

**Dust** Emissions/Absorptions  
from Balmer Break Galaxies  
at  $z=1-2$   
in AKARI Deep Field

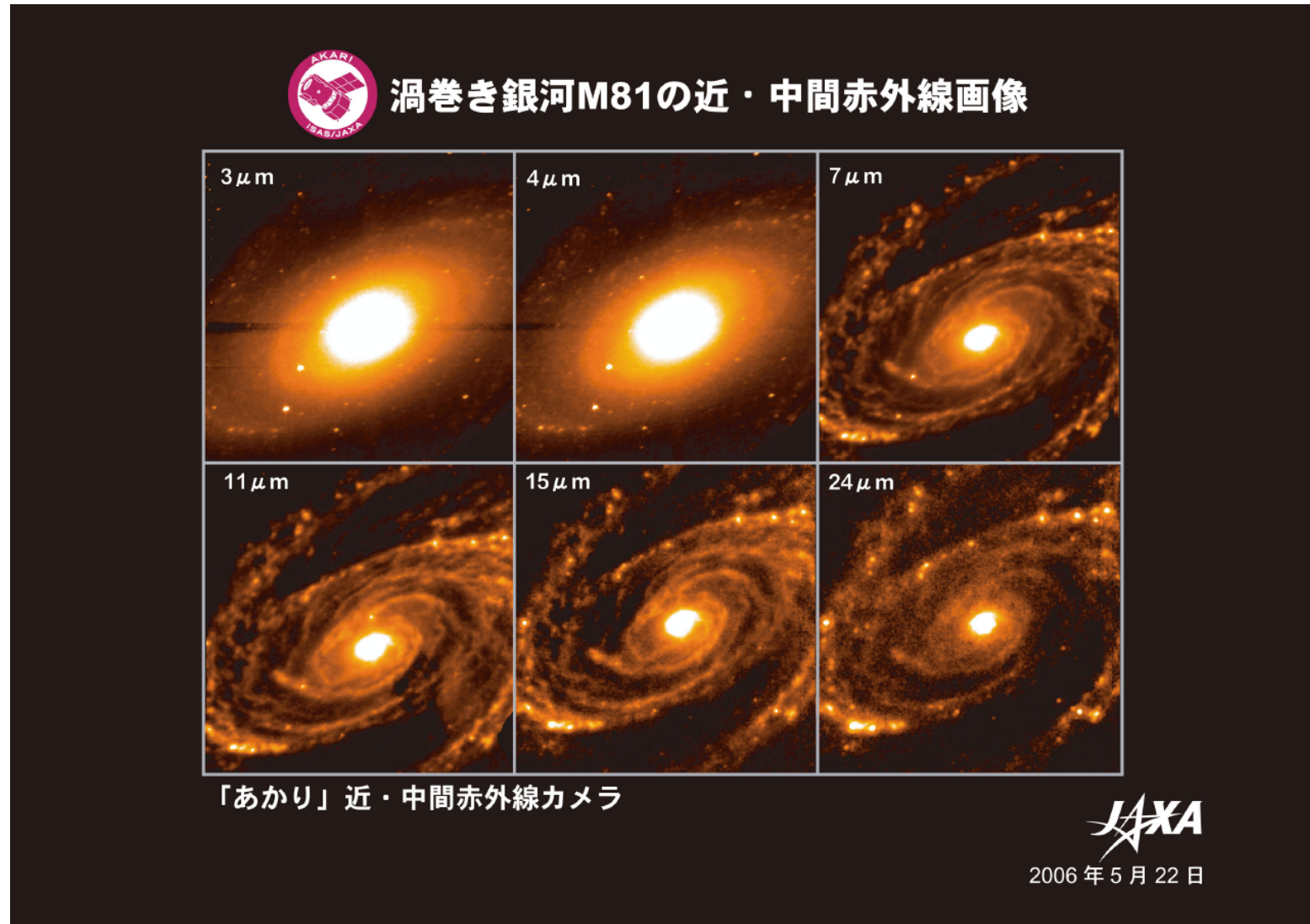
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Tsuyoshi ISHIGAKI (Asahikawa T.C.),

AKARI Extragalactic Survey Team

2009/03/24

# Multi-MIR Imagings with IRC/AKARI



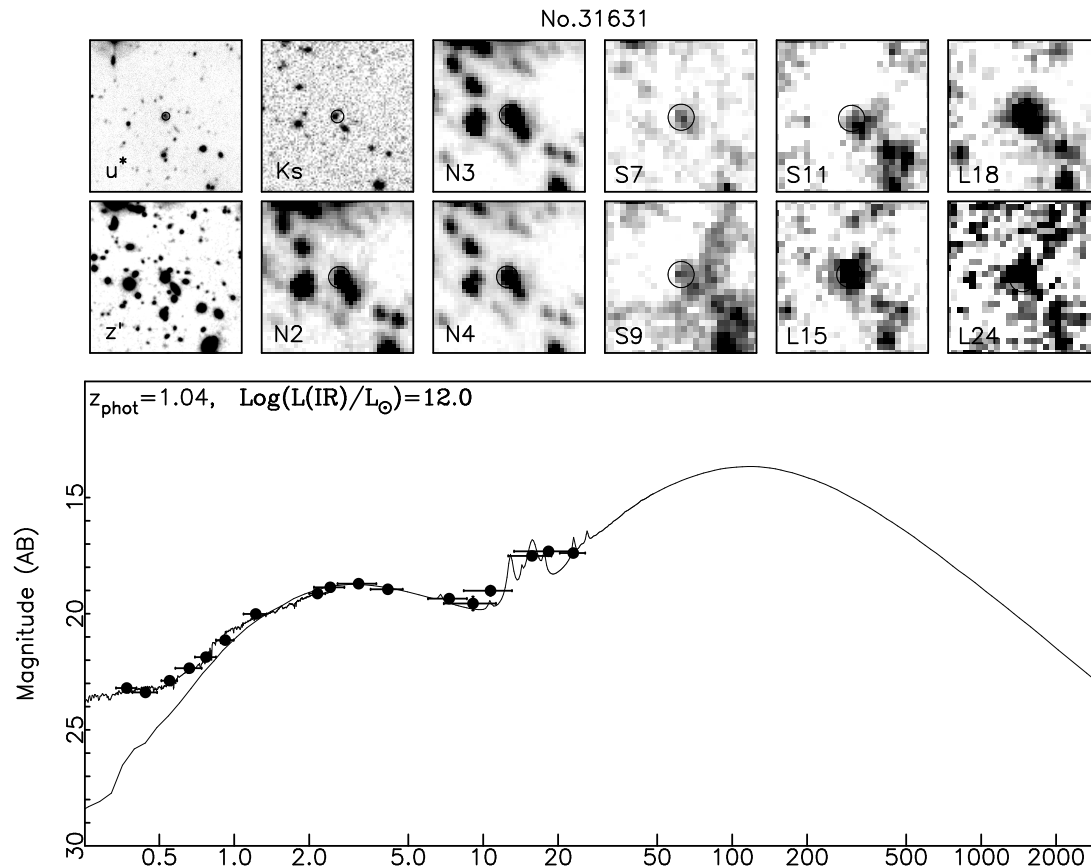
Covering 9-20  $\mu\text{m}$  Gap between IRAC/MIPS

# AKARI Deep Field (ADF)-North

Observatory	Band/Filter	Area	Sensitivity
<i>AKARI/IRC</i>	<i>2-24<math>\mu</math>m</i>	0.4 deg <sup>2</sup>	90 $\mu$ Jy(15 $\mu$ m)
Subaru/S-Cam	<i>BV Ri' z'</i>	27' $\times$ 34'	<i>B &lt; 28.2</i>
KPNO2.1/FLMG	<i>JK<sub>s</sub></i>	4 $\times$ 27' $\times$ 34'	<i>K<sub>s</sub> &lt; 22</i>
CFHT/M-Cam	<i>u(g'r'i'z')</i>	1(2) deg <sup>2</sup>	<i>u &lt; 26</i>
GALEX	NUV,FUV	0.6deg circ.	NUV < 25
Subaru/FOCAS	Opt.Spec.	57 sources	<i>R &lt; 24</i>
Keck/DEIMOS	Opt.Spec.	420 sources	<i>R &lt; 24</i>
Chandra/ACIS-I	0.5-8KeV	27' $\times$ 34'	10 <sup>-15</sup> erg s <sup>-1</sup> cm <sup>-2</sup>

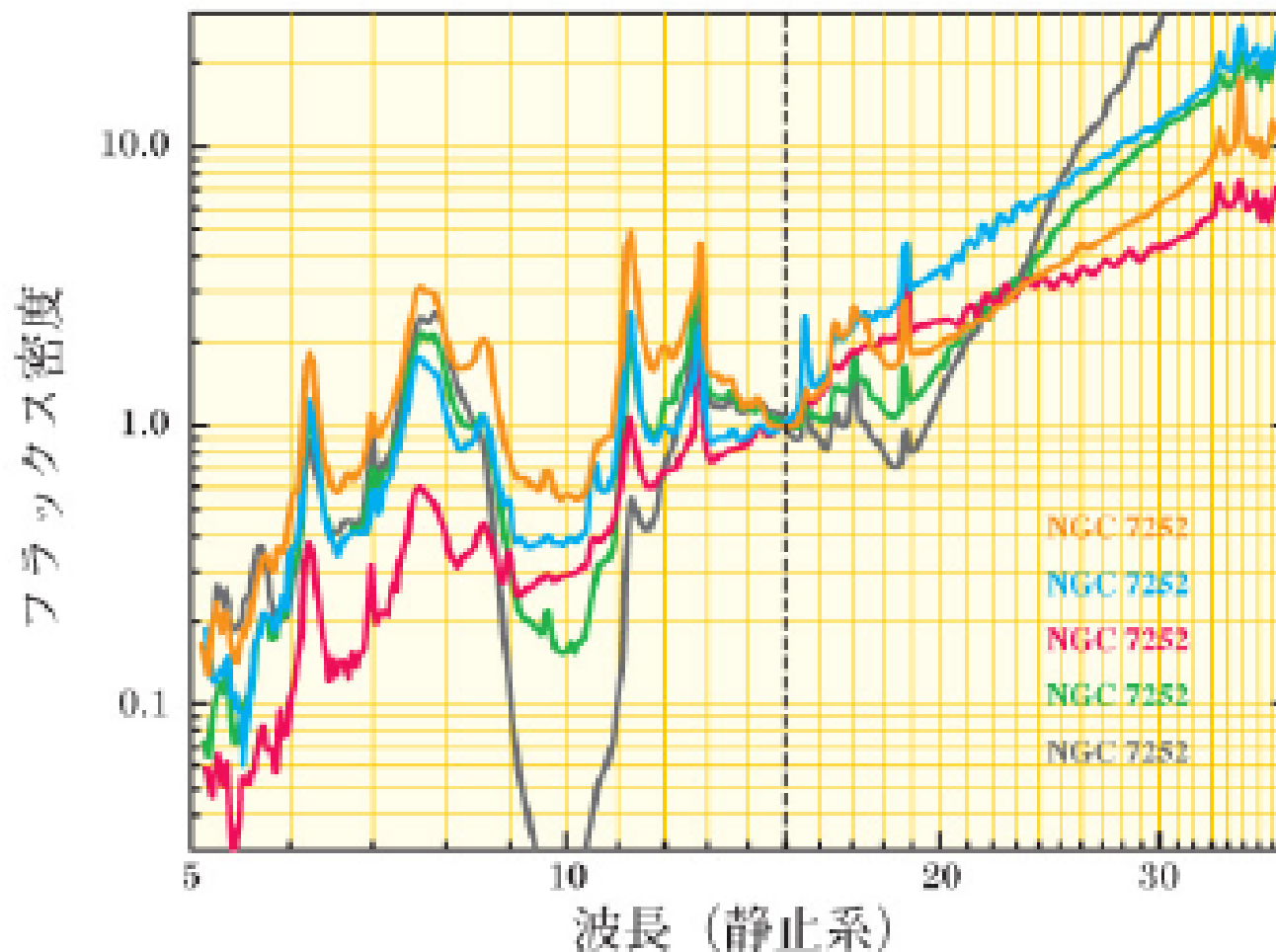
- **Deeper Than SWIRE, Wider than GOODS**

# SED of a Dusty Starburst @ $z \simeq 1$



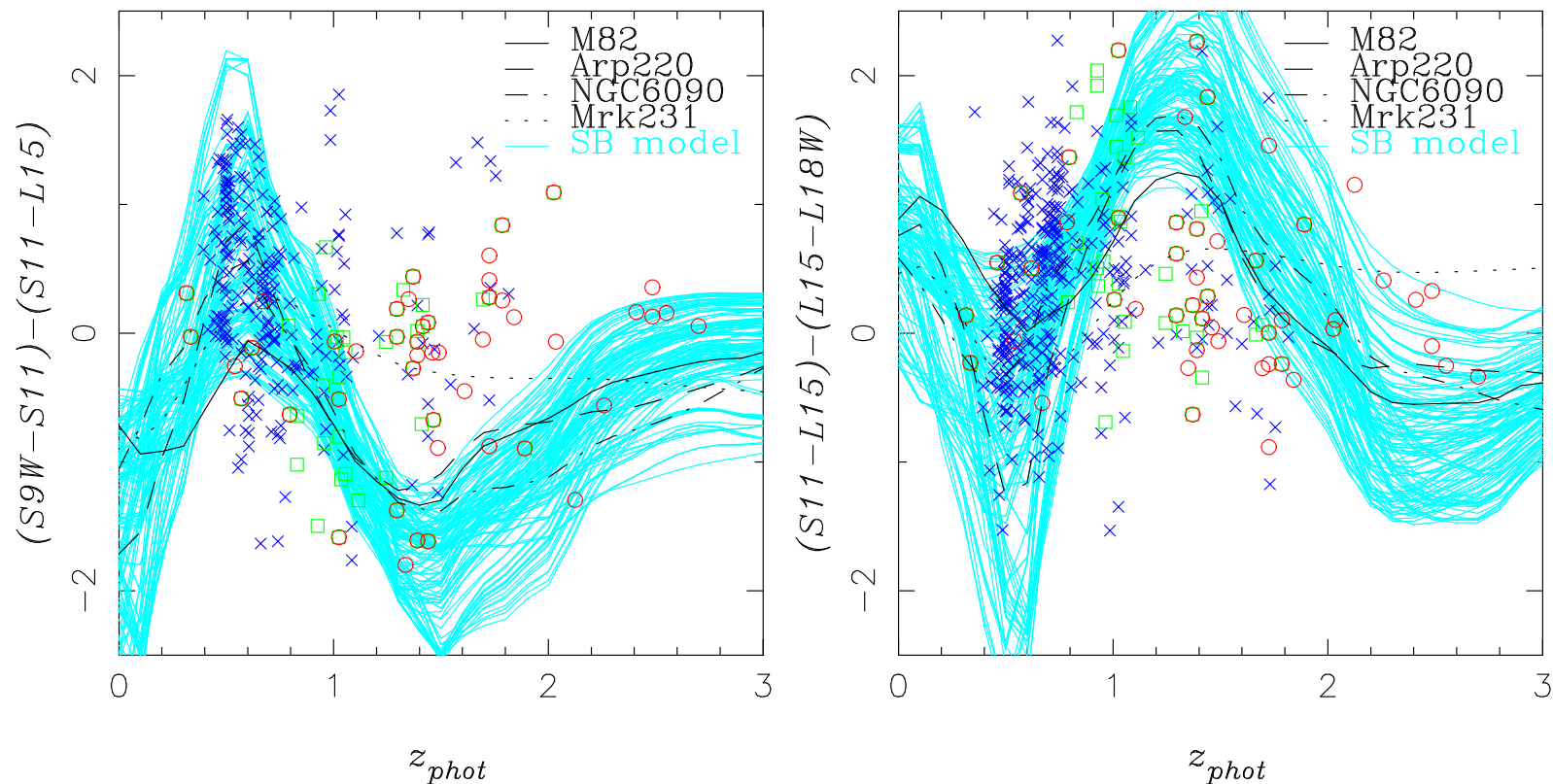
- **Stellar Emissions**  $< 2\mu\text{m}$  with BC03
- **Dust Emissions**  $> 2\mu\text{m}$  with DustySB (SK08)

# Spitzer's View for PAHs & Si Abs.



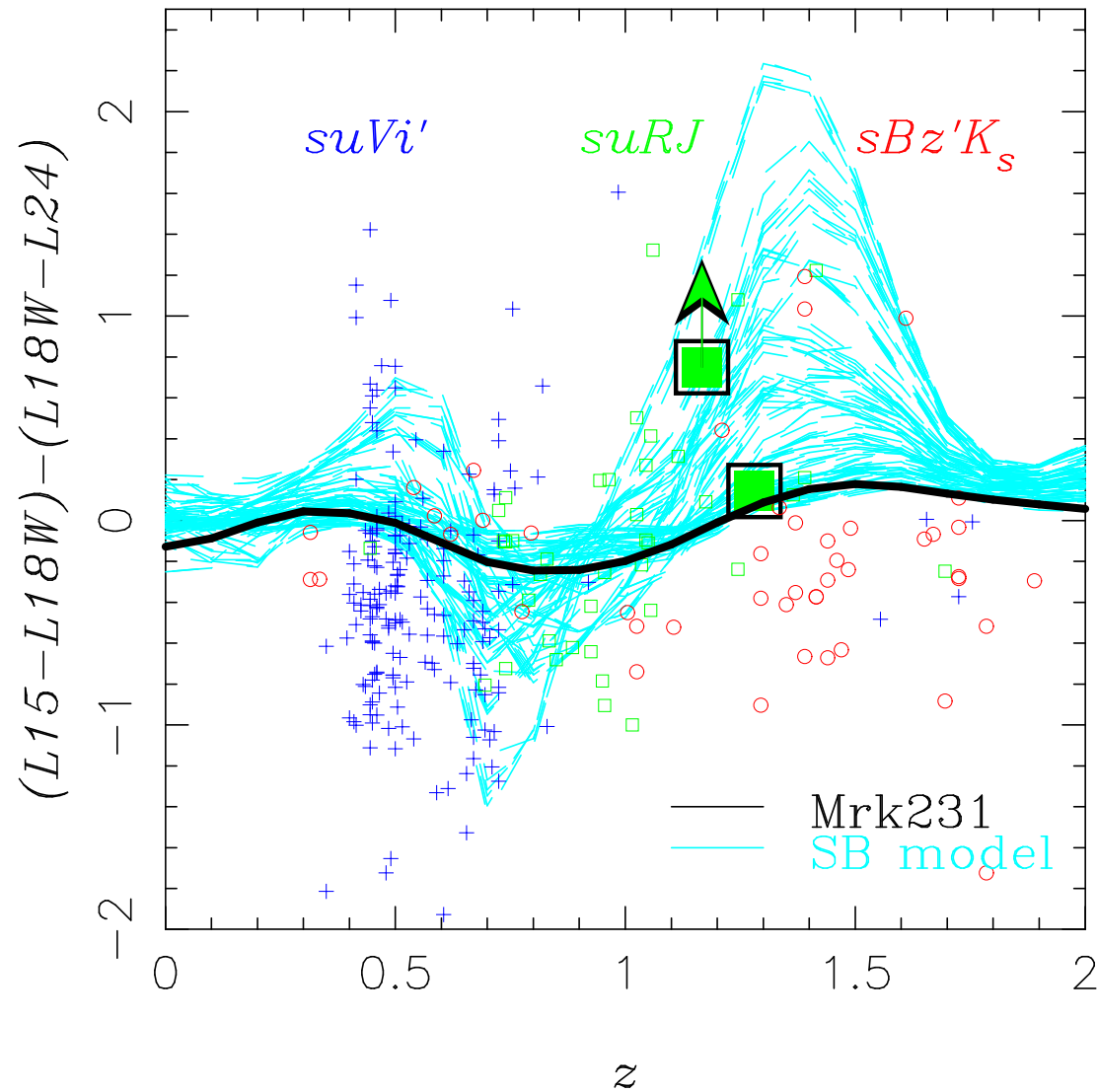
- 6.2, 7.7, 11.2  $\mu\text{m}$  PAH & 10  $\mu\text{m}$  Si Absorption

# Diagnostics with AKARI MIR Colors



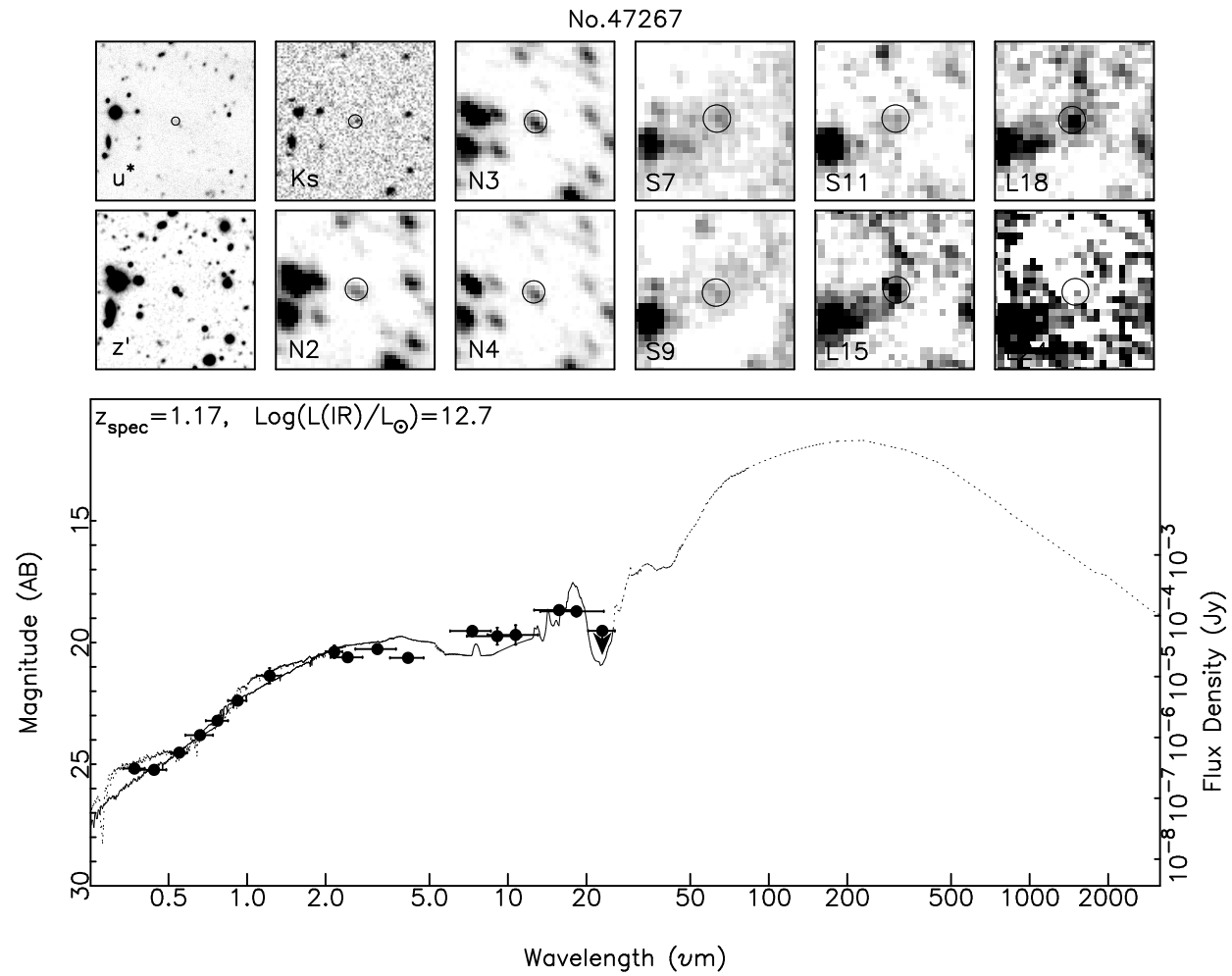
- Distinction bet. **SBs and AGNs with MIR colors**
- **More Luminous PAH** in BBGs than Local ULIRGs
- $7.7 \mu\text{m}$  PAH in  $11/15\mu\text{m}$  @  $0.4 < z < 1/1 < z < 2$

# MIR Color Features with Si Abs.



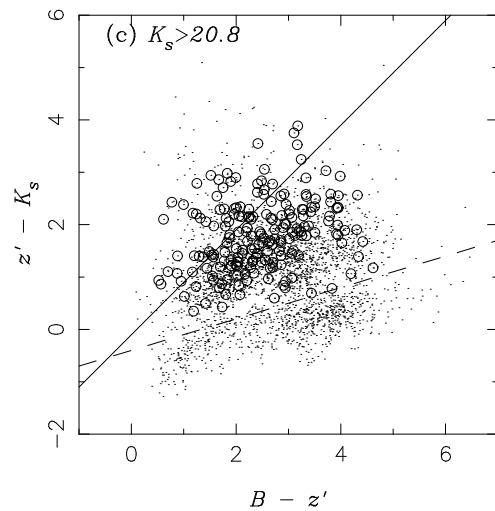
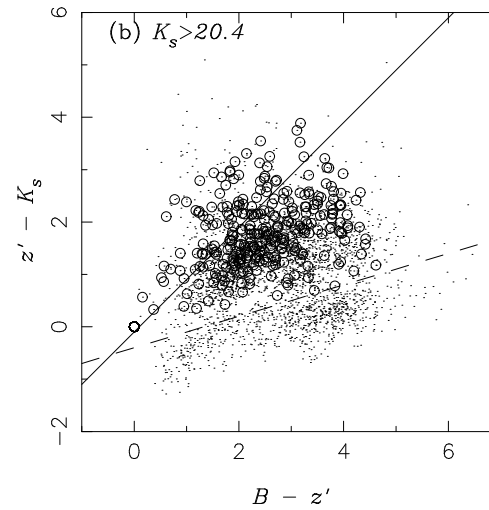
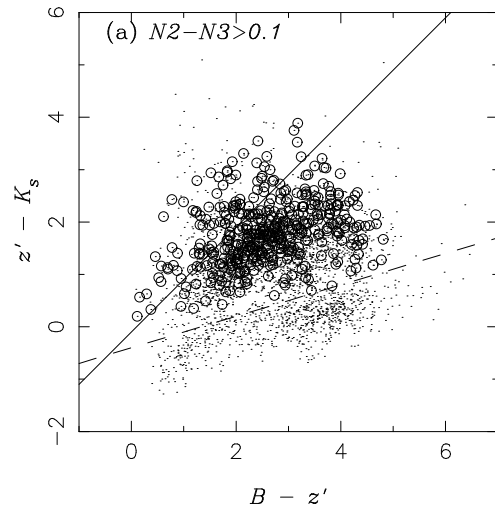
10  $\mu\text{m}$  Si Absorption in 24 $\mu\text{m}$  @  $z > 1$

# A ULIRG @ $z > 1$ with Si Abs.



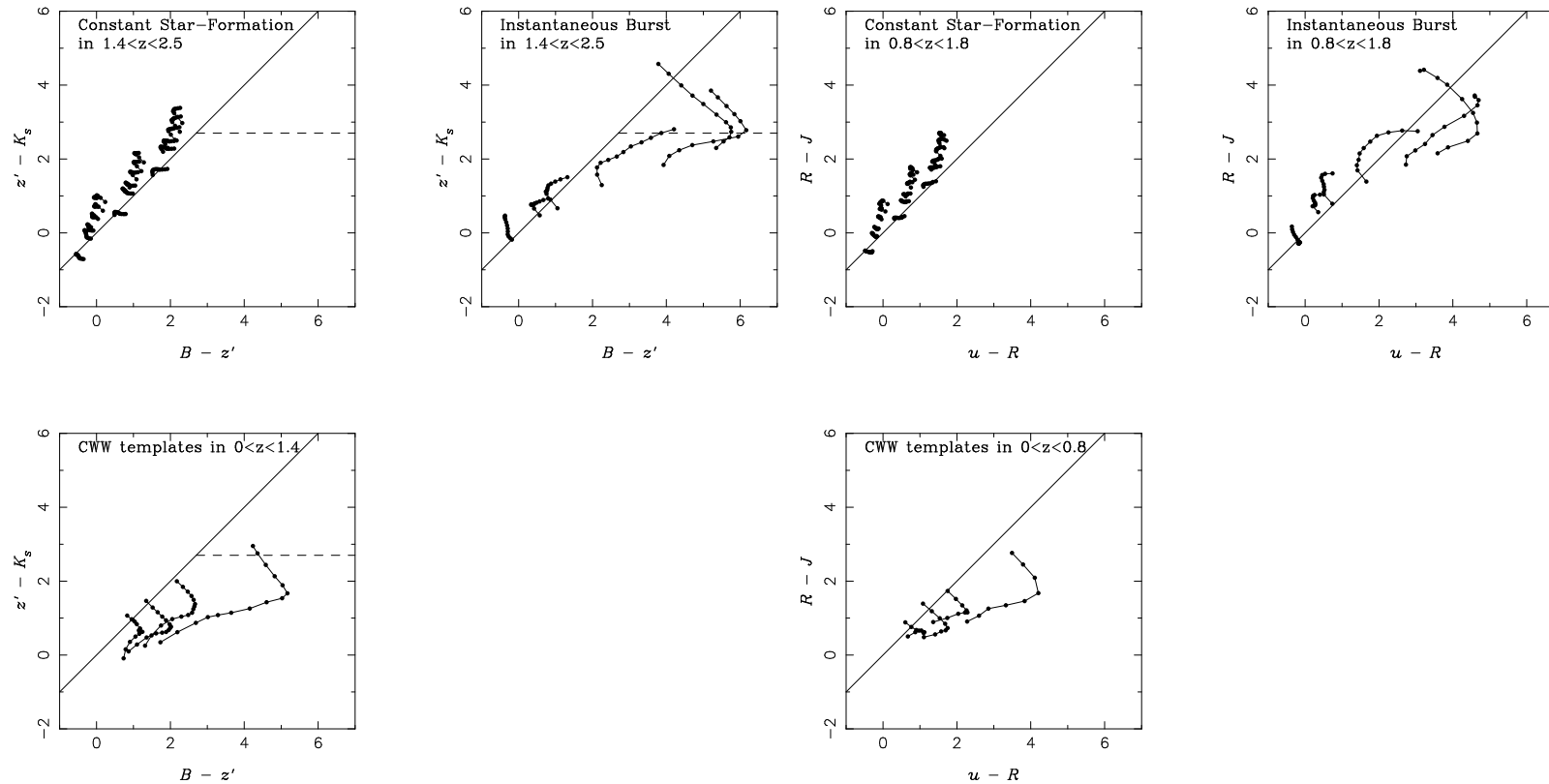


# $BzKs$ in ADF-N



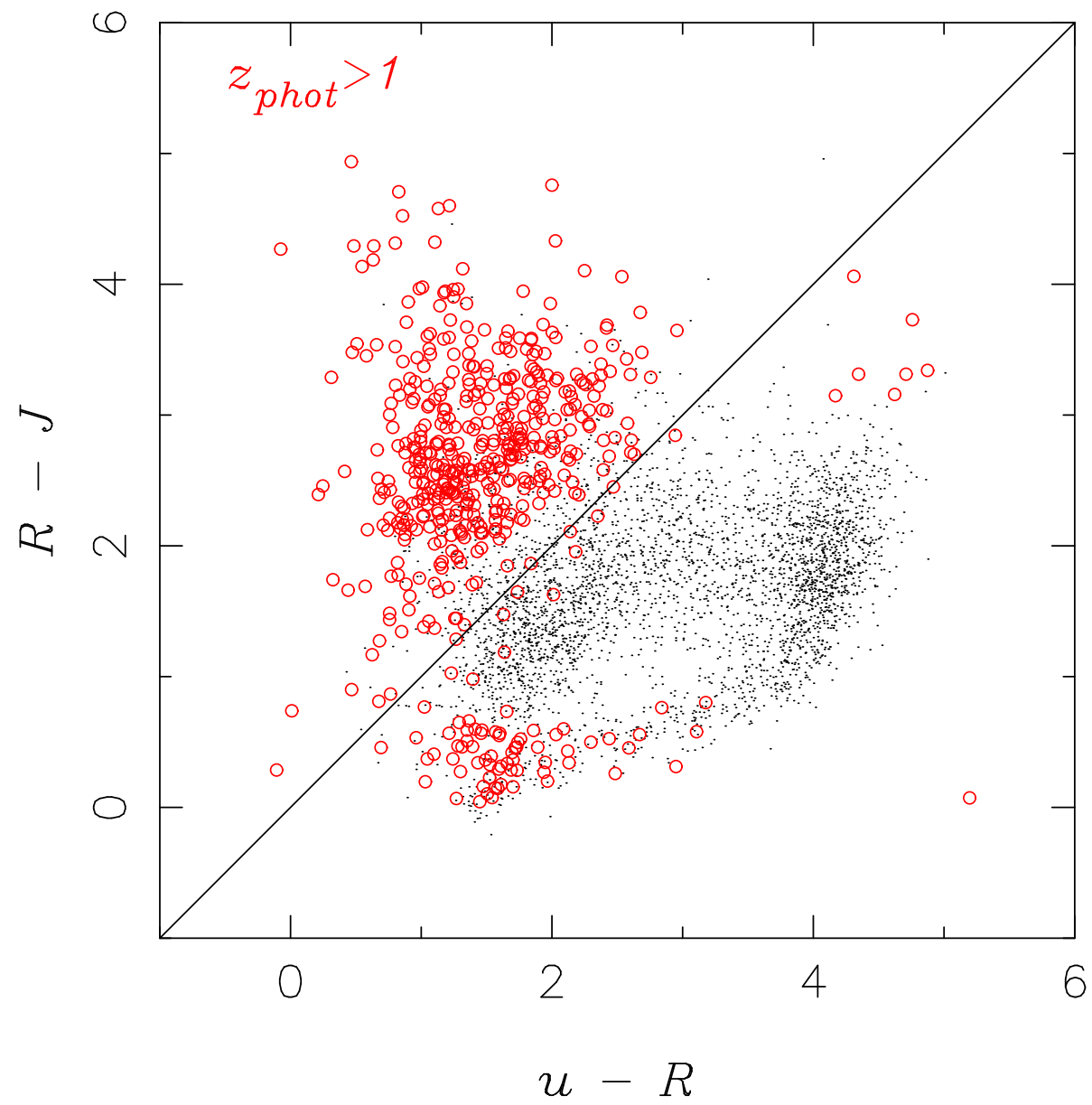
- $BzKs$  with 4000Å/Balmer Break @  $z \simeq 2$

# Lower- $z$ Balmer Break Galaxies (BBGs)

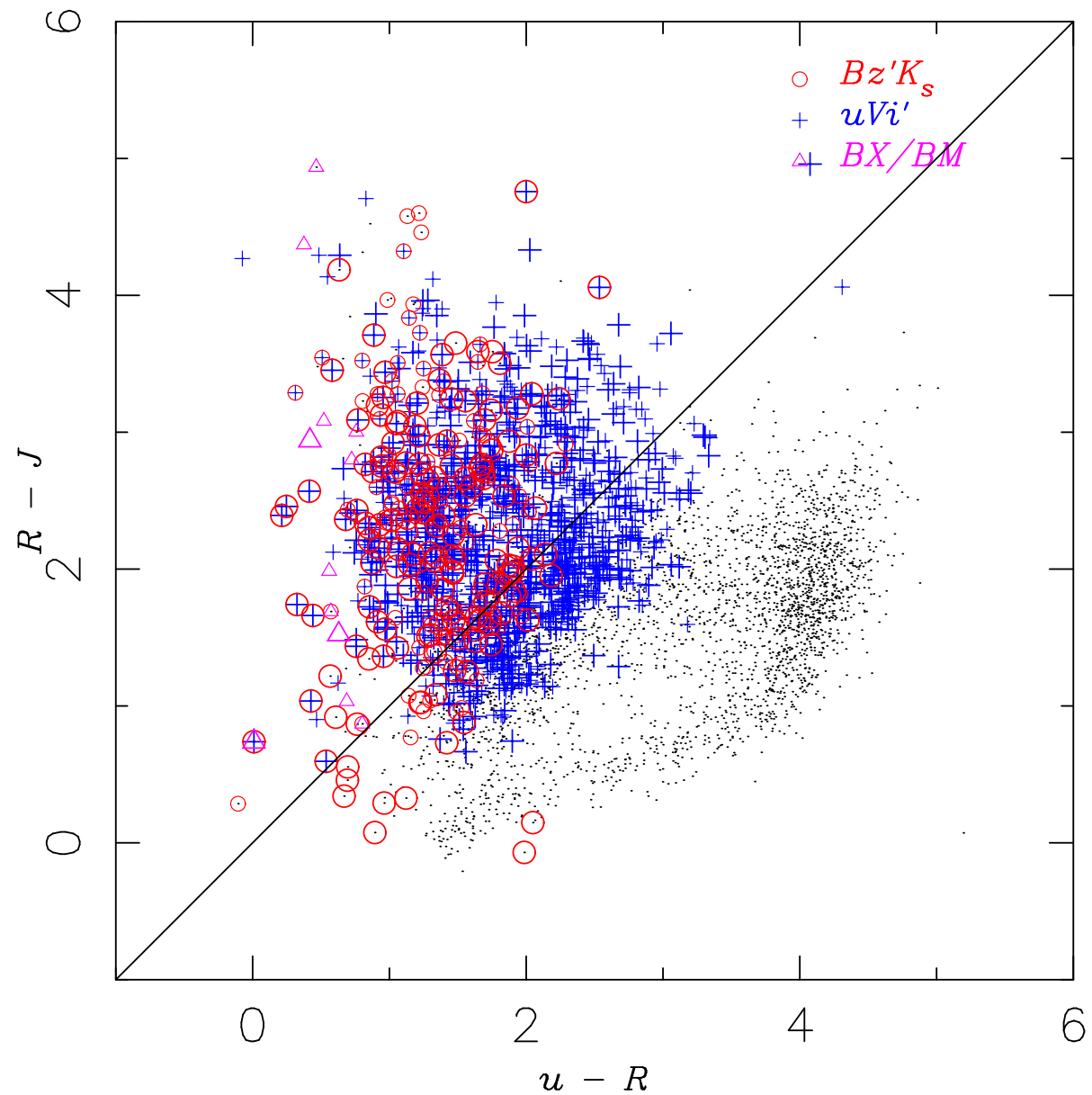


- $uRJs$  and  $uVis$  as **lower- $z$  mimics** of  $BzKs$
- **PAHs @  $z = 1 - 2$  covered with AKARI**

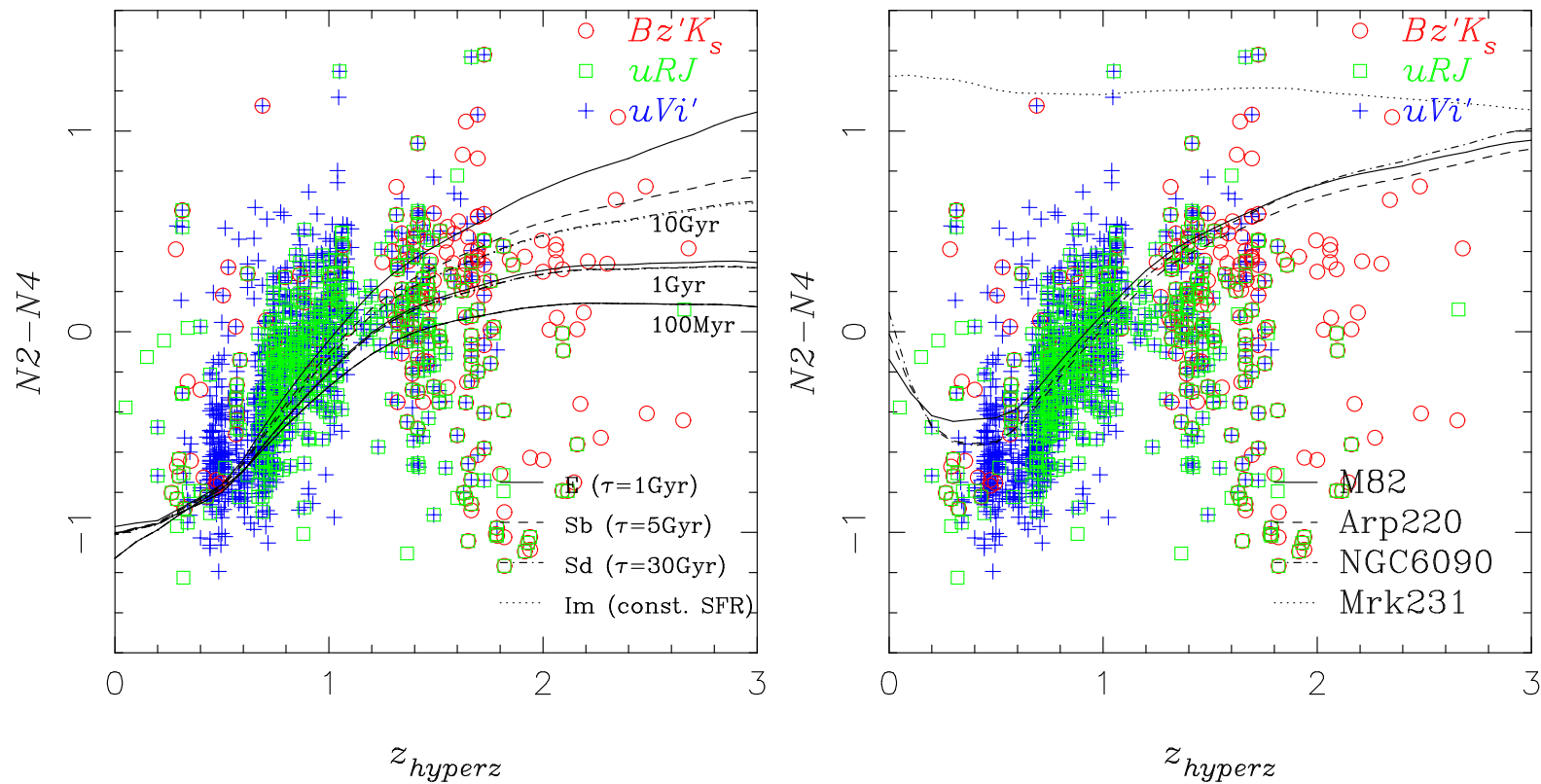
$uRJ$  @  $z_{phot} > 1$



# BBGs @ $z \simeq 1$ : $uRJs$ with $BzKs/uVis$

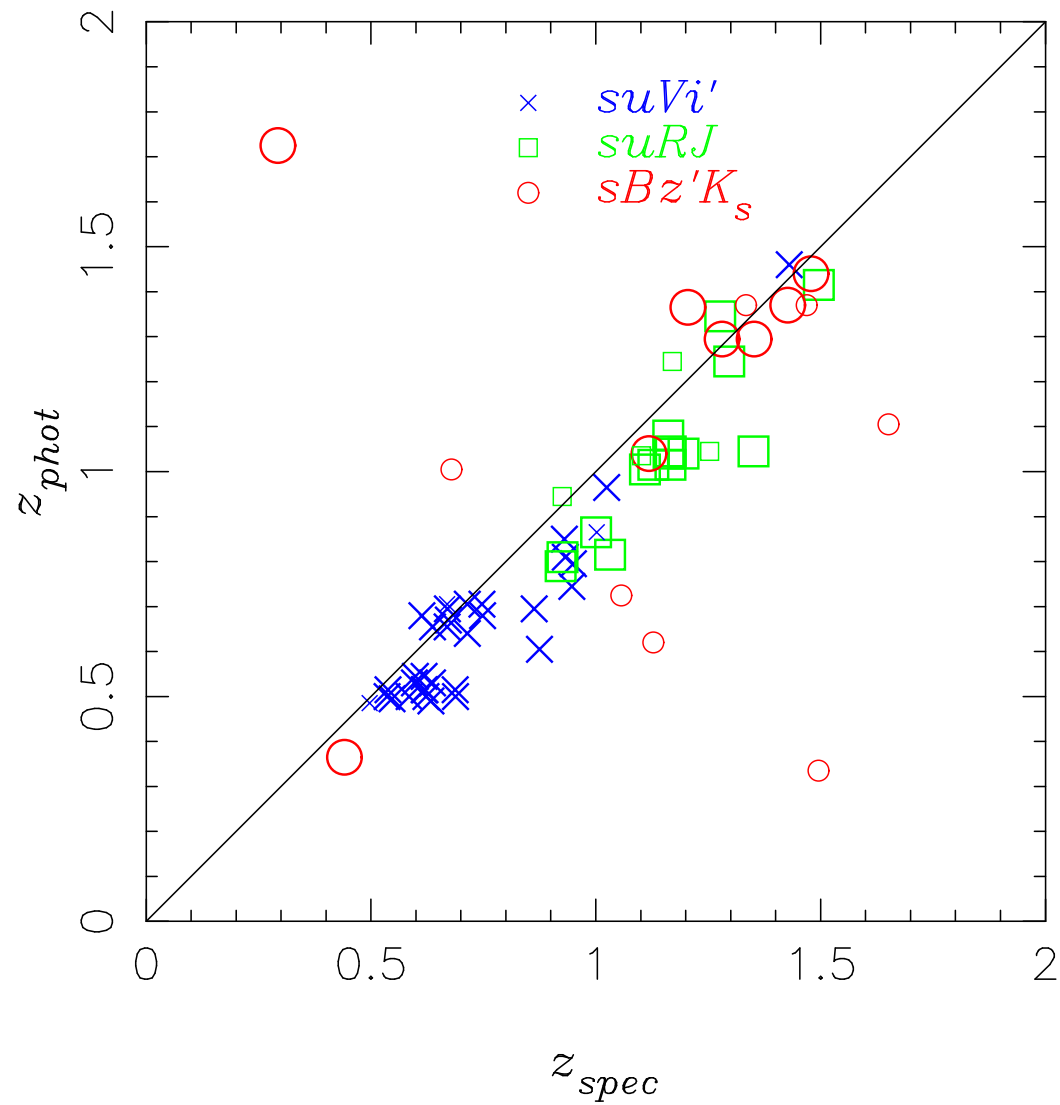


# Redshifts with $1.6 \mu\text{m}$ Bump



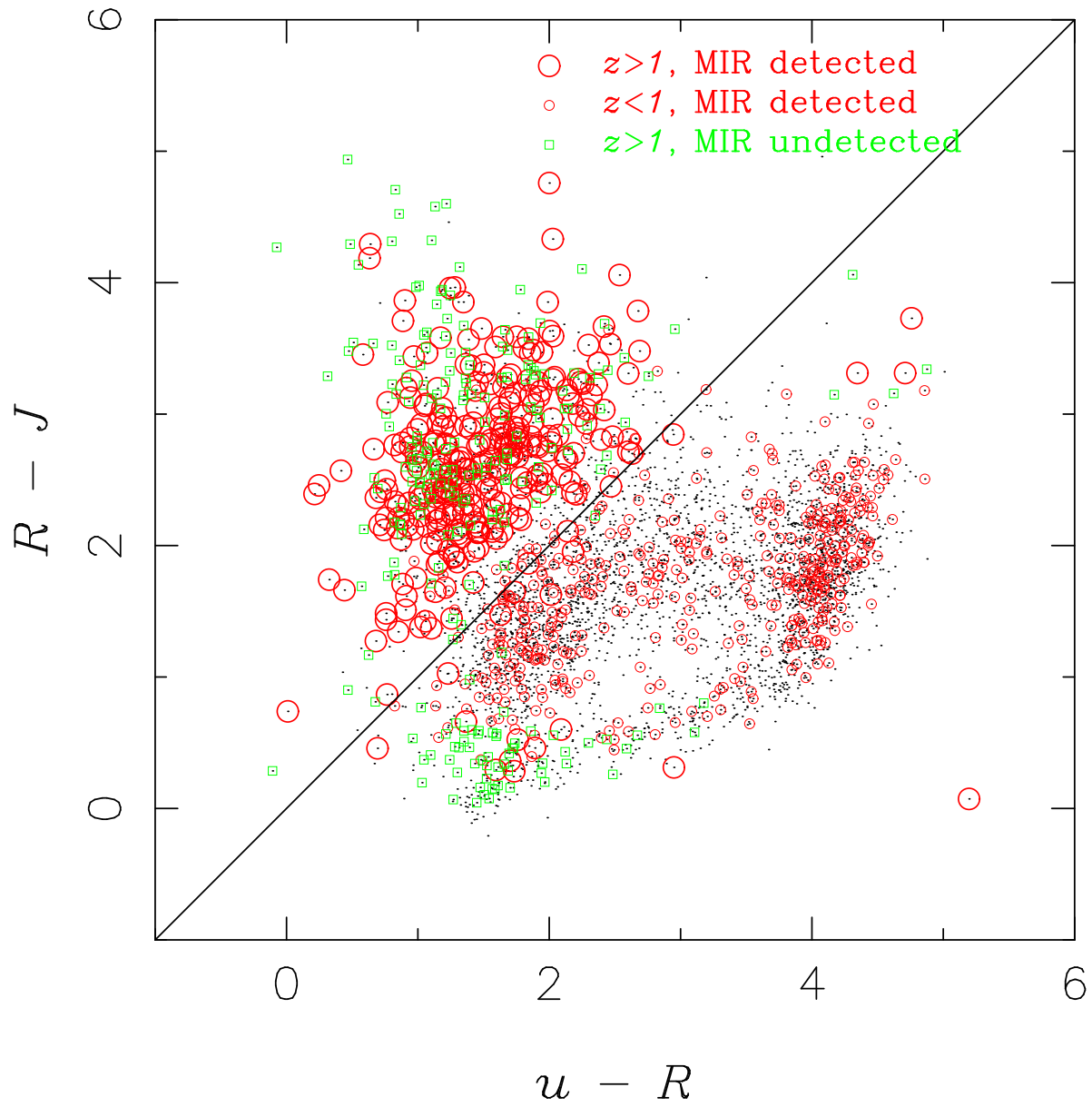
- **Aged Stars:  $4000\text{\AA}$  Break +  $1.6\mu\text{m}$  Bump**
- **IR Bump Galaxies  $\longleftrightarrow$  BBGs**
- $uVi$ -,  $uRJ$ -,  $BzK$ -IRBGs @  $z = 0.5 - 1, 1 - 2, > 2$ .

# Spec-z of *uVi*-, *uRJ*-, *BzK*-IRBGs

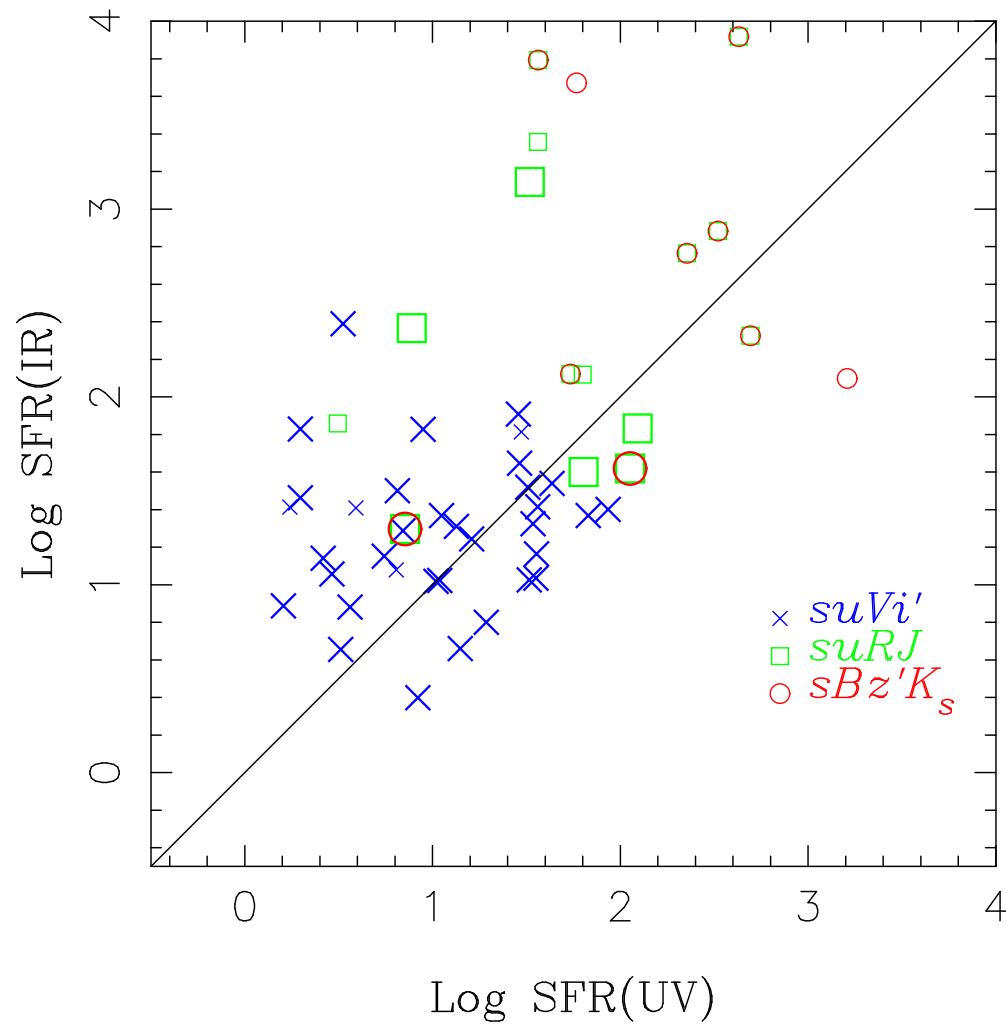


*uRJs*@ $z \simeq 1 - 2$ ; *uVis*@ $z \simeq 0.5 - 1$

# MIR Detected $uRJ$



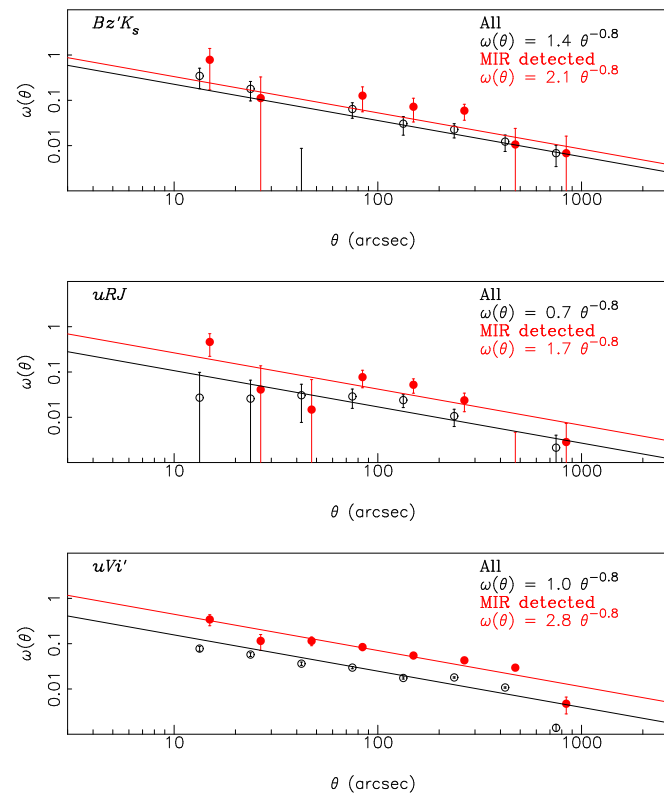
# SFR(Corrected UV) vs. SFR(IR)



- AGN Activities → SFR(IR) Excess



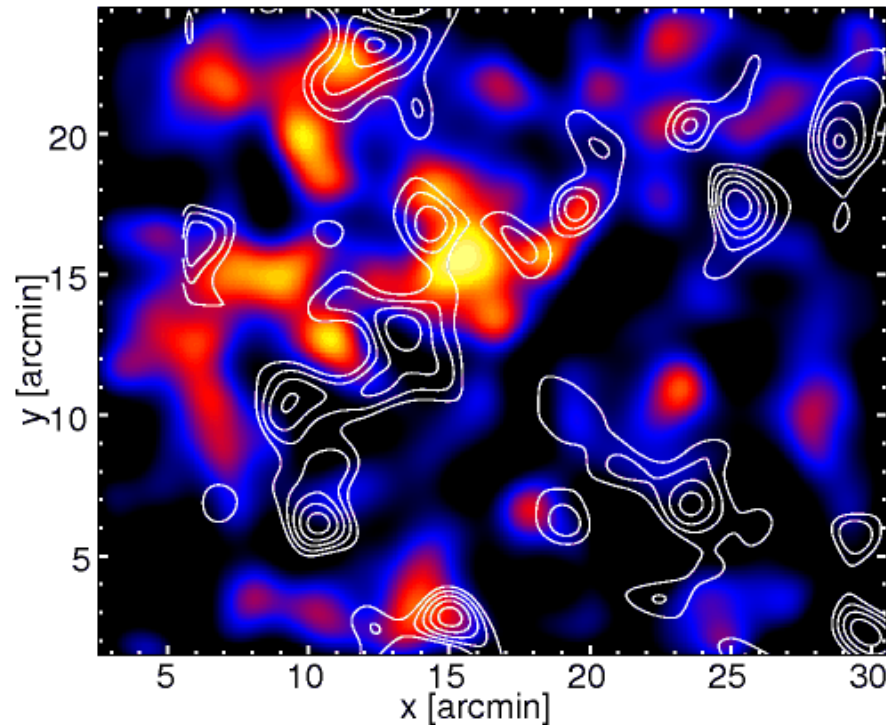
# Ang. Corr. Funs. of BBGs



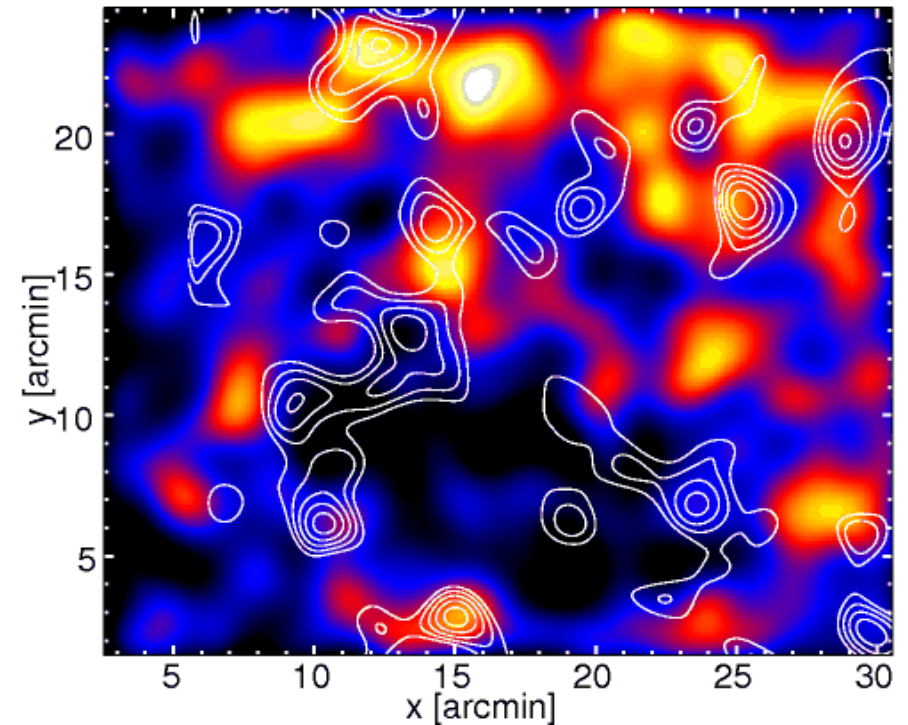
- **MIR Detected galaxies are More Biased**
- **SF activities more activated in Massive DMHs**

# Mapping LSS of DM with WL @ $z \simeq 0.5$

Akari MIR selected SBGs



UV bright BBGs  $(V-i)-(u-V)>0$

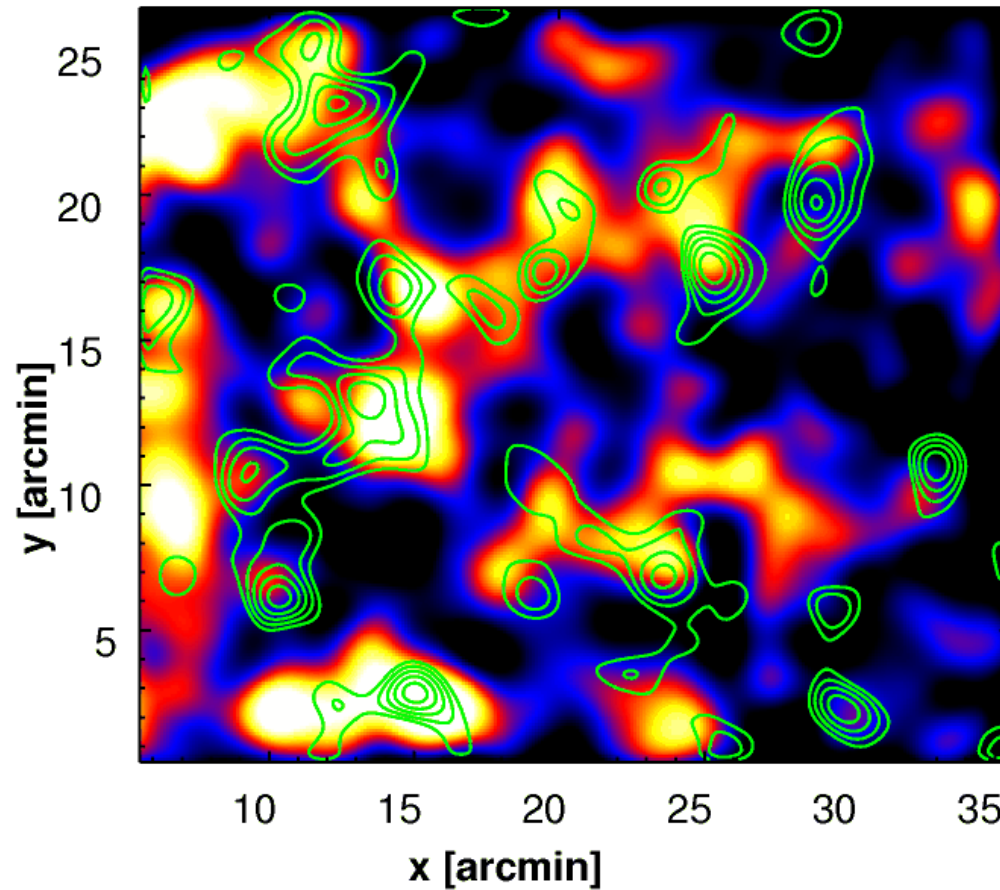


By K. Umetsu/ASIAA

- Contours represent Dark Matter Distributions
- SF (MIR/ $uVi$ ) Galaxies: **Outskirts** of DM Conc.

# Dark Matter vs. Stellar Comp.

Bright galaxies  $i' < 23$  ABmag



- Bright Galaxies follow Dark Matter

# Implications from AKARI Deep Survey

- Optical/Submm Windows → ELT/ALMA
- **MIR Windows for PAH & Si Abs.:** → SPICA:  
10-100 times Multi-MIR Deeper Imagings from Space  
( $1\mu\text{Jy}@15\mu\text{m}$ )
- Wide Field Views → WL/SF mapping in LSS