TAIPAN

Andrew Hopkins
Australian Astronomical Observatory

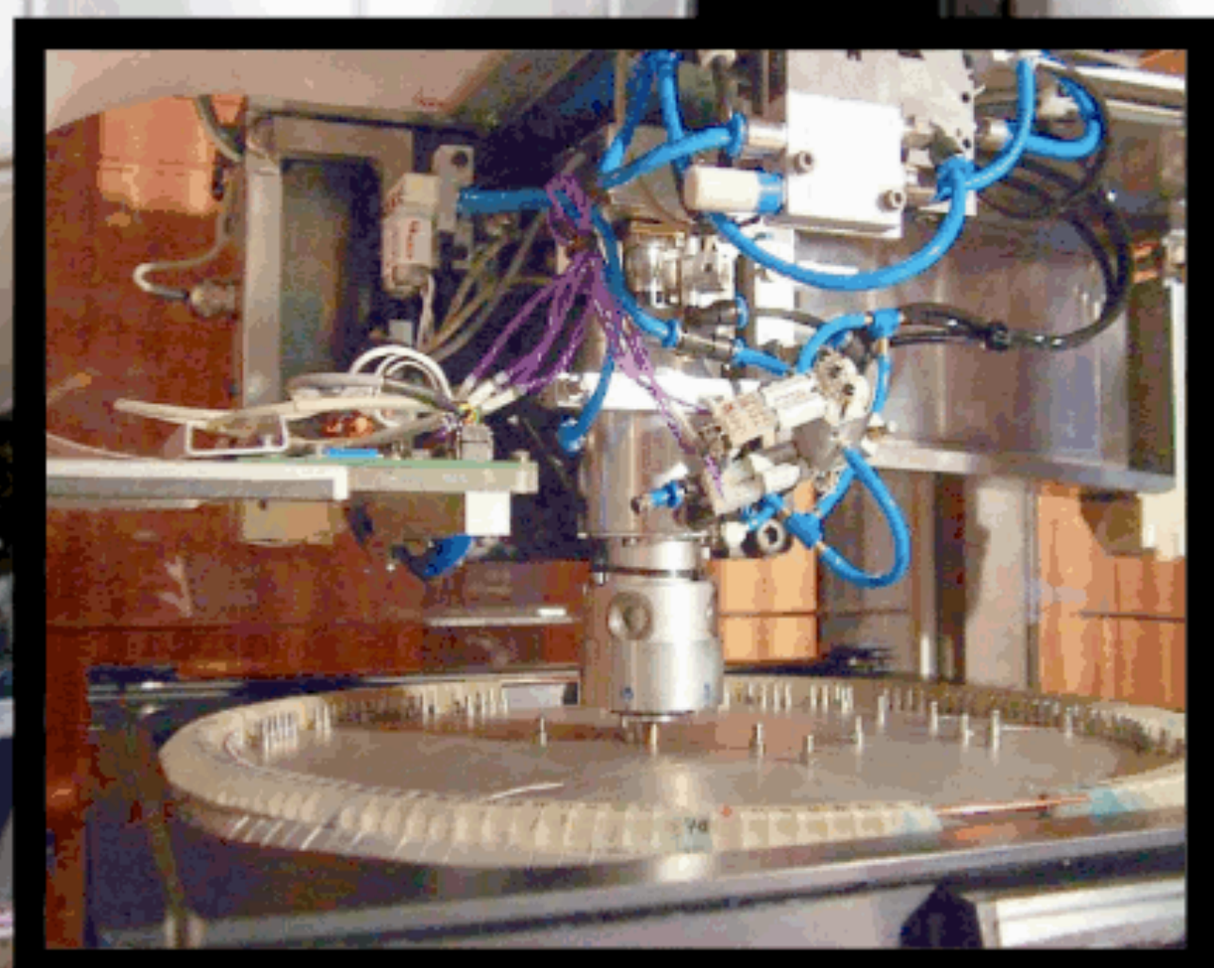
Australian Government
Department of Industry
Innovation, Science, Research
and Tertiary Education

TAIPAN

* Transforming Astronomical Imaging-surveys through Polychromatic Analysis of Nebulae
* Survey with the UK Schmidt Telescope at Siding Spring, following in the footsteps of the 6dF Galaxy Survey (Jones et al., 2004, 2009)
* All southern sky multi-object spectroscopic survey, ~500000 galaxies
* 30 authors on the original expression of interest to the AAO, but planning to have more people involved

The 6-Degree Field instrument (6dF)

- The 6-Degree Field is a floor-mounted spectrograph for the AAO's UK Schmidt Telescope:
  - commissioned in 2001
  - 5.7° field (25.5 deg^2)
  - up to 150 objects at a time



- 6dF has *by far* the largest F.O.V. of any multi-object spectrograph in the southern hemisphere…
  - 6dFGS: 110,256 new galaxy redshifts (2001 – 2005)
  - RAVE: >500,000 stellar radial velocities (2005 – present)

Survey design

* Scaled from 6dFGS
* Desirable wavelength range: 3700-7500Å
* [OII], Hβ, [OIII], Hα, [NII], [SII], (Hα to z<0.14)
* Resolution: R>3000, to allow 1 pixel=100 km/s sampling

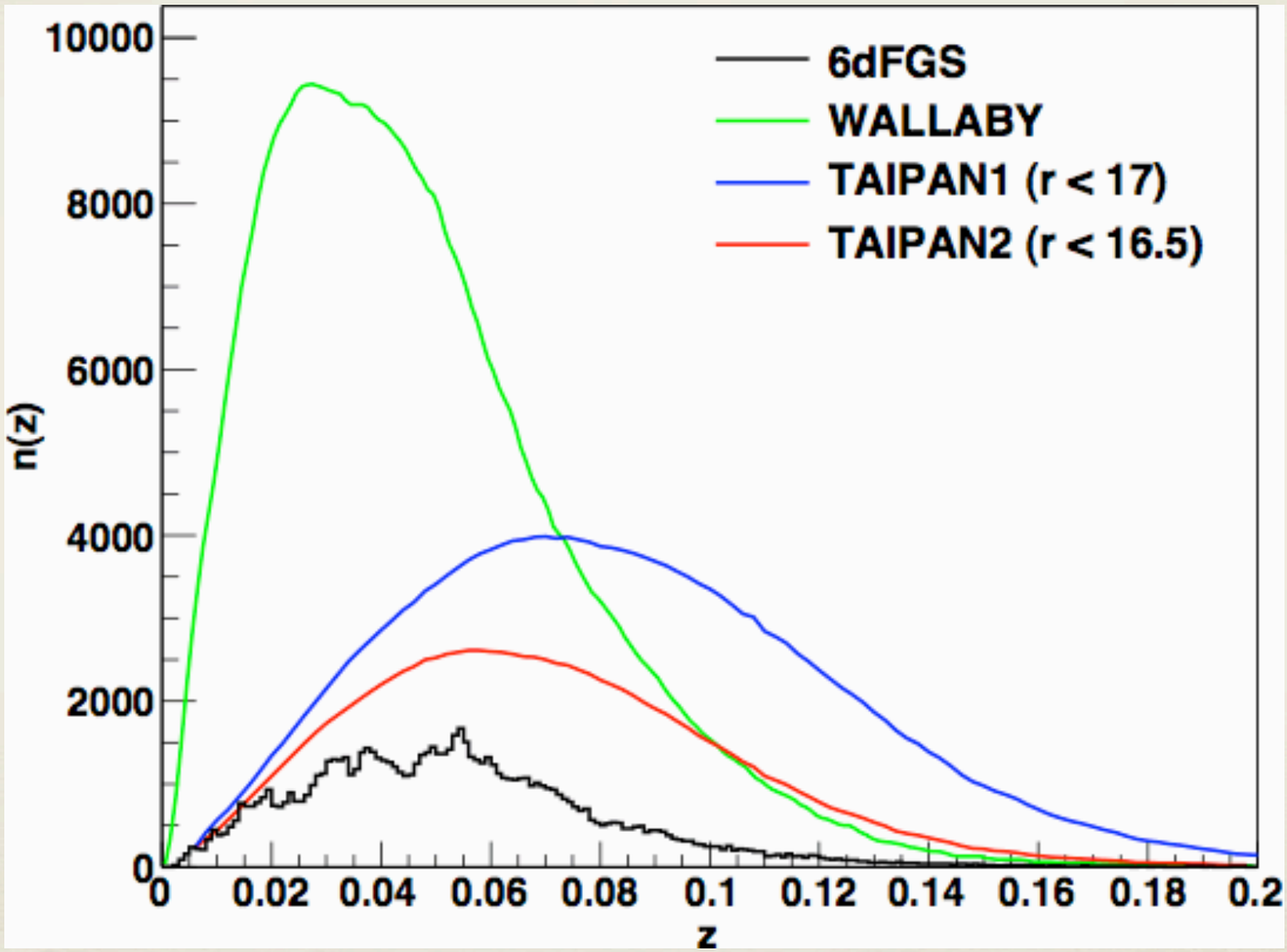
Survey design

* Survey to r<17 (c.f. SDSS at r<17.7)
* Assumes ×2 spectrograph efficiency improvement compared to 6dF
* Assumes 300 “starbug” fibre probes
* ~700000 targets, (~1000 per 6dF field)
* 50 min exposures ➛ S/N~10, 3.3 visits per field
* 2.2 year survey
* With r<17.7, a little over twice the number of targets, survey could be done in about 5 years

Scientific Goals

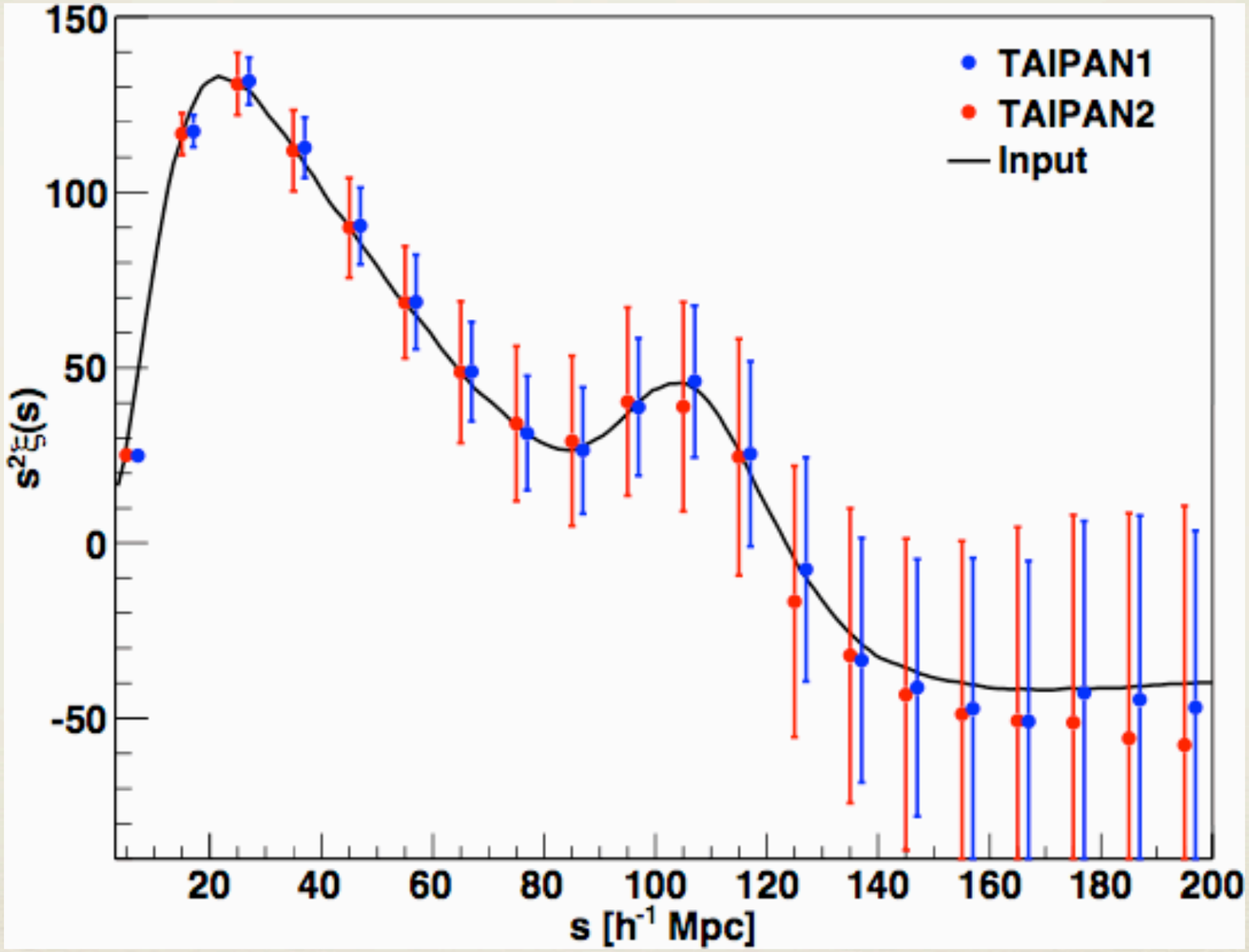
* Independent measurement of H_0
* The connection between gas and stars
* The impact of environment and mergers
* Large scale structure: Stellar and halo mass functions
* Star formation and AGN
* Intergalactic magnetic field
* Legacy value

TAIPAN cosmology



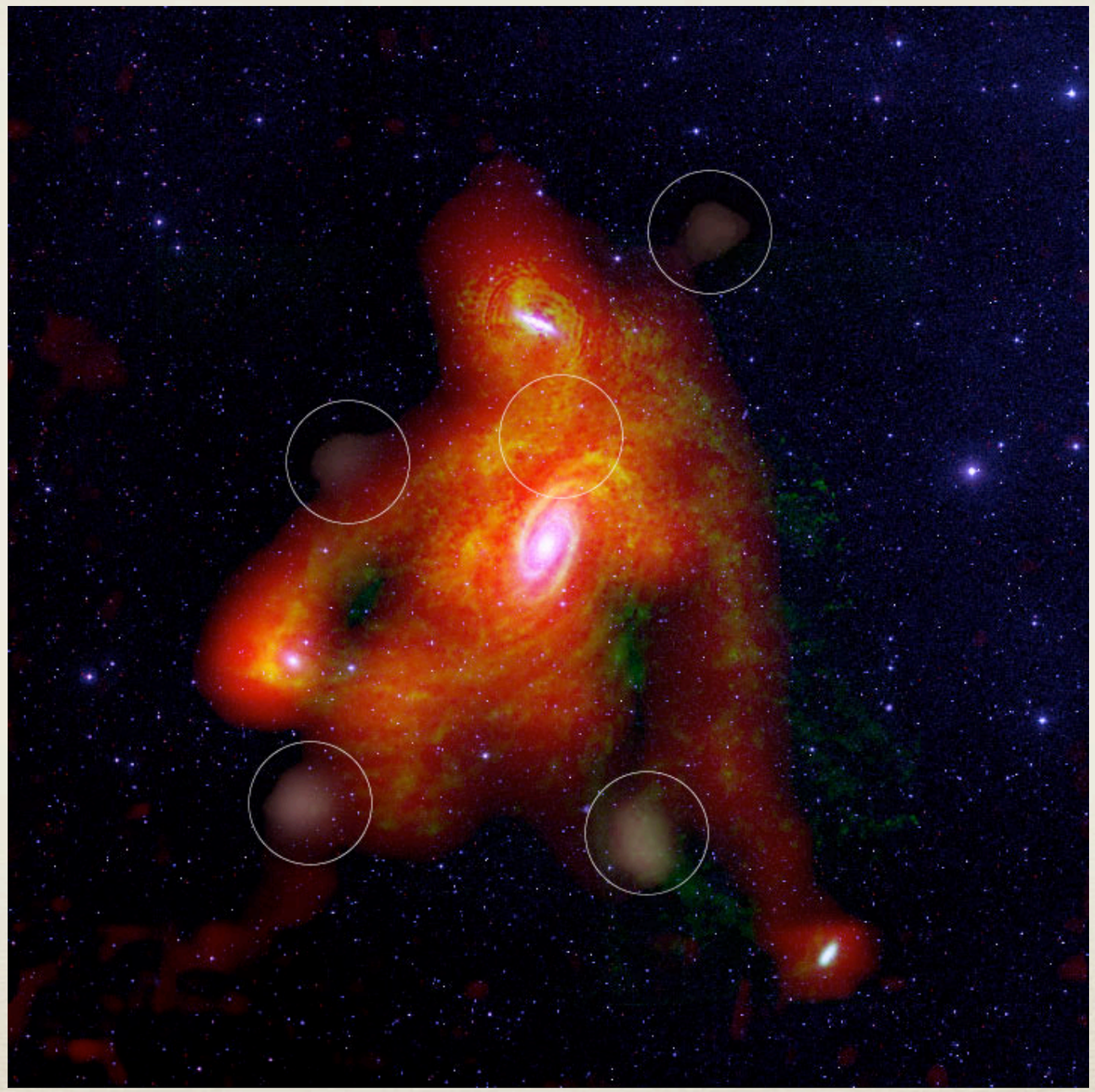
Beutler et al., 2011, MNRAS, 416, 3017

TAIPAN cosmology



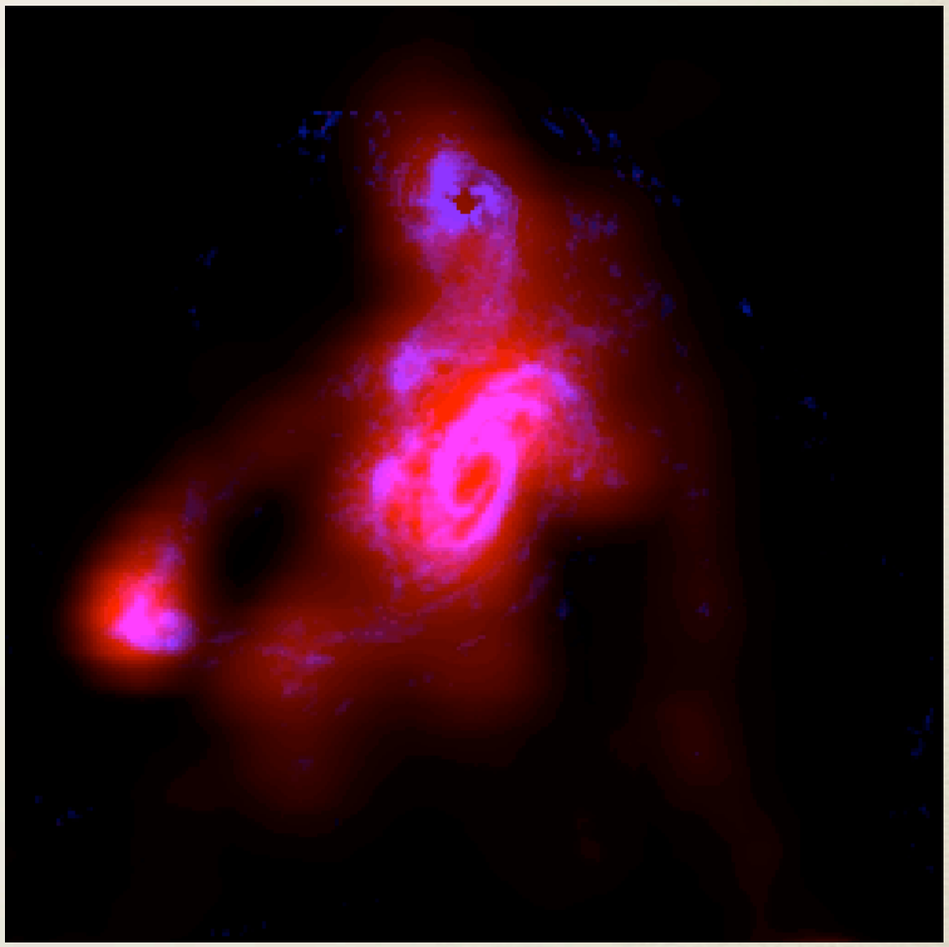
Beutler et al., 2011, MNRAS, 416, 3017

Stars and Gas



Katie Chynoweth & NRAO

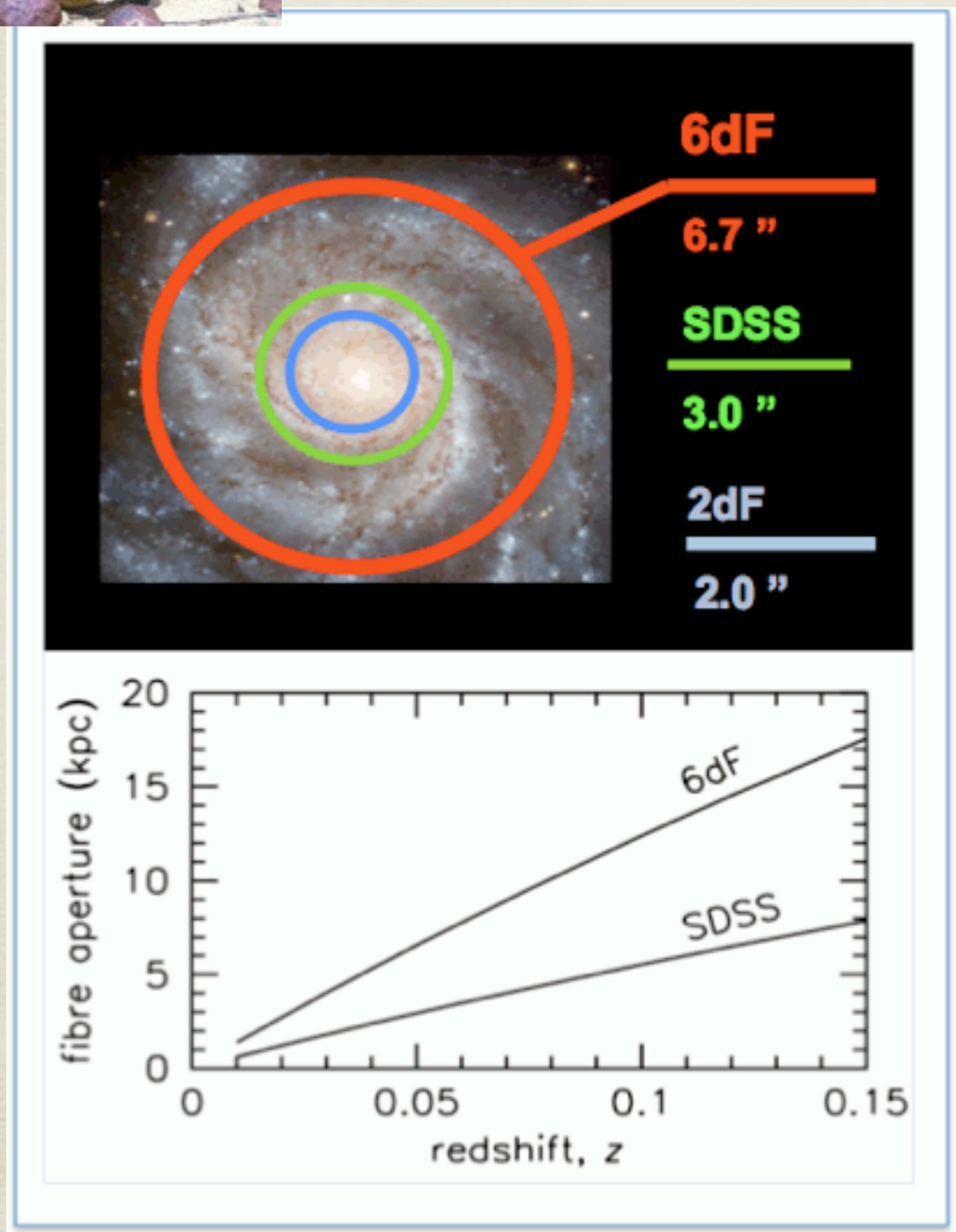
Stars and Gas

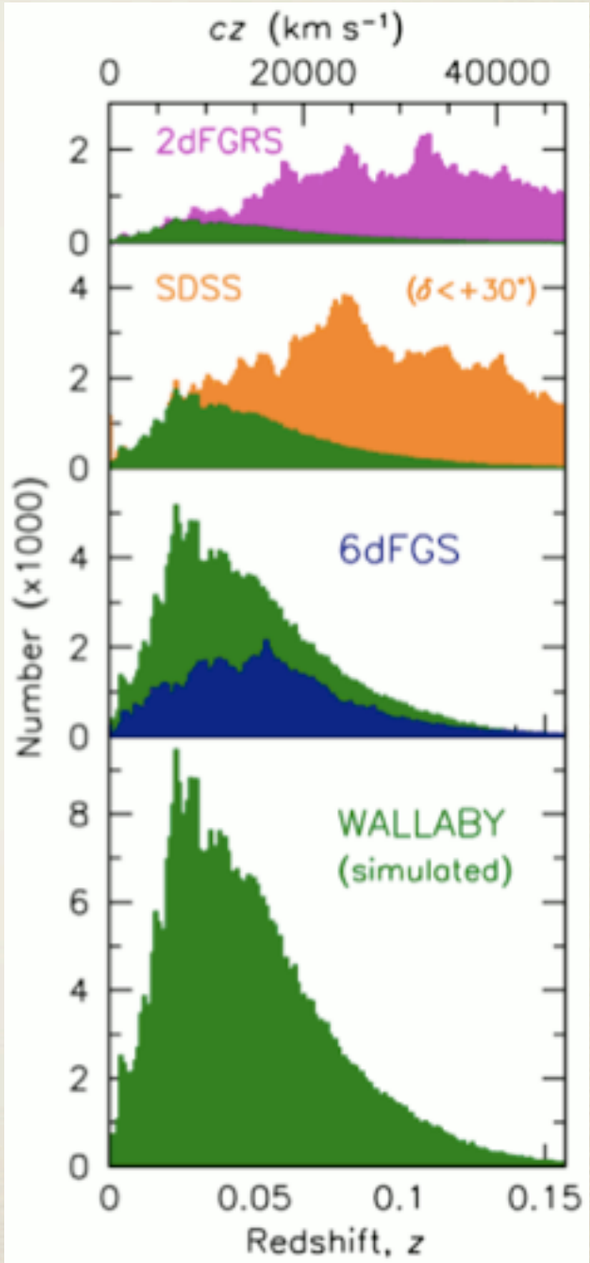


M81 galaxy group

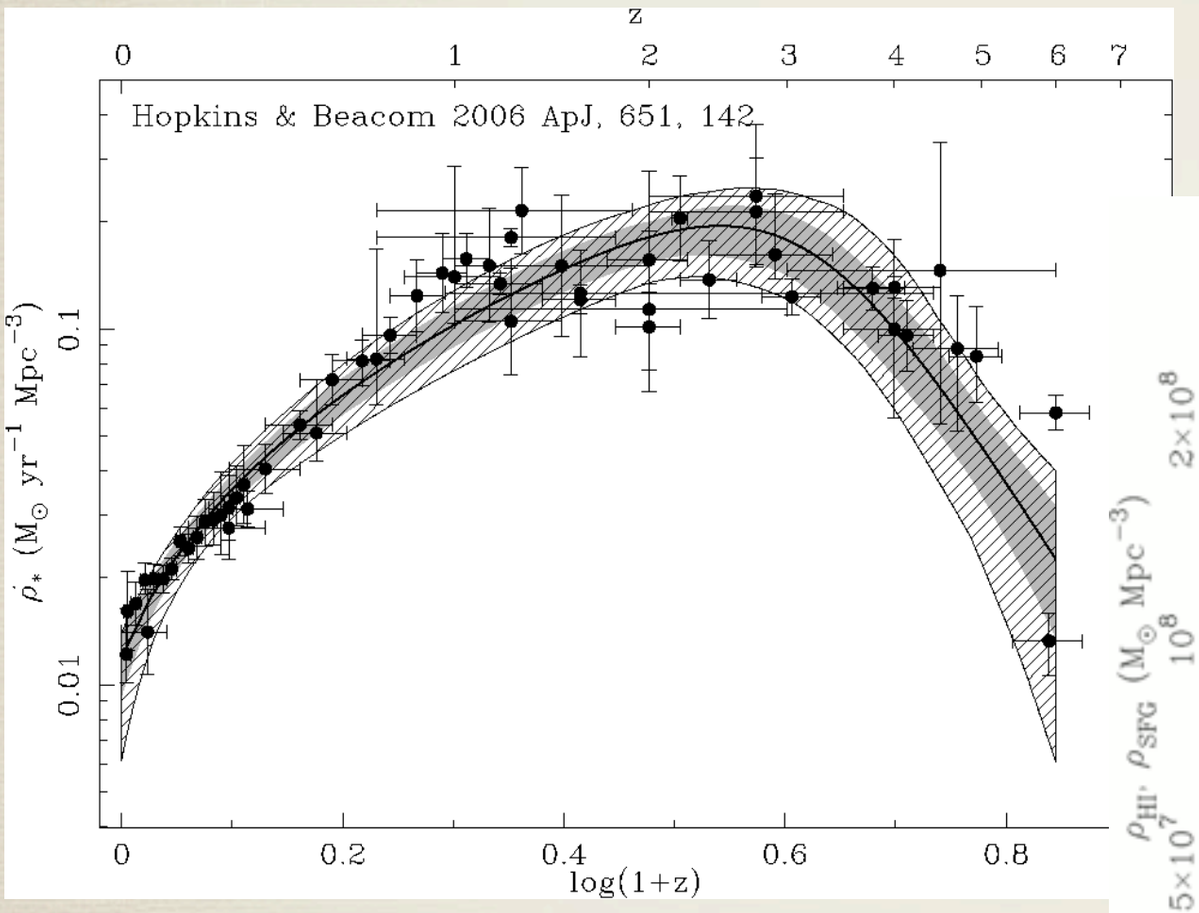
Thanks to Katie Chynoweth for the individual fits files

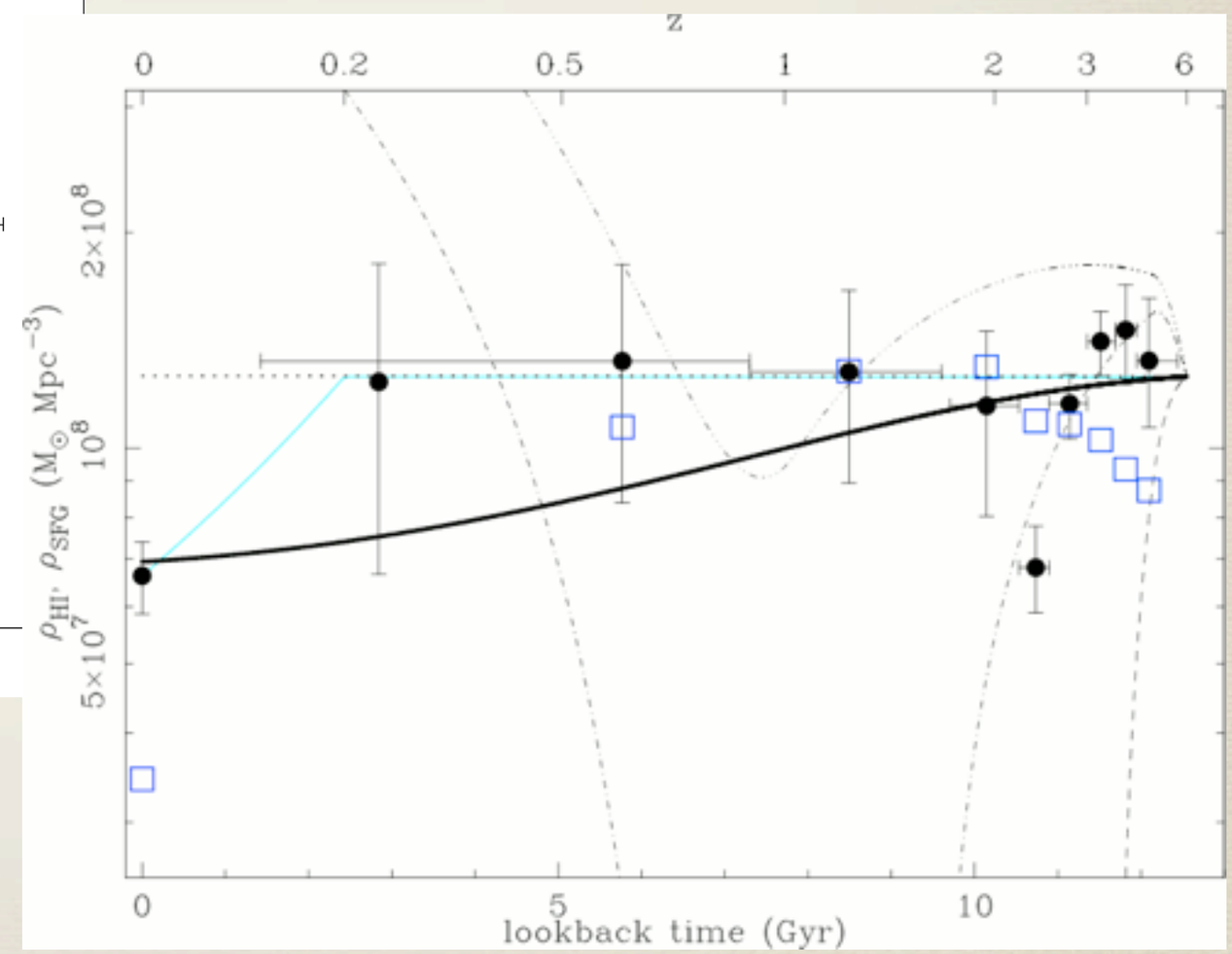
6dF and WALLABY





Evolution of HI vs SFR





Hopkins, McClure-Griffiths & Gaensler, 2008, ApJ, 682, L13

Intergalactic magnetic field

- The POSSUM survey with ASKAP (PI: Gaensler) will provide rotation measures for all (polarised) radio sources discovered with the EMU (continuum, hemisphere survey).
- EMU (PI: Norris): ~70 million sources; POSSUM: ~1-10% of these, some fraction of which will also be TAIPAN targets (perhaps ~10% of TAIPAN targets, maybe ~50k-100k galaxies, possibly more).
- Rotation measures can be used to infer the strength of the intergalactic magnetic field, but there is an ambiguity due to the $n\pi$ rotation effect.
- Redshifts for POSSUM help to circumvent this degeneracy, allowing measurement of the intergalactic magnetic field in perhaps ~100k directions (two years ago, this was known for ~few hundred, and now for ~5000, so this is another order of magnitude increase).
- Cross-correlating the angular distribution of extragalactic rotation measures with the foreground large-scale structure from TAIPAN allows measurement of the strength and length-scales of the intergalactic magnetic field.

Scientific Goals

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* **The connection between gas and stars**
* The impact of environment and mergers
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* **Intergalactic magnetic field**
* **Legacy value**

Competition

* BigBOSS (but looking at high-z, emission-line, LRGs)
* HETDEX (but looking at high-z, Lyα)
* SAMI → HECTOR, looking at gas/stars connection over comparable time-frame (complementary)
* 4MOST, DESpec, massively multiplexed, on 4m class telescopes, but still >5 yrs away (complementary)
* TAIPAN really does provide a unique opportunity