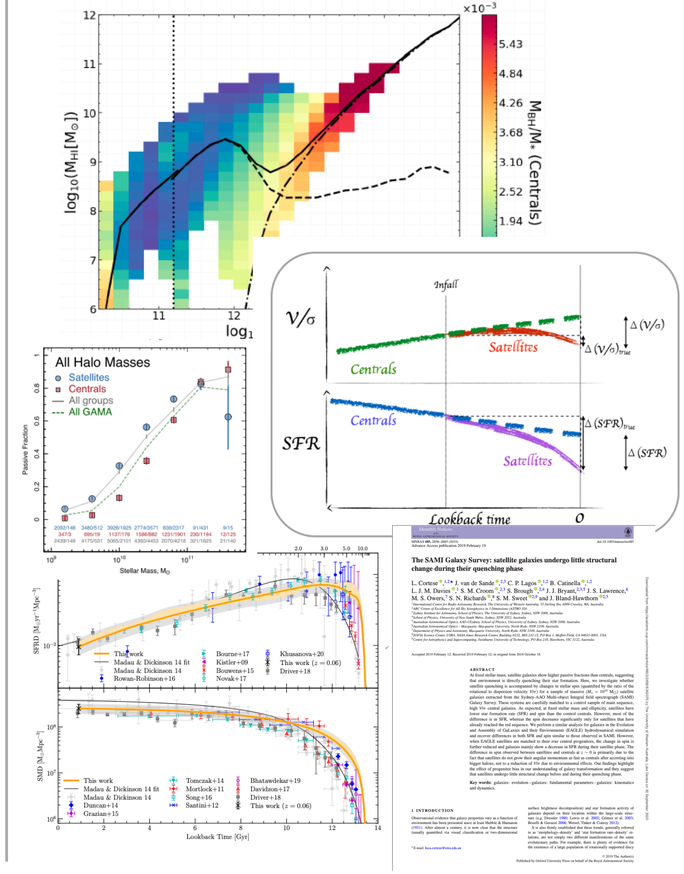
MaunaKea Spectroscopic Explorer

➜ Observe with world's best telescopes

➜ Write software, analyse galaxy/ structure properties



➜ Compare to predictions, models, and previous results



Propose New Surveys/Observations

Core Science Topics

Impact of environment on galaxy evolution
(how where a galaxy lives affects its life)

The evolution of star-formation and stellar mass
(how galaxies grow with time)

The energy budget of the Universe
(how and where are photons produced in the Universe)

Resolved studies of galaxies and dynamics
(how galaxies move and where are stars formed)

Morphology and structure of galaxies over time
(how galaxies look and what it tells us about how they formed)

Very high redshift galaxies
(understanding the first galaxies that form in the Universe)

HI gas content of galaxies
(understanding the fuel that galaxies have to form new stars)

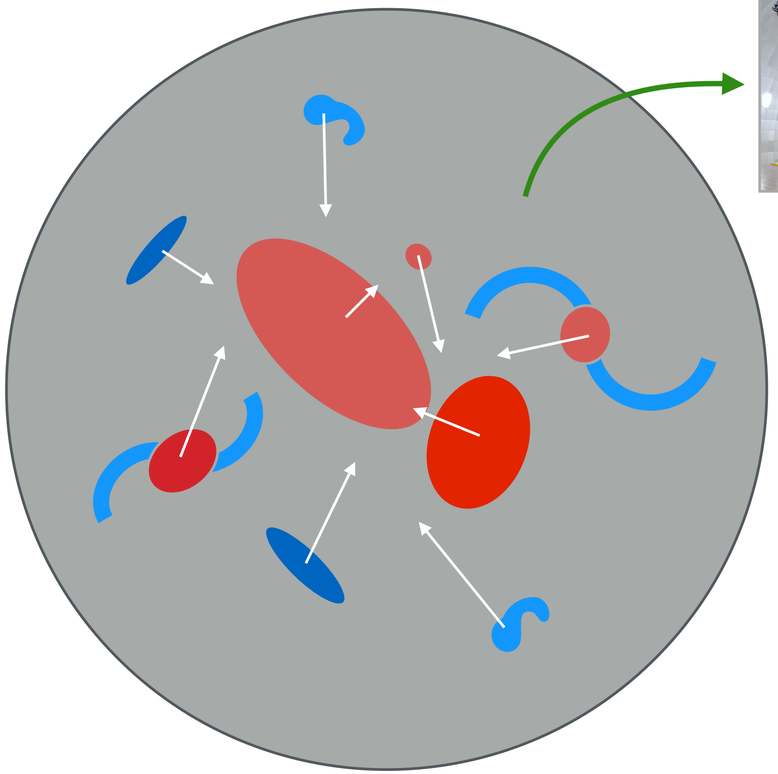
Software for studying galaxy evolution
(developing new software for studying galaxies)

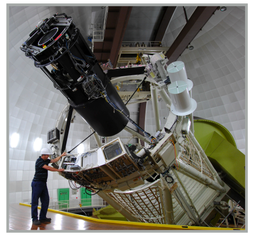
Management of large galaxy surveys
(observations, data management, software for data collection)

Science Snippet: Dark Matter

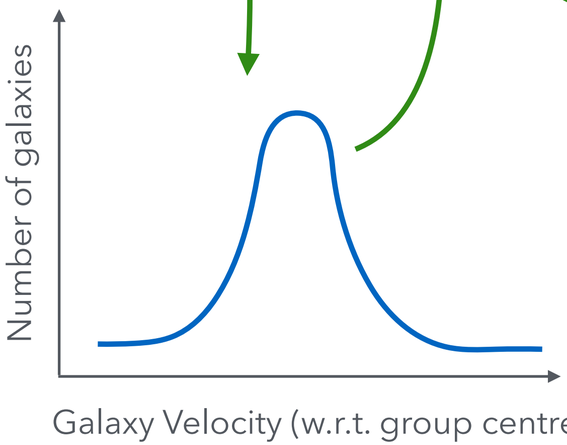
Major focus of international physics research (particle physics and astrophysics) is concerned with determining the nature of dark matter….

….the distribution and velocities of galaxies in groups allows us to 'weigh' dark matter halos, providing a key astrophysical test of our understanding of dark matter





GAMA



M_{DM}

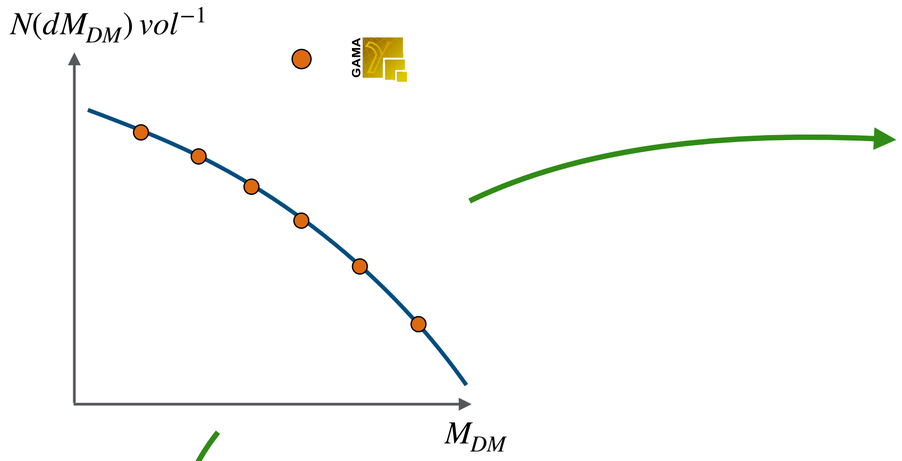
$N(dM_{DM})\,vol^{-1}$

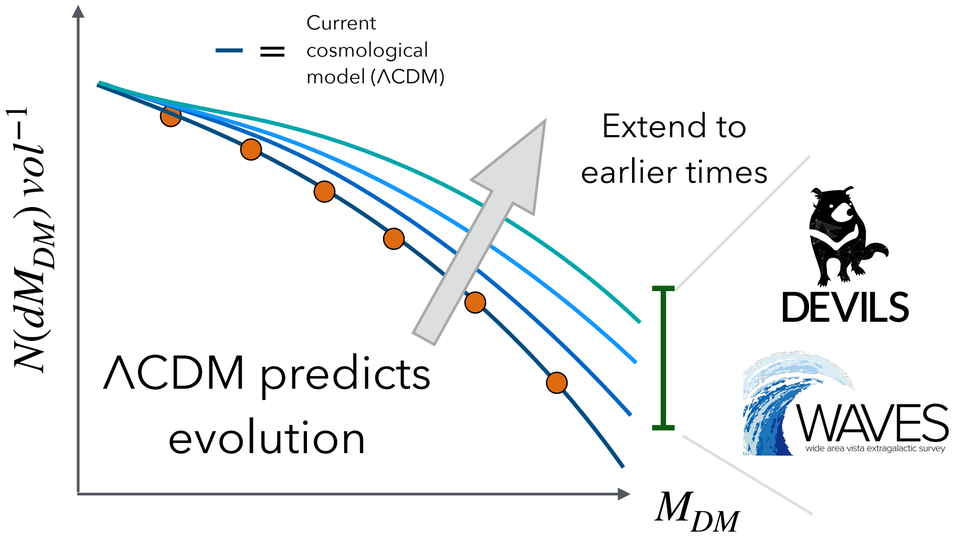
GAMA = Current cosmological model (ΛCDM)

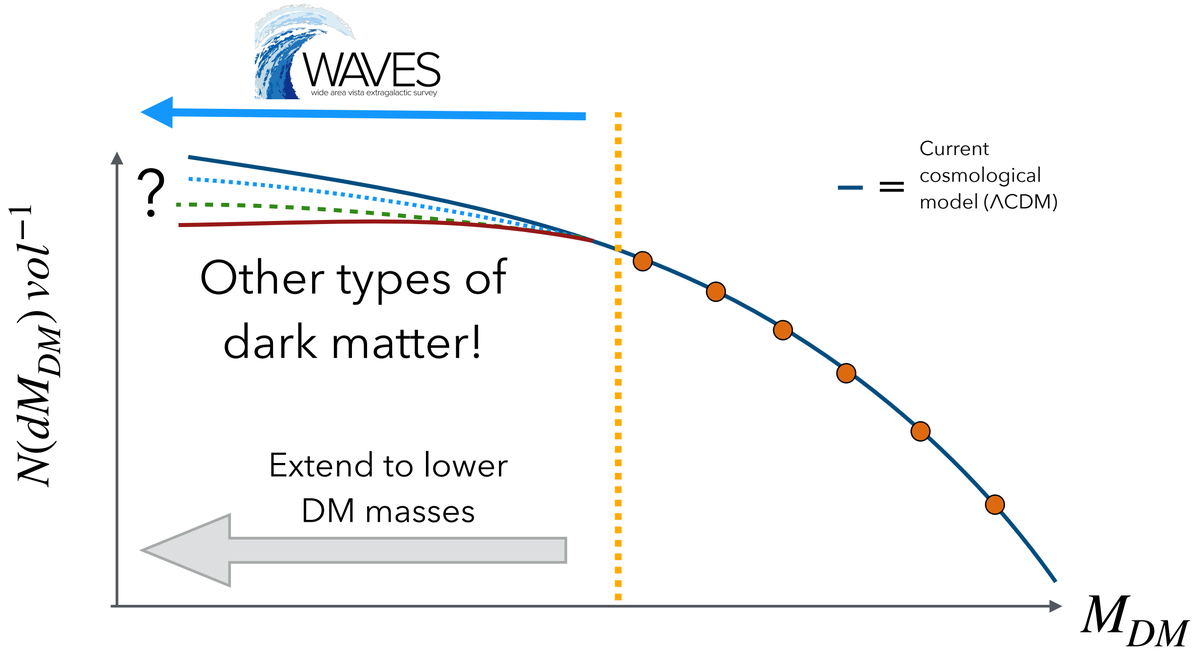
= Other types of dark matter

M_{DM}

Science Snippet: Dark Matter







Using data from DEVILS and WAVES wide area vista extragalactic survey we will 'weigh' dark matter halos to low masses and over a range of cosmic epochs to test the nature of dark matter

Group Members

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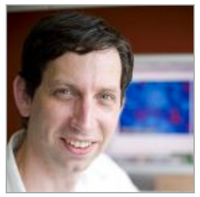

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