The Evolving Luminosity Function of Red Galaxies

Michael J.I. Brown

Buell Jannuzi, Arjun Dey, Kate Brand, Mark Brodwin,
Peter Eisenhardt, Andrew Benson, Darren Croton

Massive Galaxies Over Cosmic Time 2

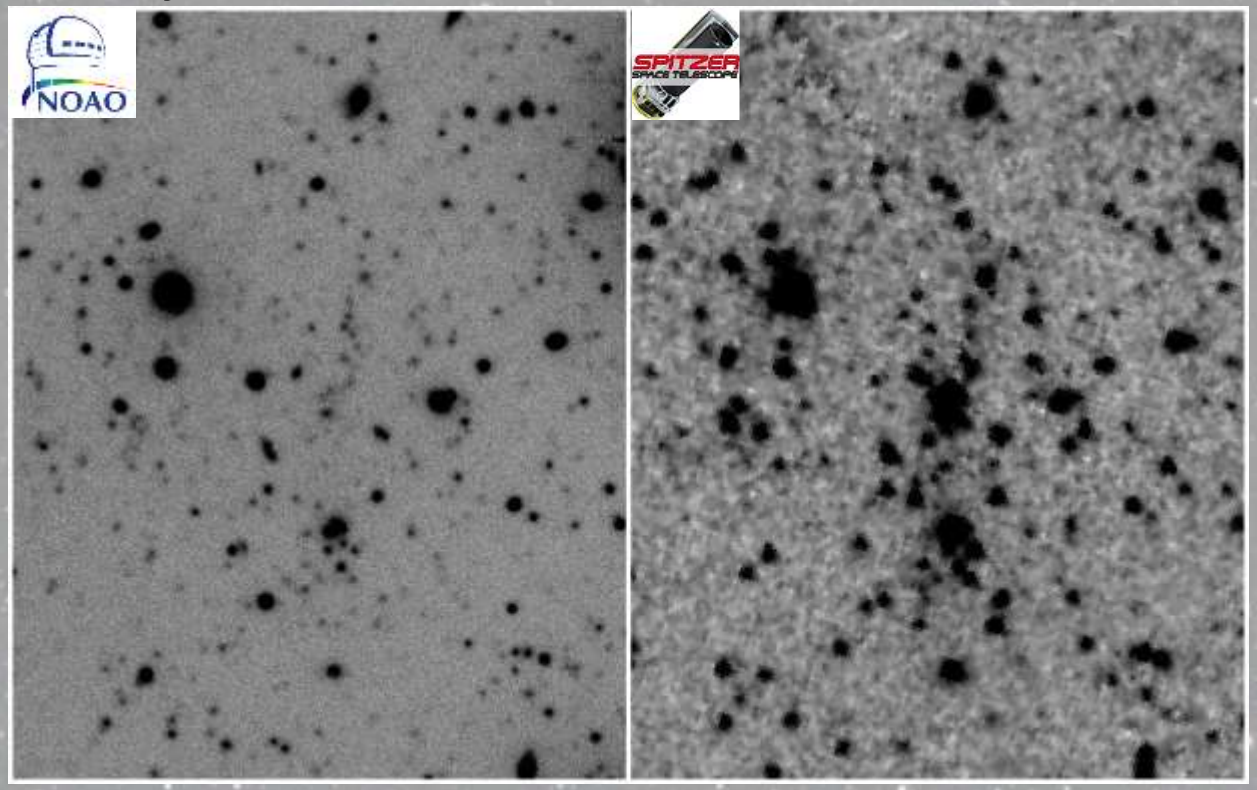
Red Galaxies

- Ideal for tests of simulations & models.
  - Contain the bulk of the stars at low redshift.
  - Include the most massive low redshift galaxies.
  - Little growth from recent star formation.

Image stolen from SDSS

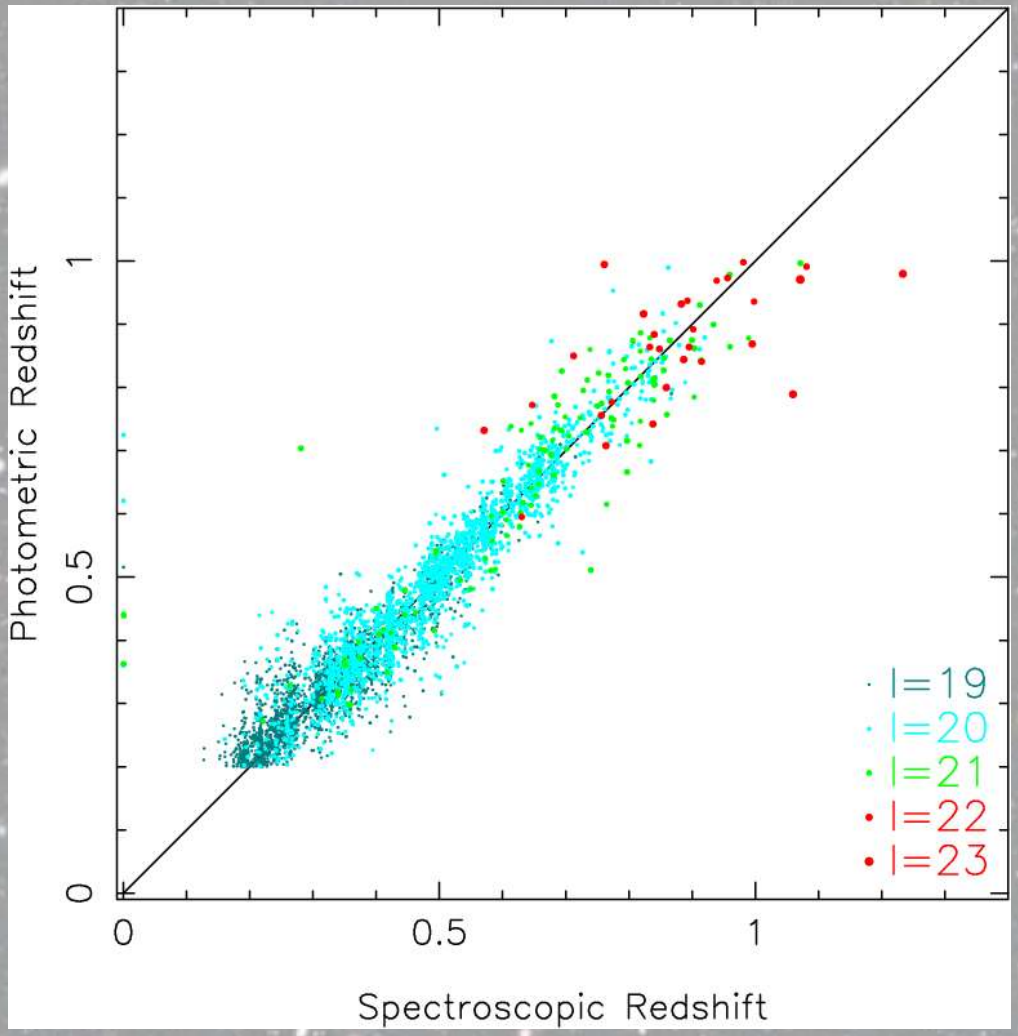
Bootes Surveys

NOAO Deep Wide-field Survey
Spitzer IRAC Shallow Survey
AGES
Spitzer MIPS Bootes
XBootes
FLAMEX
GALEX



NDWFS I-band IRAC 3.6μm

Photometric Redshifts



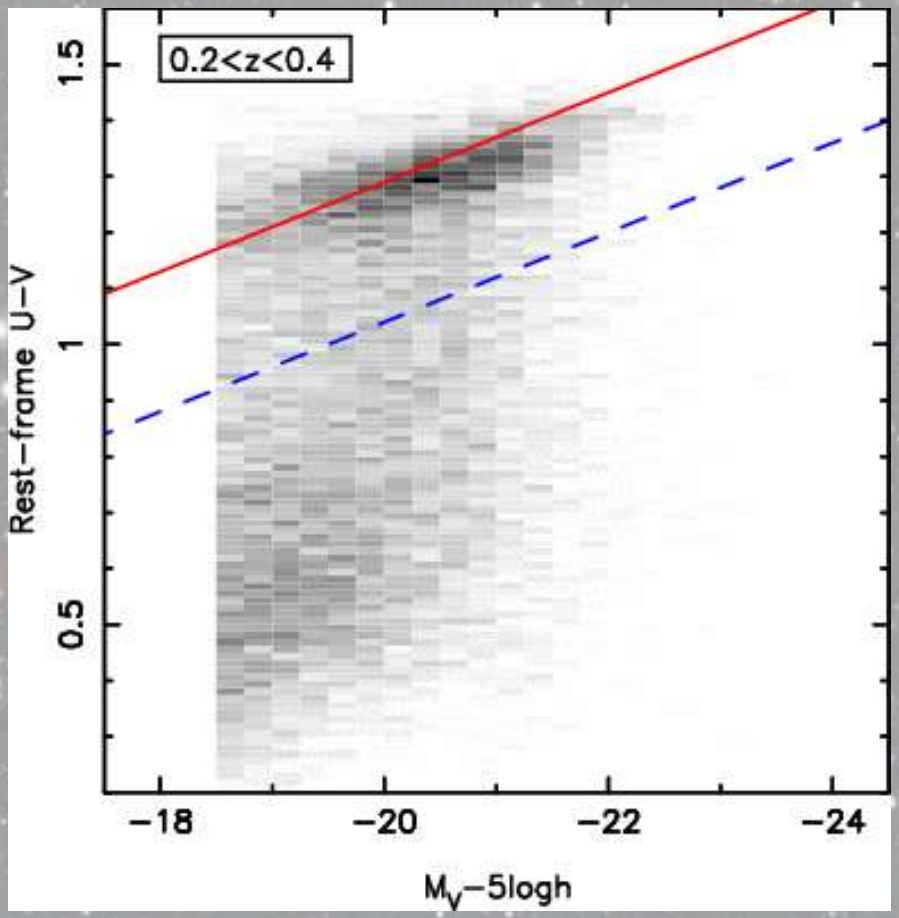
Larger volumes than spec-z surveys.

Photo-zs accurate to +/-0.05 at I<22.

Luminosities & colours from SED model fits

Red Galaxy Selection

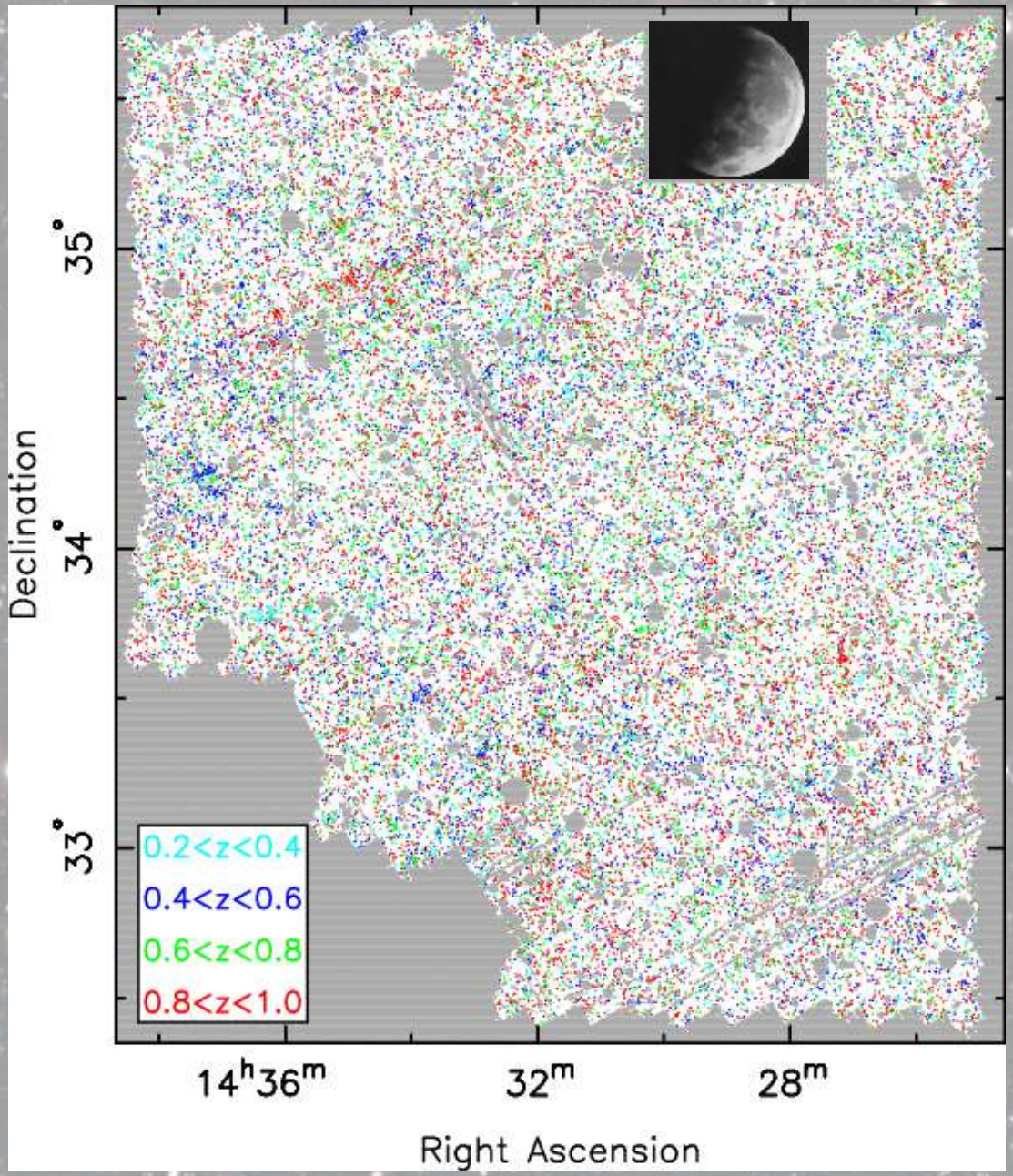
Colour



Magnitude

Selection criterion falls between CMR and blue cloud.

Similar selection used in the recent literature.

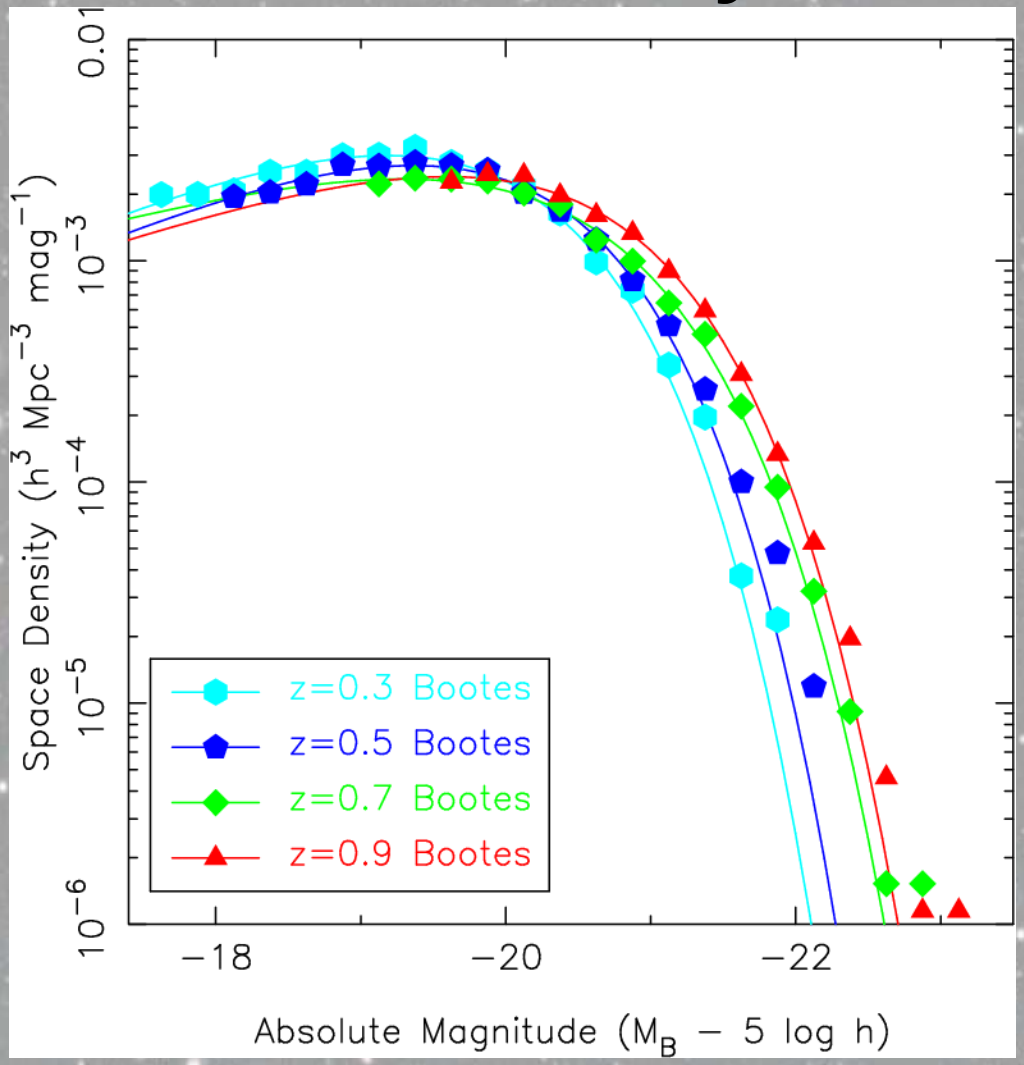


39599
red galaxies

Brown et al. (2006),
ApJ, accepted
astro-ph/0609584

The Luminosity Function

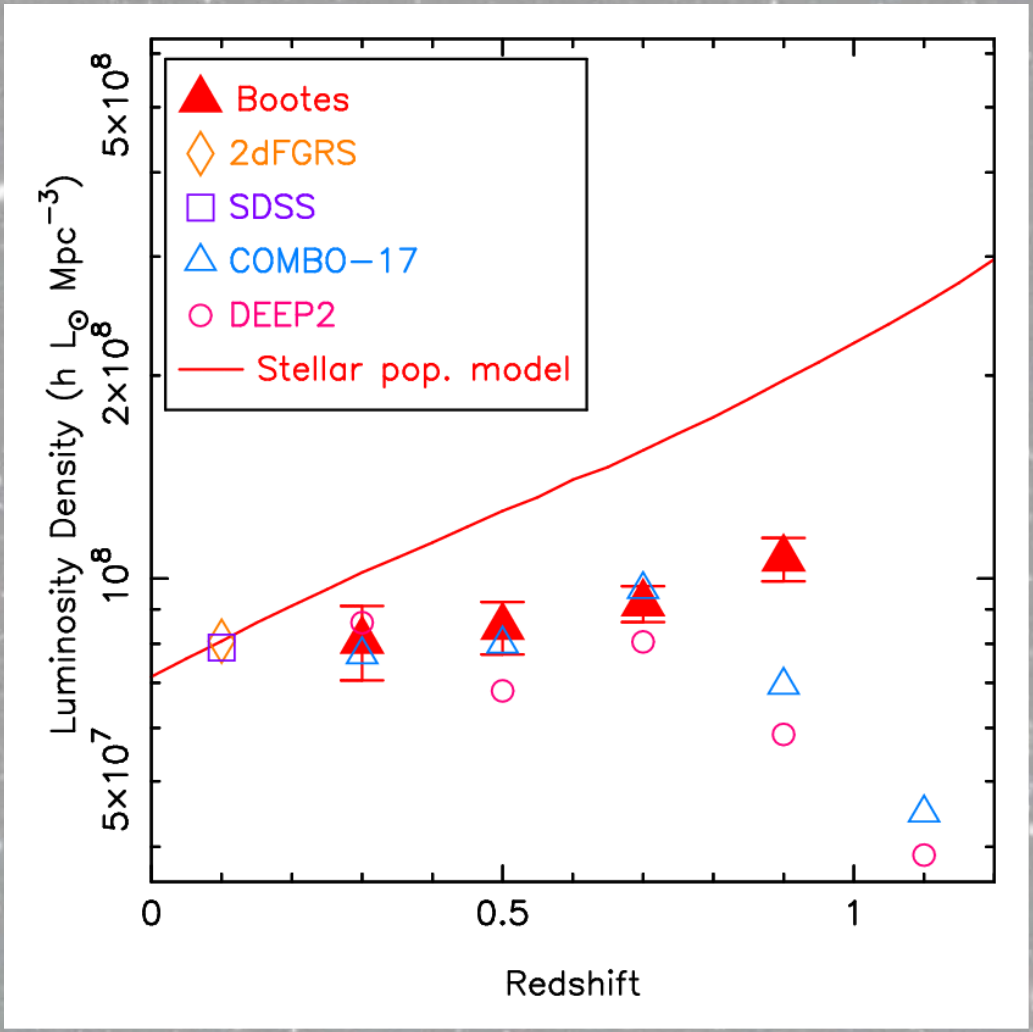
Galaxies per unit volume



Red galaxies were brighter in the past.

Brown et al. (2006), ApJ, accepted astro-ph/0609584

Luminosity Density



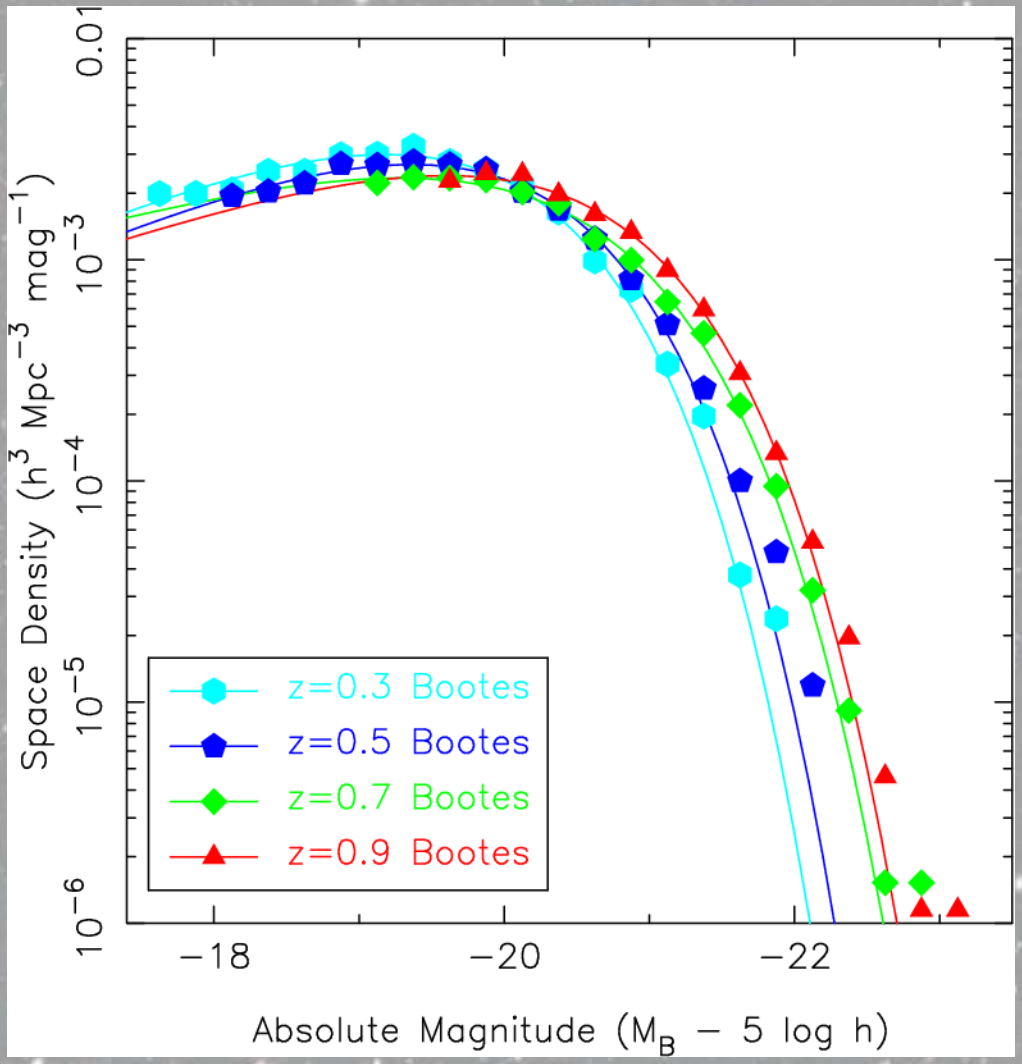
Stellar pop. model overestimates j_B at z~1

Stellar mass in red population increases.

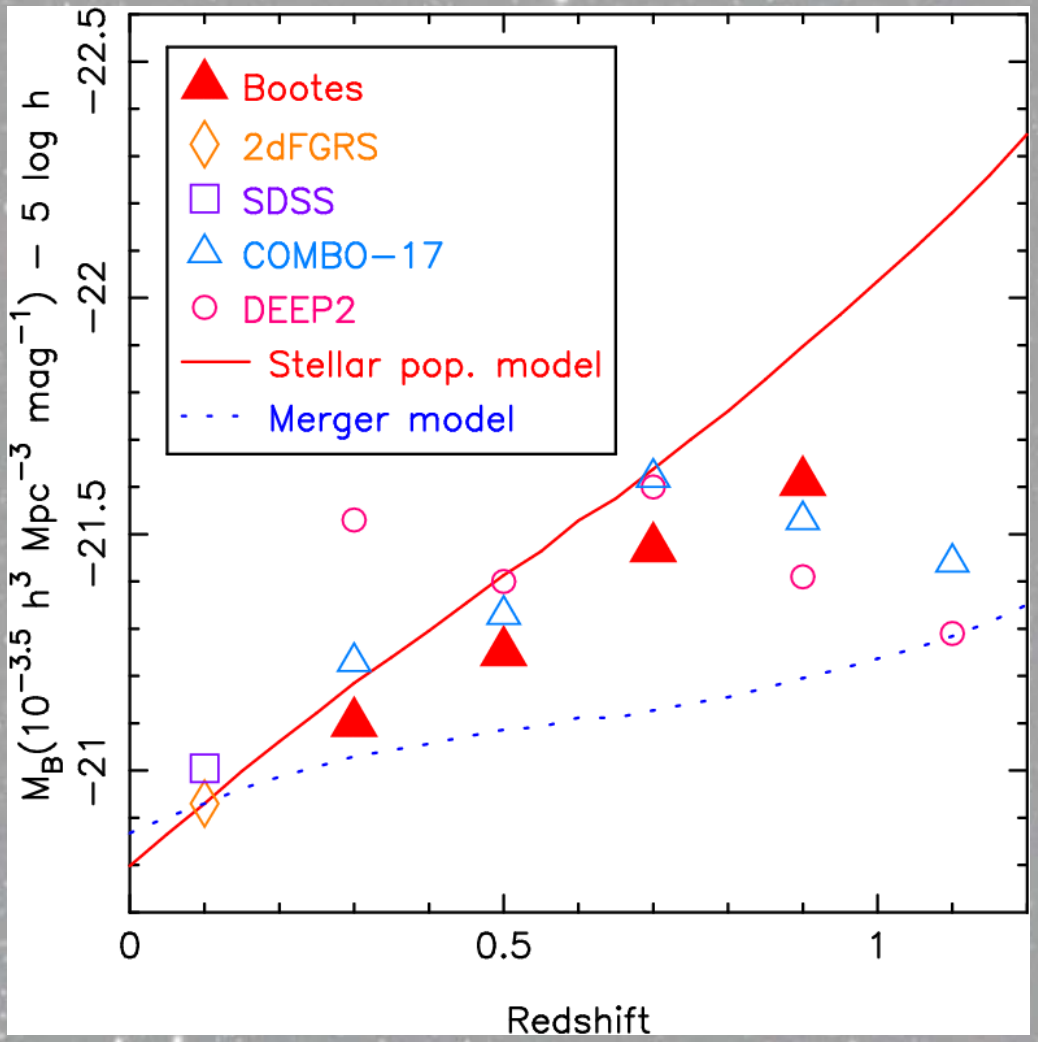
Truncation of SF in blue galaxies.

Brown et al. (2006), ApJ, accepted astro-ph/0609584

The Luminosity Function



~4L* Red Galaxies



Steady evolution of luminosity with z

Differs slightly from stellar pop. model

Growth via mergers, but not rapid growth.

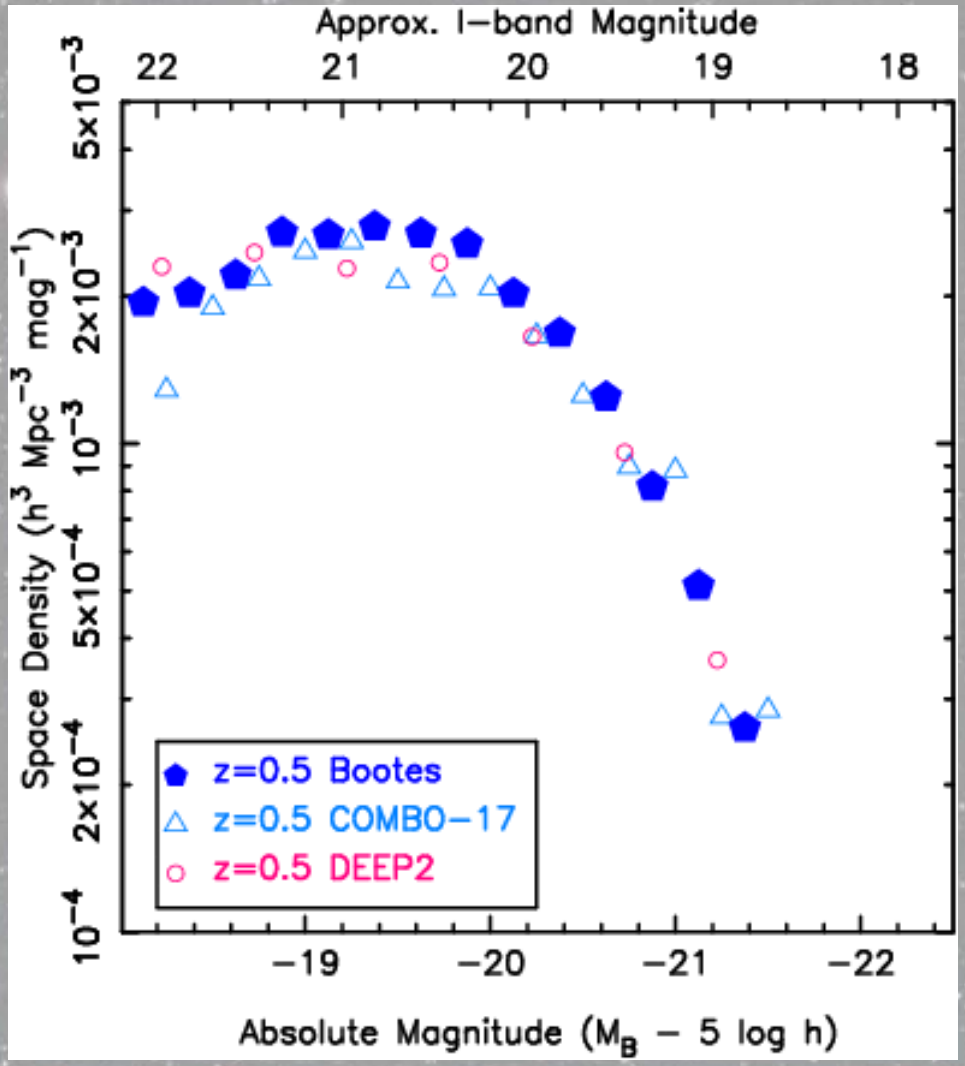
Brown et al. (2006), ApJ, accepted astro-ph/0609584

Summary

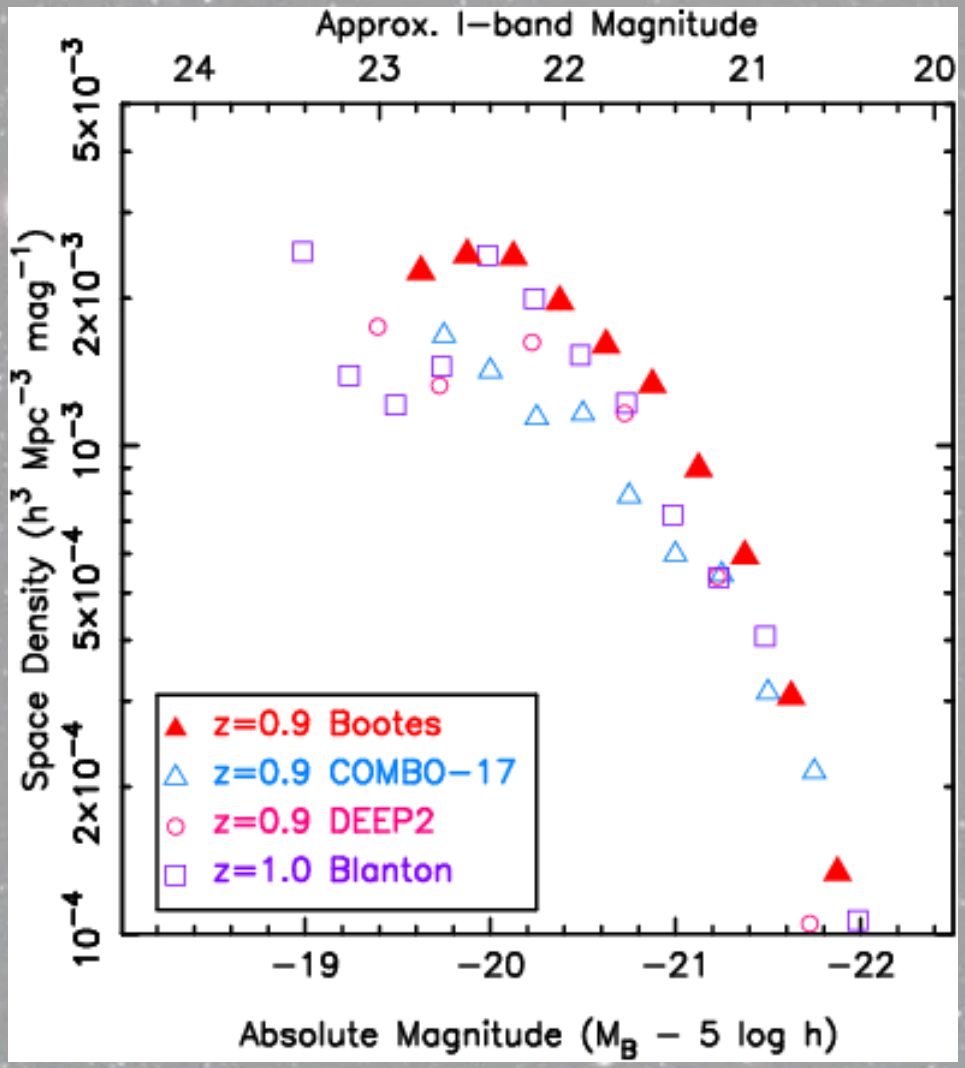
- Red galaxy assembly over the past 7 billion years:
  - Stellar mass within the red galaxy population doubles.
  - Star forming blue galaxies are being transformed.
  - The most luminous galaxies were assembled at $z>1$.
  - Some simulations overestimate $z<1$ galaxy assembly.

- Key Remaining questions.
  - What truncates star formation in galaxies?
  - When were massive red galaxies assembled?
  - What are the progenitors of today's most massive galaxies?

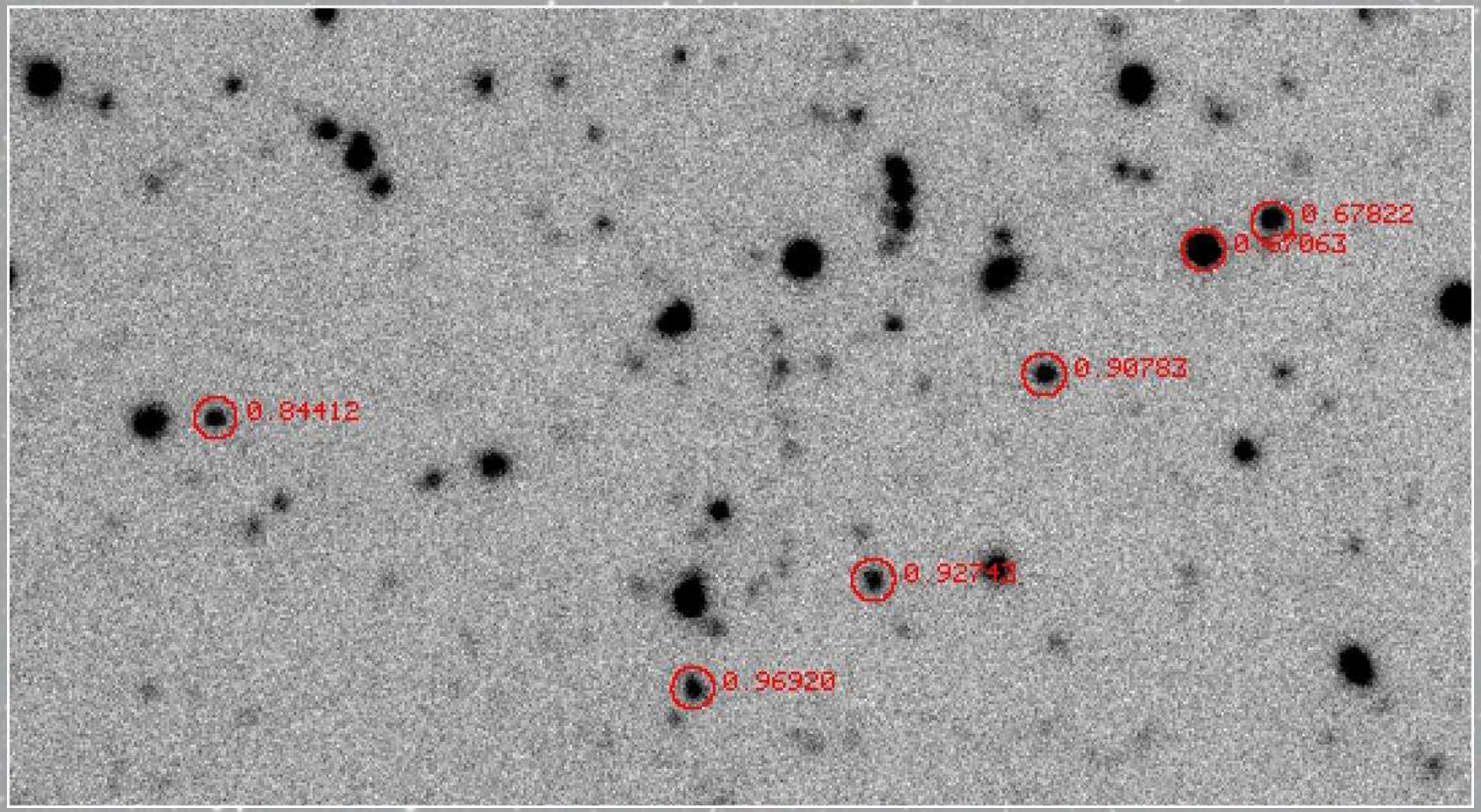
The z=0.5 Luminosity Function



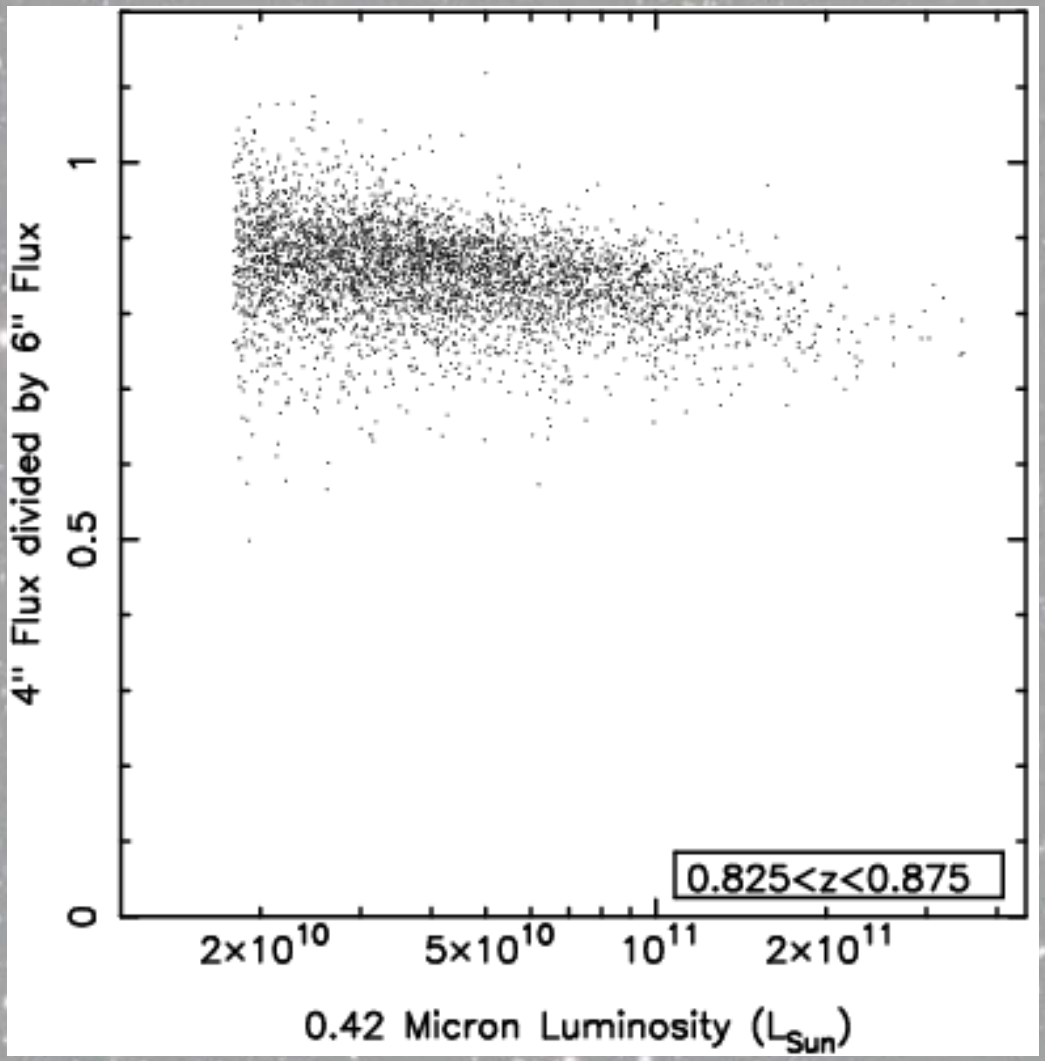
The z=0.9 Luminosity Function



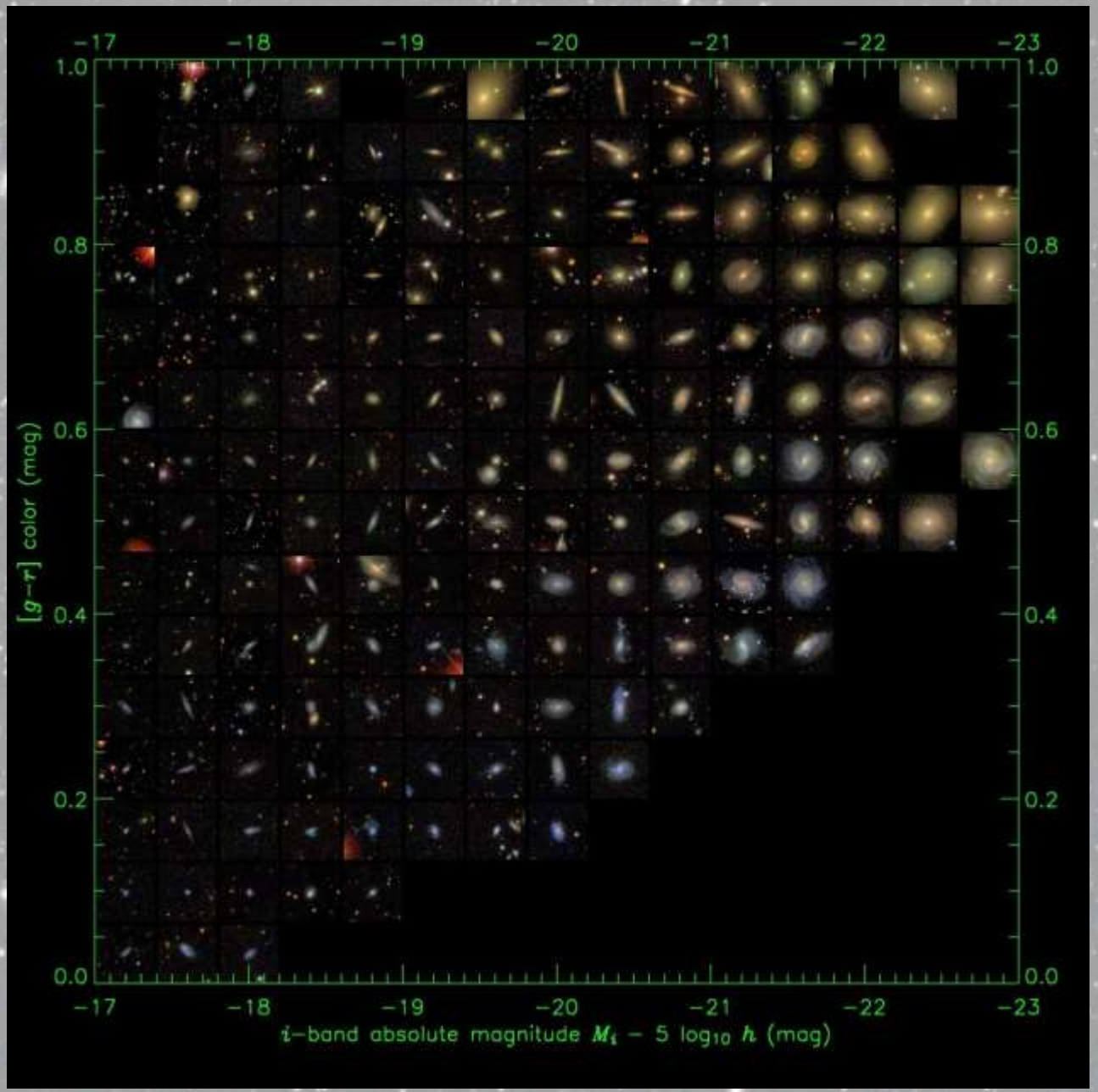
Luminosities



Luminosity-Size



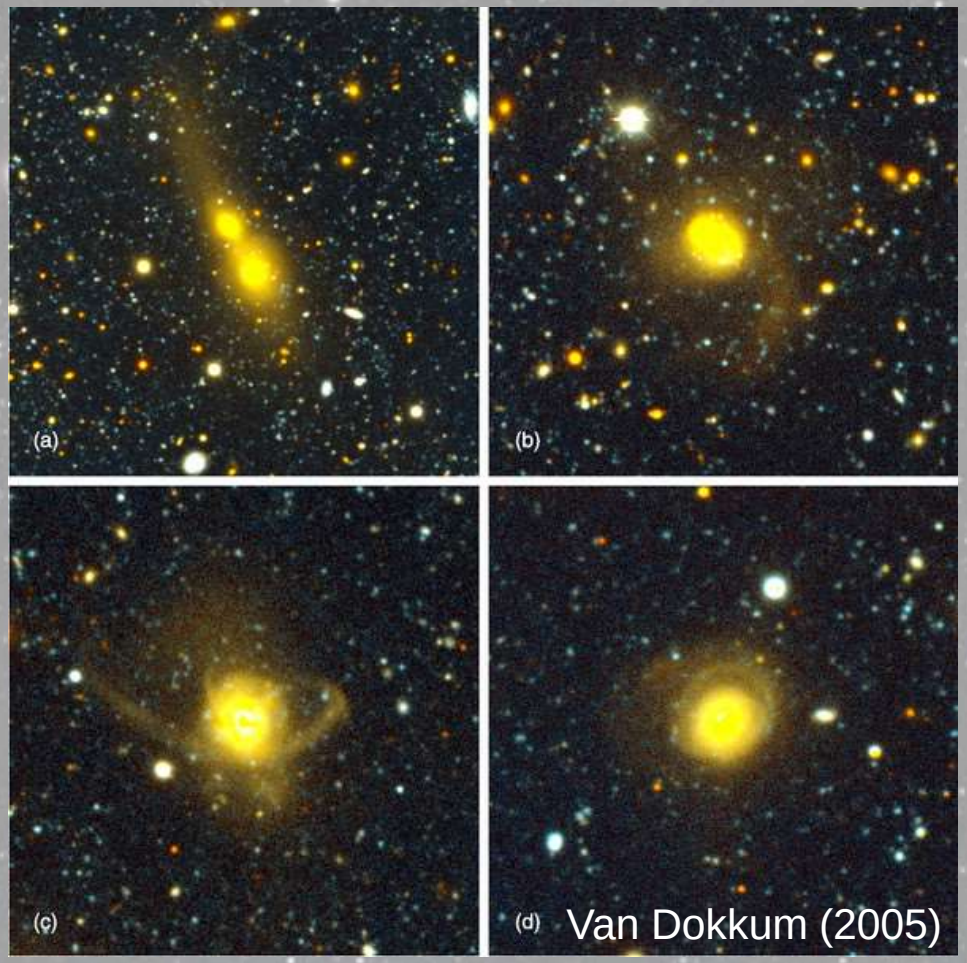
Colour



Luminosity

(SDSS, D. Hogg)

Observed Galaxy Mergers



Timescales? Significance?