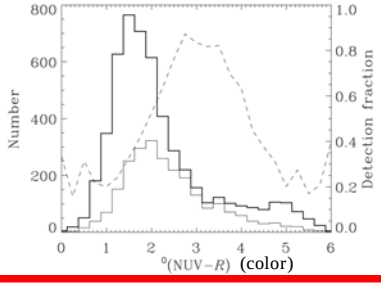
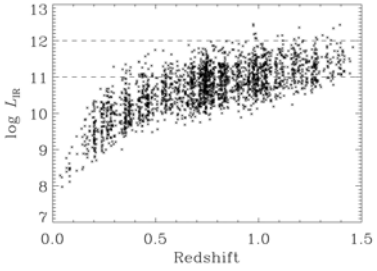
Mid-IR Luminosities and UV+Optical Star Formation Rates at $z < 1.4$

Samir Salim, Mark E. Dickinson (NOAO), AEGIS/FIDEL collaborations

1. Introduction

- Field: Extended Groth Strip
- Sample: 5,000 galaxies with spectra from DEEP2, deepest GALEX imaging, and deep optical + *K*-band
- Redshift range: $0.2<z<1.4$
- Use 24 μm from FIDEL MIPS
  - near-GOODS depth

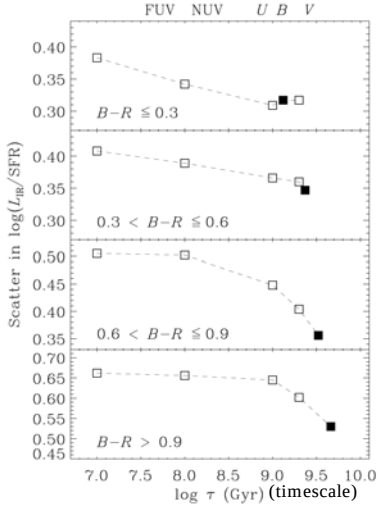




- Most sources LIRGs
  - Normal L_{IR} up to z~1
- NUV-*R* rest-frame color
  - thick line (all DEEP2)
  - thin line (24 μm detected)
  - 24 μm most efficient in the "green valley"

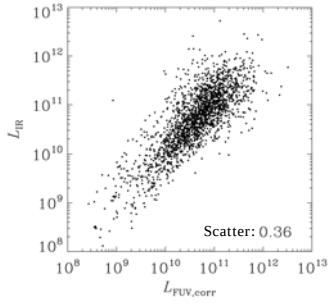
2. IR luminosity and SF timescale

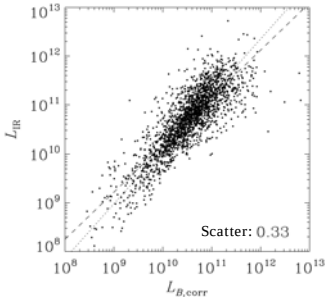
- Star formation rates
  - Dust-corrected SFRs are obtained from SED fitting of UV + optical + K-band
  - Use BC03 models
  - Models reddened
- SF timescales
  - Constrain SFRs at several timescales: 10^7, 10^8, 10^9, 2×10^9 yr
  - UV timescale = 10^8 yr
  - Also, age-averaged SFR (=mass/age)



- Compare IR luminosity and SFR_{UV+opt} over various timescales
  - L_{IR} vs. SFR_{UV+opt} correlation gets better (scatter in L_{IR}/SFR_{UV+opt} decreases) when SFR_{UV+opt} is averaged over longer timescales
  - For blue-sequence galaxies, L_{IR} best matches SFR_{UV+opt} over 1-2 Gyr (first two panels)
  - For green-valley and red galaxies, best timescale is >2 Gyr (age-averaged SFR – filled squares)

3. IR luminosity vs. UV and *B*-band

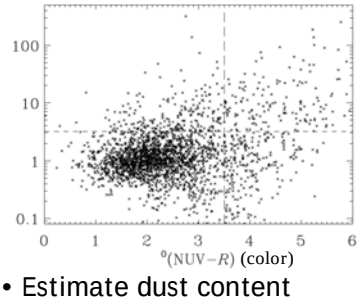


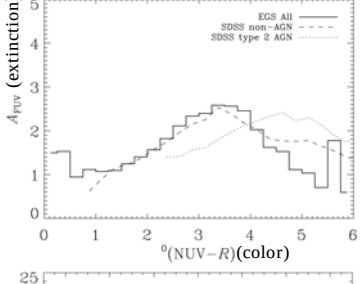


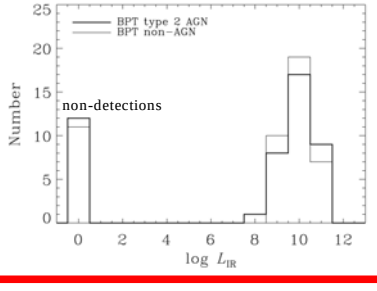
- Compare IR luminosity and dust-corrected FUV and *B*-band luminosities for blue-sequence galaxies
  - L_{IR} correlates better to dust-corrected *B* luminosity (right panel), then to dust-corrected far-UV (left)
  - 24 μm (rest-frame 10-20 μm) traces blue light better than UV ⇒ *dust heating mostly not by very young stars*
  - *IR luminosity can be predicted within 2x from UV+opt*

4. IR excess – red galaxies, not AGN

- Daddi et al. find IR excess [= ratio of SFR(IR+UV) to dust-corrected UV SFR] at z~2 to due from Compton-thick AGN
- Here, excess (IRX>3) dominant for red-sequence (NUV-R>3.5) galaxies







- Estimate dust content (A_{FUV}) required to produce the observed L_{IR}, given the population age
- Dust for EGS (histogram) consistent with dust estimate for non-AGN SDSS galaxies of the same color ⇒ *AGN heating not required at z<1.4* (Daddi et al. sample different – ULIRGs)
- 1-line-BPT AGNs in the EGS and the control-group non-AGNs (with matching mass and specific SFR) have the same L_{IR} distribution