Gas & Galaxy Evolution:
Perspectives from a decade of UV-optical surveys

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UV-optical surveys at $z < 1.5$

$ugriz$ imaging of 8000 sq degrees and optical spectra of ~1 million objects (800,000 galaxies at $z=0-0.3$)

Far- and Near-UV imaging of the whole sky (+ deeper imaging of 1000 sq degrees overlapping SDSS)

Optical spectroscopy of 50,000 galaxies at $z=0.7 - 1.5$
Despite their apparent diversity, galaxies exhibit well defined correlations among their physical properties. These correlations are clues to the physics governing galaxy evolution.
In the last decade we have made enormous progress understanding the stellar populations of galaxies.

Stellar masses and star formation rates are routinely (and reliably) derived from multi-band SED fitting.
The relation between SFR and stellar mass evolves smoothly with redshift.
Galaxies have a bi-modal distribution of properties

SDSS -- Kauffmann et al. 2003
The Stellar Mass -- Metallicity Relation

Is this due to the loss of metals from low mass galaxies via galactic winds, or to a decrease in gas fraction with stellar mass? We need HI to find out!

80,000 galaxies

SDSS -- Tremonti et al. 2004
Some gas data from ALFALFA (out to $z \sim 0.06$), more needed!
HI data will be essential in interpreting these trends!

In most models there is a degeneracy between gas accretion and feedback.
Cold accretion in dense streams

Columns $> 10^{20}$ cm$^2$

Dekel et al. 2008
My SKA Wish List

- a deep large area survey -- HI masses down to $10^8 \, M_{\text{sun}}$ from $z=0 - 1$ (~300,000 galaxies)

- good spatial resolution (~1″), so no ambiguity in combining with existing UV, optical, IR data

- high level of data quality and uniformity

- automated measurement of basic galaxy properties -- HI mass, linewidth, axial ratio, etc.