First IR-based implications for the dust attenuation and star formation of typical LAEs

If you have interest, please check Kusakabe+15, ApJL, 800, L29

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ABSTRACT

IR data are essential for deriving reliable dust attenuation and stellar pop parameters. By stacking Spitzer/MIPS & Herschel/PACS data for typical LAEs, high-z low M_* galaxies, we obtain $L_{TIR}<1.1\times10^{10}L_\odot$. We find that they favor SMC attenuation curve than Calzetti curve (Sec. 2). The two curves give very different SED fitting results (Sec. 3). Their Lyα & UV escape fractions are similar to those of average galaxies at z>4 (Sec. 4). Our LAEs lie on the star formation main sequence (Sec. 5). Typical LAEs are excluded from the candidate counterparts of faint SMGs (>0.1mJy) by ALMA (Sec.6).

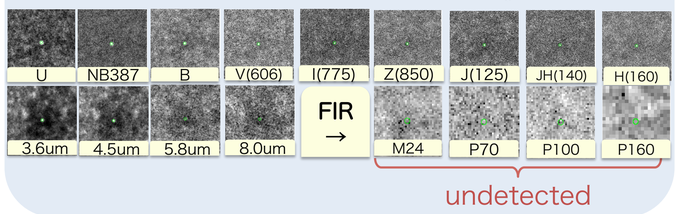
1. Stacking Analysis

< Sample selection >

- Narrow band NB387 by Subaru/Suprime-Cam combined with public U and B in GOODS-South (Nakajima+12, 13)
- 213 objects in PEP region
- M_{UV} = -18.7 ± 0.6 mag

< Stacking >

- Spitzer/MIPS 24μm; M24 (GOODS) Herschel /PACS 70,100,160μm; P70, P100, P160 (PEP)
- U to IRAC Ch4 (various surveys)



2. L_{TIR} & IRX-β

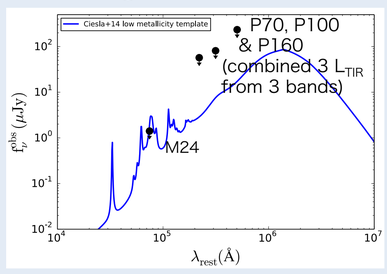
< IR luminosity >

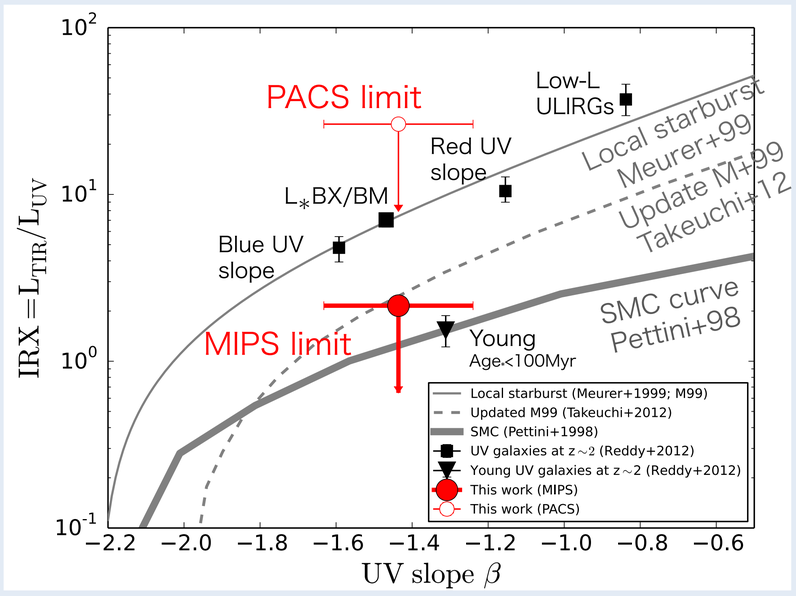
- 3σ L_{TIR} upper limit :
  $L_{TIR} < 1.1\times10^{10}L_\odot$ from MIPS→ adopted
  $L_{TIR} < 1.4\times10^{11}L_\odot$ from PACS
- $SFR_{IR} < 1.8\ M_\odot/yr$
  $1.5\ M_\odot/yr < SFR_{tot} < 3.3\ M_\odot/yr$
- IRX=2.2 , s.t. A1600 < 0.9mag

< IR SED template >

- Post-Herschel IR SEDs for local galaxies (Ciesla+14)
- Low metallicity template is adopted (most conservative)

See Kusakabe+15 for the discussion on the L_{TIR} derived from MIPS and PACS.



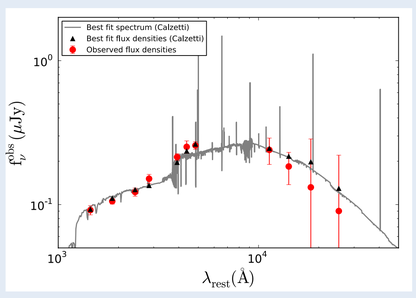


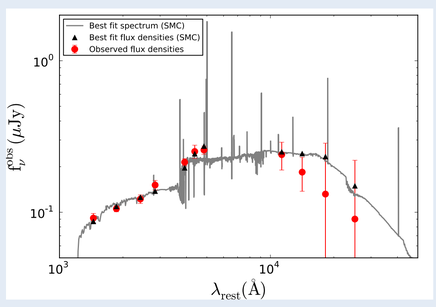
- Typical LAEs favor SMC attenuation curve and Takeuchi+12 relation than Meurer+99's.

3. SED fitting

- SED model including **nebular emission** (Ono+10)

Attenuation curve	X_r^2	M_* [$10^8 M_\odot$]	A_{1600} [mag]	Age [Myr]	f_{esc}^{ion}	SFR_{UVcorr} [$M_\odot$/yr]
Calzetti	1.02	$3.7^{+0.1}_{-0.1}$	$3.0^{+0.0}_{-0.0}$ too high*1	$8.7^{+0.8}_{-1.1}$ much shorter than dynamical times*2	90^{+0}_{-0}% much higher than 10-30 % *3	25^{+1}_{-1} much higher than SFR_{tot} *4
SMC	1.22	$6.3^{+0.8}_{-2.0}$	$1.2^{+0.2}_{-0.1}$	200^{+50}_{-100}	40^{+30}_{-30}	$4.9^{+1.7}_{-0.3}$





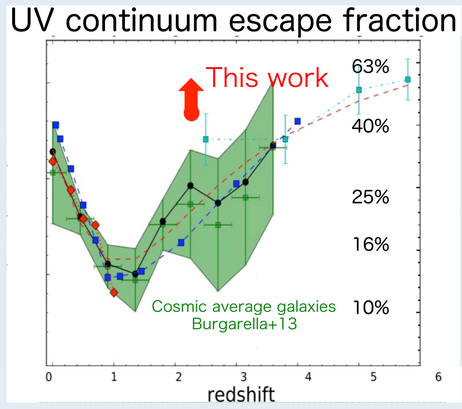
*1: Sec. 2
*2: Rhoads+14
*3: Nestor+13
*4: Sec. 2

- The two curves give very different SED fitting results.
- The results from the Calzetti curve are inconsistent with the resultsof other observations.

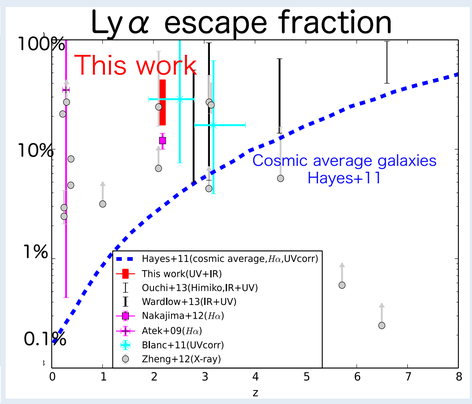
4. Escape Fractions

- $F_{esc}(UV)\geq44\%$, $F_{esc}(Ly\alpha)$= 16-37%

UV continuum escape fraction



Lyα escape fraction



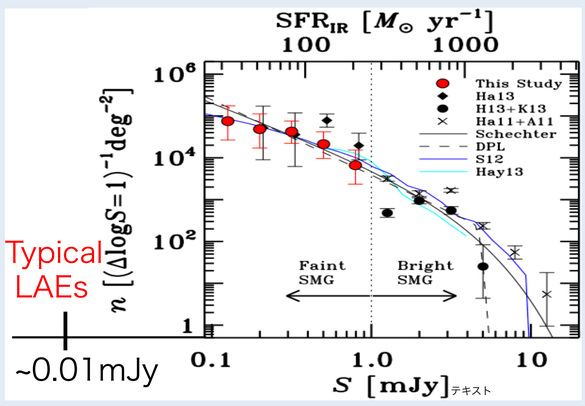
Burgarella+13

- Similar to those of z >4 average galaxies

5. Mode of Star Formation

- Typical LAEs lie on a lower mass extrapolation of the star formation main sequence.
- Some bright LAEs may also not be bursty, if they have SMC like curves.

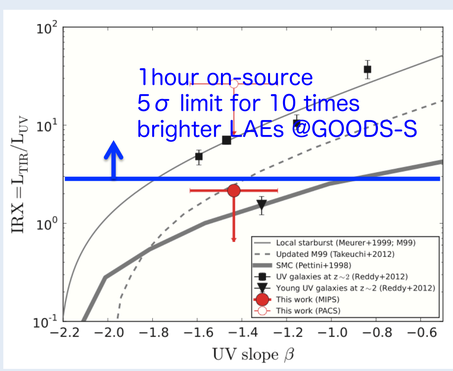
6. Can be detected by ALMA?



- Typical LAEs are too faint.

Ono+14

- Brighter (> ~×10) LAEs may be detectable.
- Even with non-detection, their attenuation curve may be constrained.



Future work : Dust attenuation and star formation mode of individual bright LAEs by ALMA