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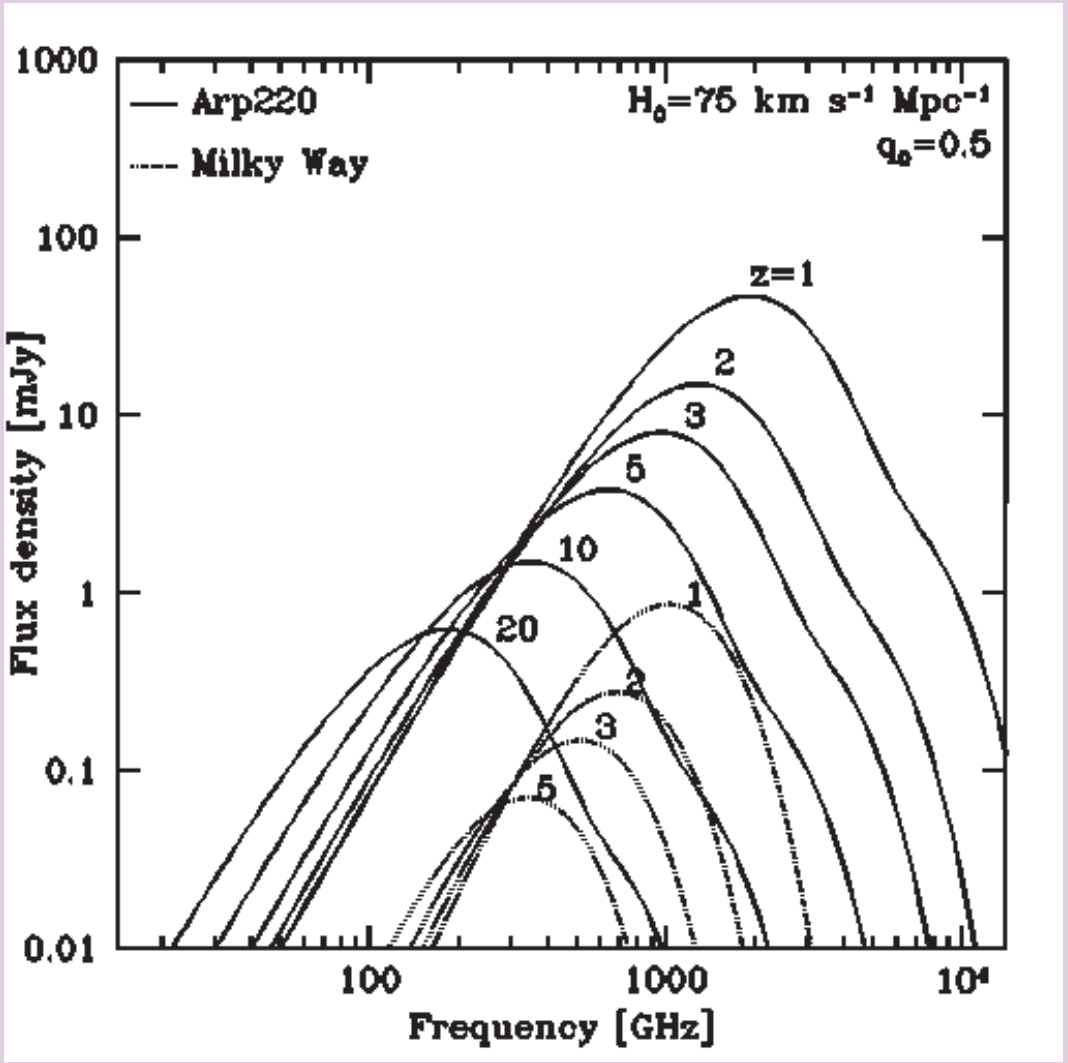
The Herschel-ATLAS survey: what we can learn from the largest extra-galactic submillimeter maps

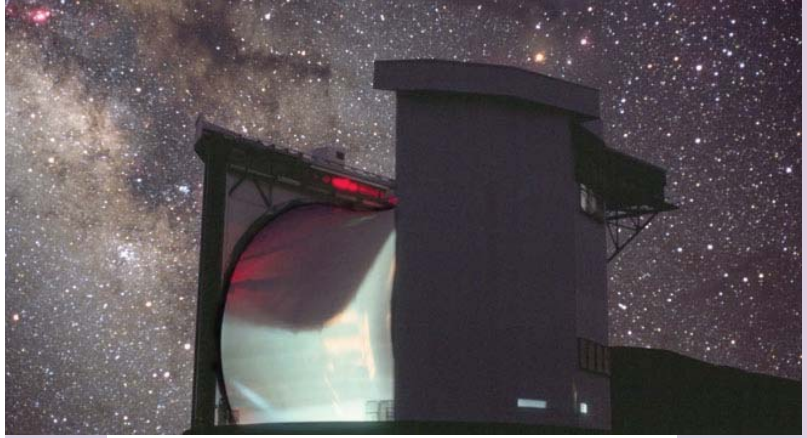
(Elisabetta Valiante – Cardiff University)

IRAS (1983)

- First all-sky maps of the sky at IR wavelengths (12, 25, 60, 100 μm)
- Detection of ~350000 IR sources
- Discovery of a new population: the Ultra-Luminous Infrared Galaxies (ULIRGs)

The negative K-correction

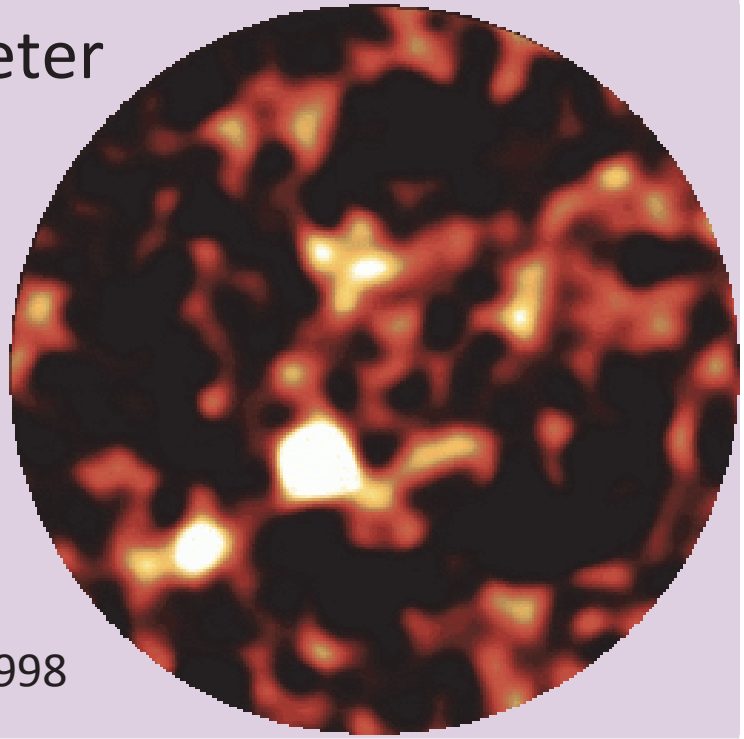




James Clerk Maxwell Telescope (Mauna Kea, Hawaii)

SCUBA (1998)

- First observations of submillimeter galaxies (850 μm)
- Hubble deep field, 200 arcsec diameter
- Detection of 7 sources



Hughes at al. 1998

BLAST (2006)

- Balloon-borne experiment developed by several European and North American institutions
- Provided the first large maps of the sky (~10 deg^2) at 250, 350, 500 μm
- Measured the peak of the dust emission for galaxies at z~1-2

Herschel (2009)

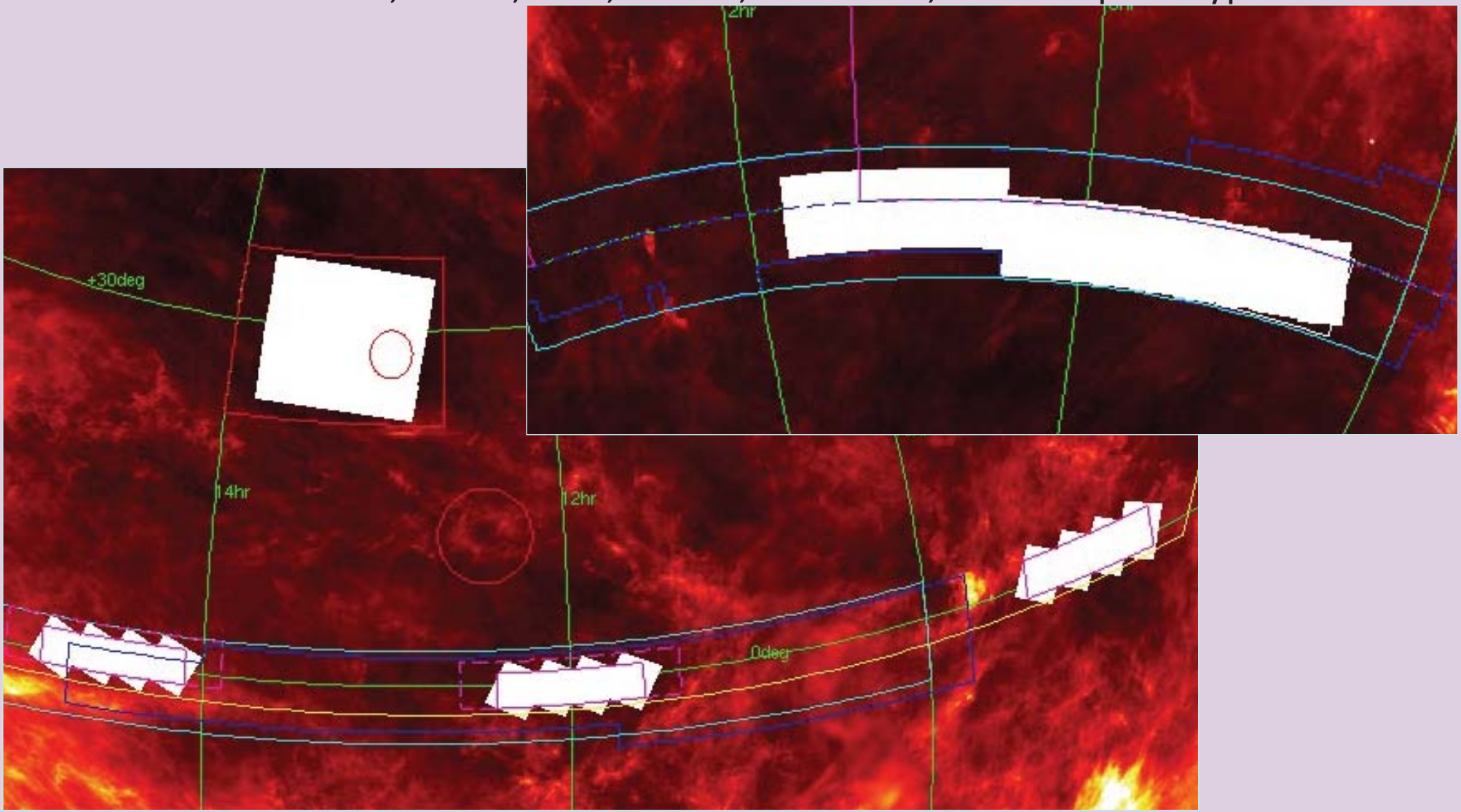
- Extended and deep surveys at 70, 100, 160, 250, 350, 500 μm
- Detection of thousands of sources
- Discovery of a new population of lensed galaxies, detected at submm wavelengths

The Herschel-ATLAS

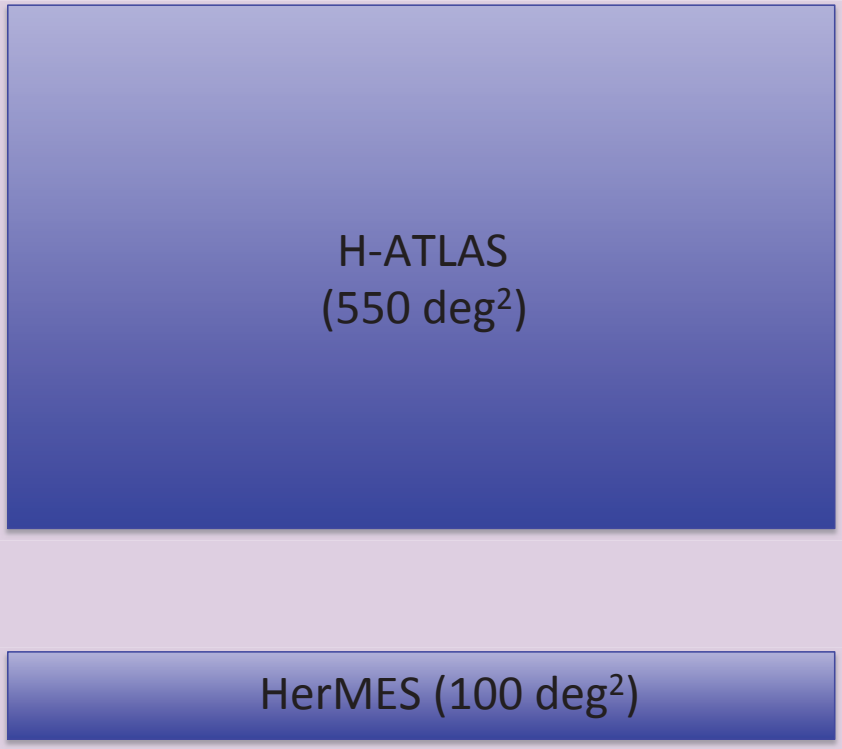
- The widest extragalactic area survey with Herschel (~550 deg^2)
- Consortium of 150+ astronomers worldwide led by Cardiff, UK (S. Eales) and Canterbury, NZ (L. Dunne)
- Covering 5 band with PACS and SPIRE (100 - 500 μm) in fast parallel mode
- Primary aim: to provide the kind of leap 2DF/SDSS made in the optical for the FIR/submm

Fields chosen to allow maximum overlap with existing and planned surveys
GALEX, 2dF, SDSS, GAMA, UKIDSS, KIDS, VIKING, PanSTARRS, DES, SPT, SASSy

and to be accessible to new facilities which will be valuable for follow-up
SCUBA2, ALMA, LMT, LOFAR, e-MERLIN, SKA and prototypes



Submm surveys to date



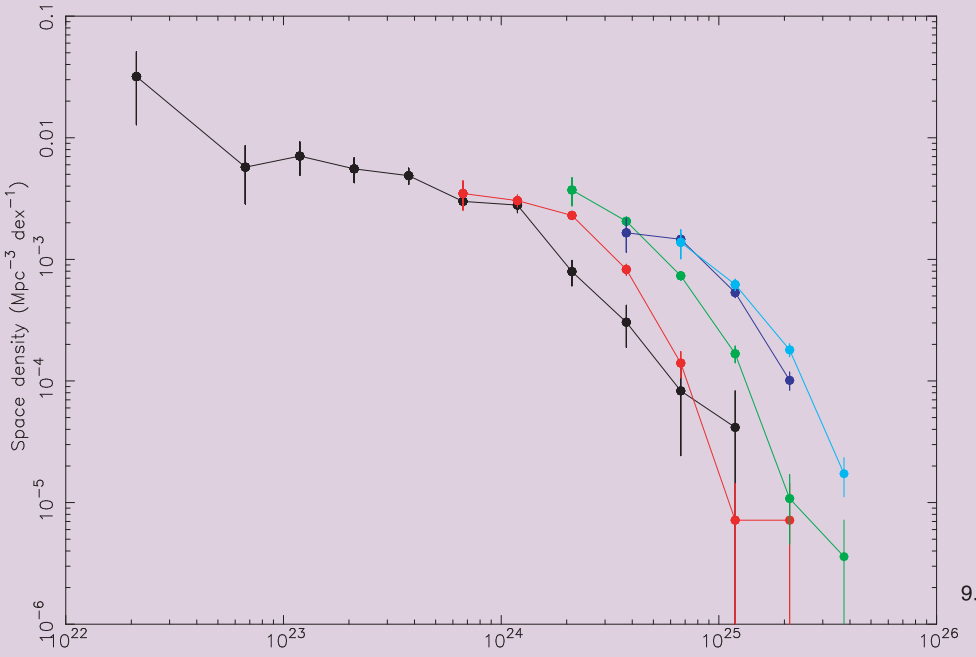
Key science themes in H-ATLAS

(more about this next week
Thu 13 Aug, S319.8.05)

- Local Universe survey
- The Herschel Lens Survey
- Synergies with Planck
- Rare (high-redshift) objects
- Galactic star and planet formation

Evolution of dust in galaxies I

Dunne et al. 2011



250 micron Luminosity [W Hz^{-1}]

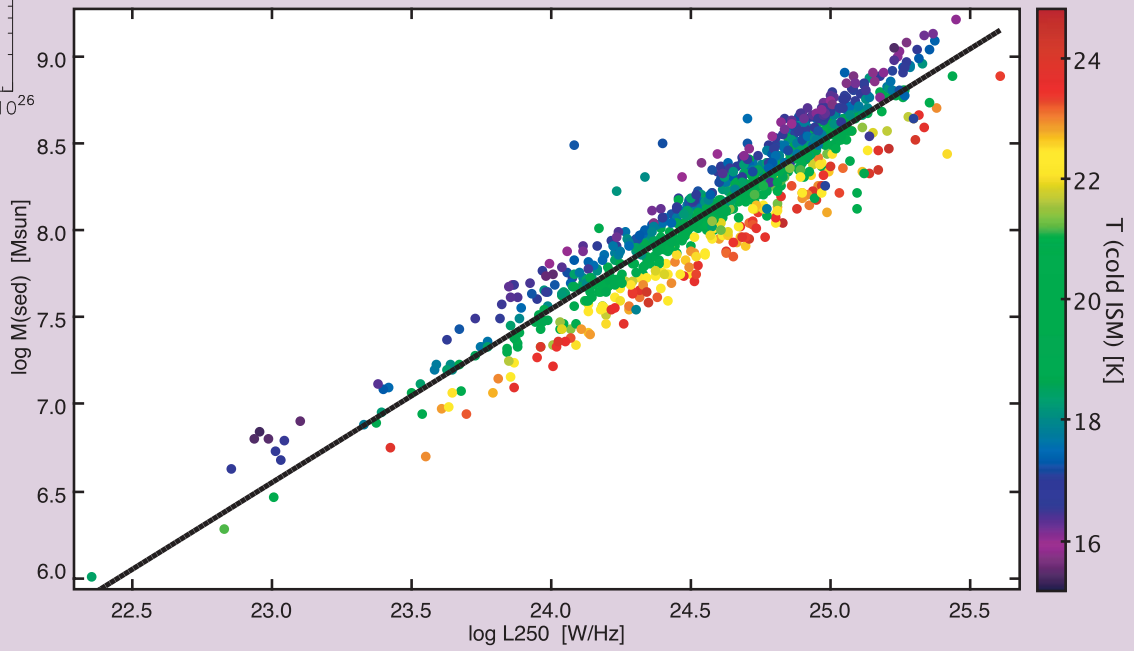
0 < z < 0.1

0.1 < z < 0.2

0.2 < z < 0.3

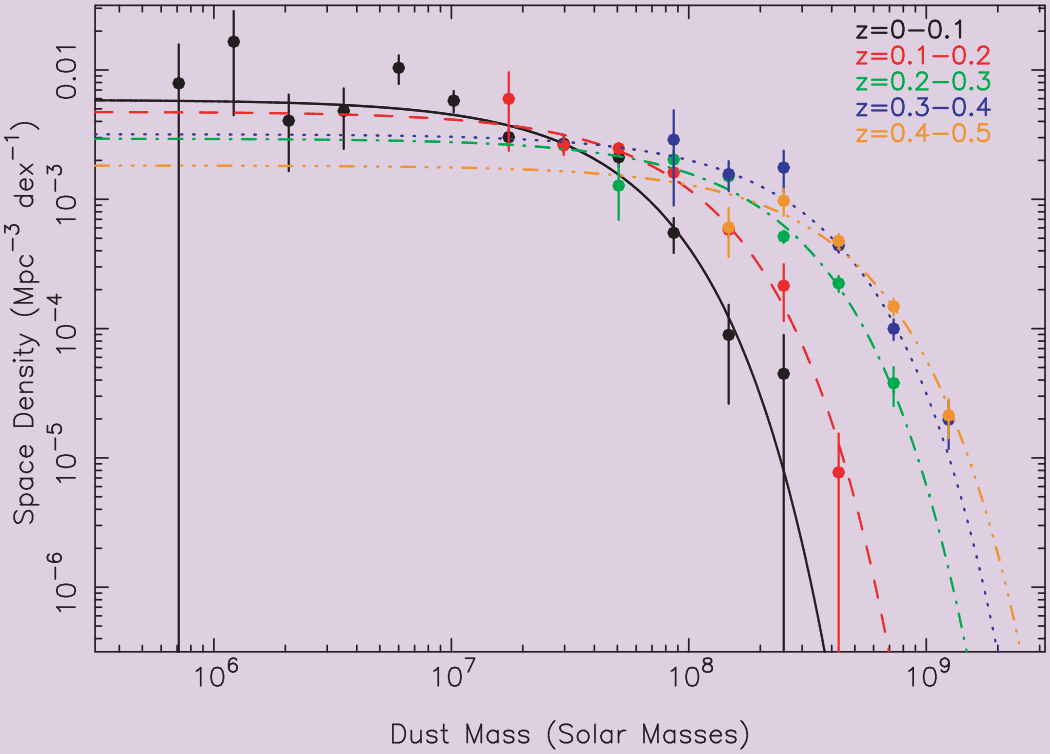
0.3 < z < 0.4

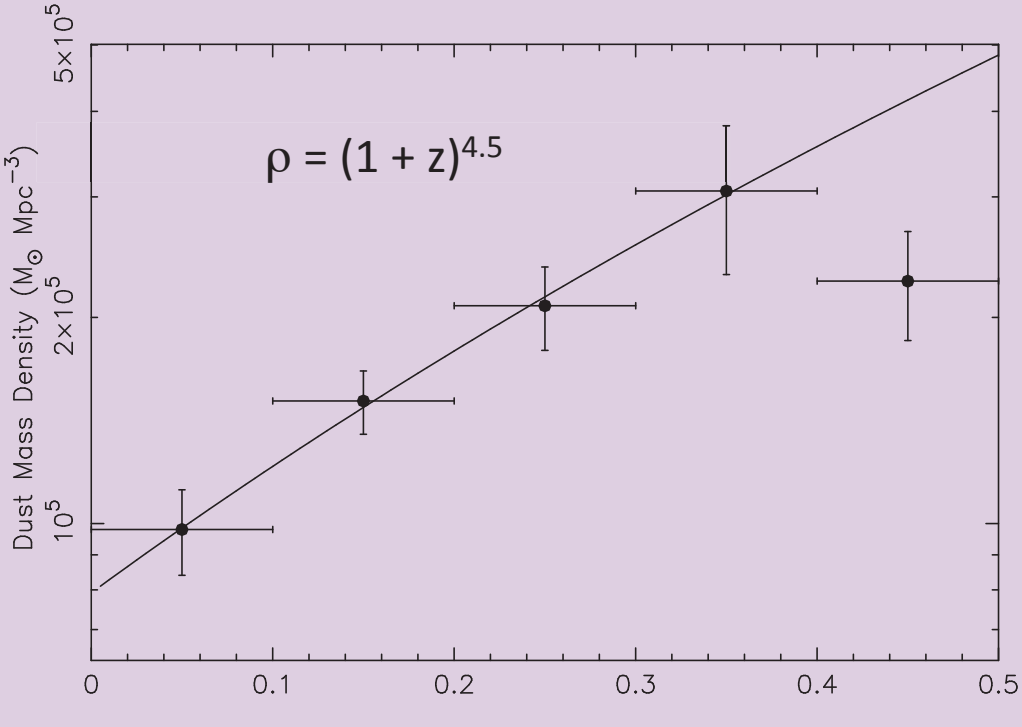
0.4 < z < 0.5



Evolution of dust in galaxies II

Dunne et al. 2011





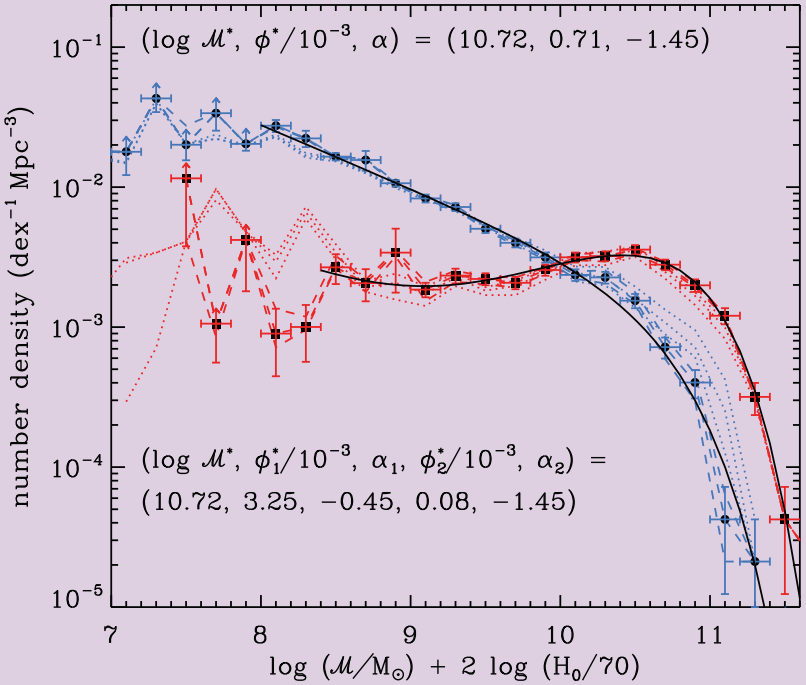
Evolution of dust in galaxies III
Dunne et al. 2011

- No evidence for evolution of dust temperature out to z = 0.5
- Strong evolution of dust mass function of dust *within* the galaxies
- Similar value of dust density estimated by Ménard et al. 2010 in the haloes of galaxies (through reddening of background quasars)
- Evolution of the LF is due to larger interstellar dust content in galaxies together with an increase in SFR

Star formation history I

Eales et al., in prep.

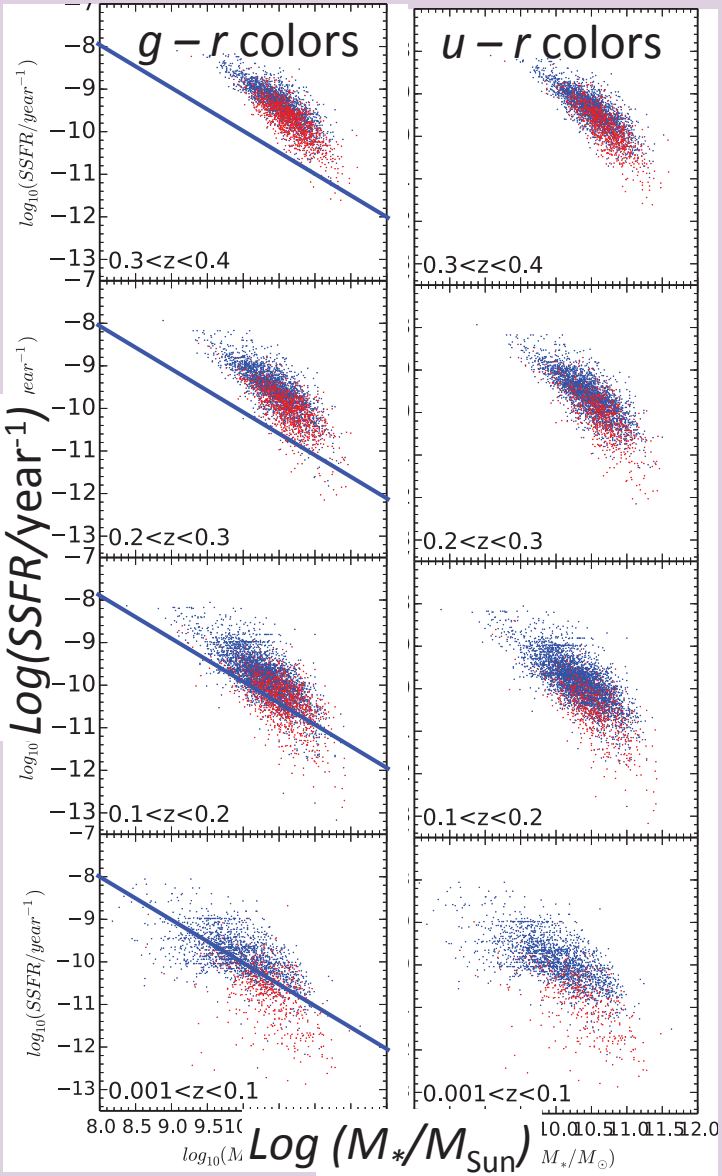
- Observational paradigm: star-forming galaxies (blue cloud) and passive galaxies (red sequence).
- Are they really different?



Baldry et al. 2012

Star formation history II

Eales et al., in prep.



- 20-30% of H-ATLAS galaxies are optically ‘passive’
- 50% of early-type galaxies are detected by Herschel, thus this population still contain a significant reservoir of cold interstellar gas (Herschel Reference Surveys, Smith et al. 2012)
- The properties of galaxies must vary gradually

Advertisement:
Phase 1 H-ATLAS Data Release

- Maps, PSFs and catalogues for the first three fields (GAMA9, GAMA12, GAMA15)
- ~ 100000 sources detected at >4σ at 250 μm
- Cross-correlation with SDSS/GAMA survey: optical spectra and photometry for ~ 1/3 of the sources
- Draft paper released to the collaboration, internal review stage
- Data available on *www.h-atlas.org* for everybody interested in local and high-z galaxies, SEDs modelling, rare objects (lensed and/or red sources, AGN,…), environment studies, dust in the Galaxy, etc.