



New Photometric Technique for Galaxy Selection at Intermediate Redshift

(For Seminar of Astro 597a Course Spring 2007)

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References

- “*A New Photometric Technique for the Joint Selection of Star-forming and Passive Galaxies at $1.4 \leq z \leq 2.5$* ”,
Daddi et al., 2004, ApJ, 617, 746



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- Galaxy Selection Criterion
 - Definition
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Galaxy Selection Criterion

- Definition of BzK parameter

$$BzK \equiv (z - K)_{AB} - (B - z)_{AB},$$

— $z > 1.4$ star-forming galaxies

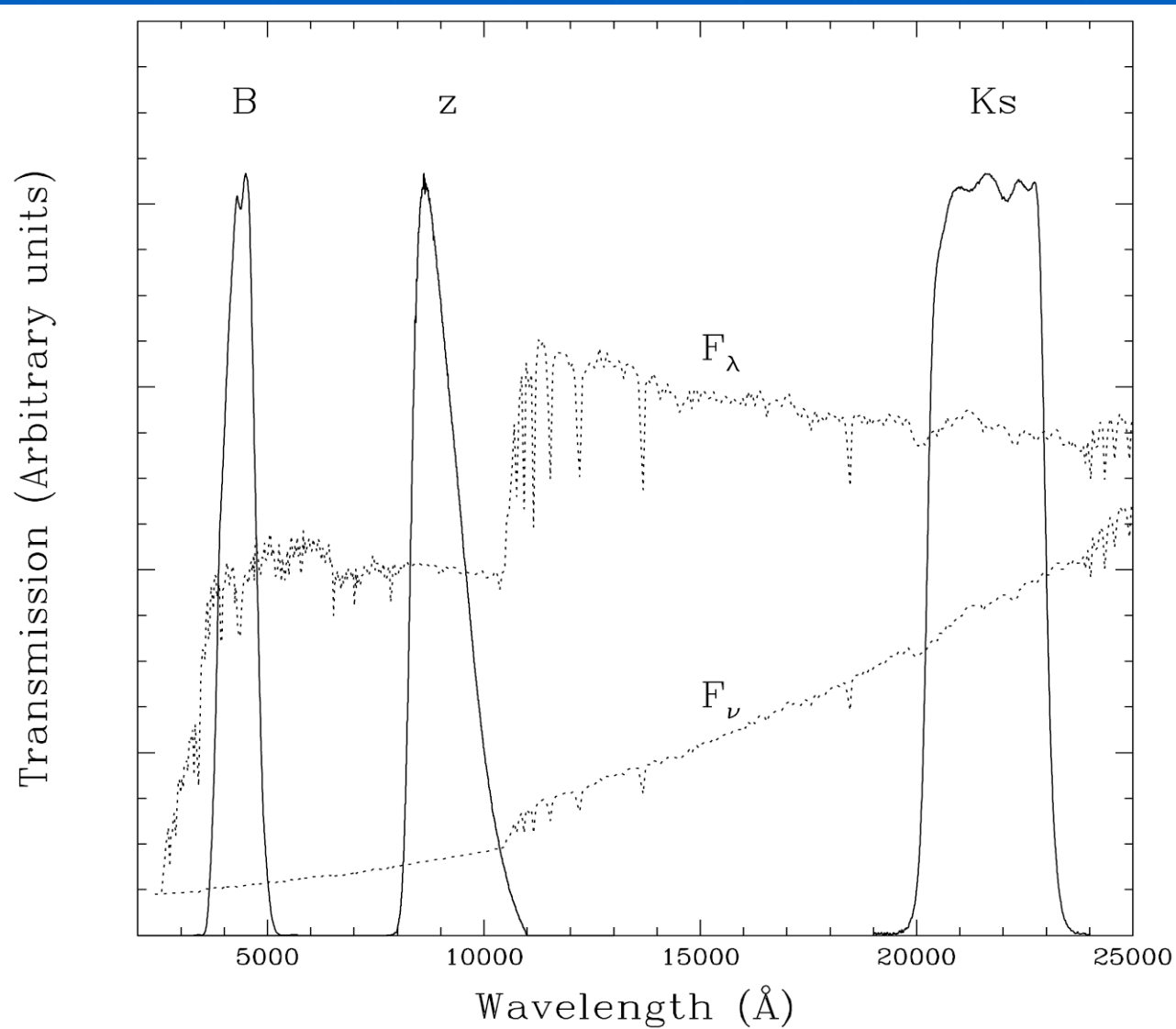
$$BzK \geq -0.2,$$

— passive galaxies

$$BzK < -0.2 \cap (z - K)_{AB} > 2.5.$$

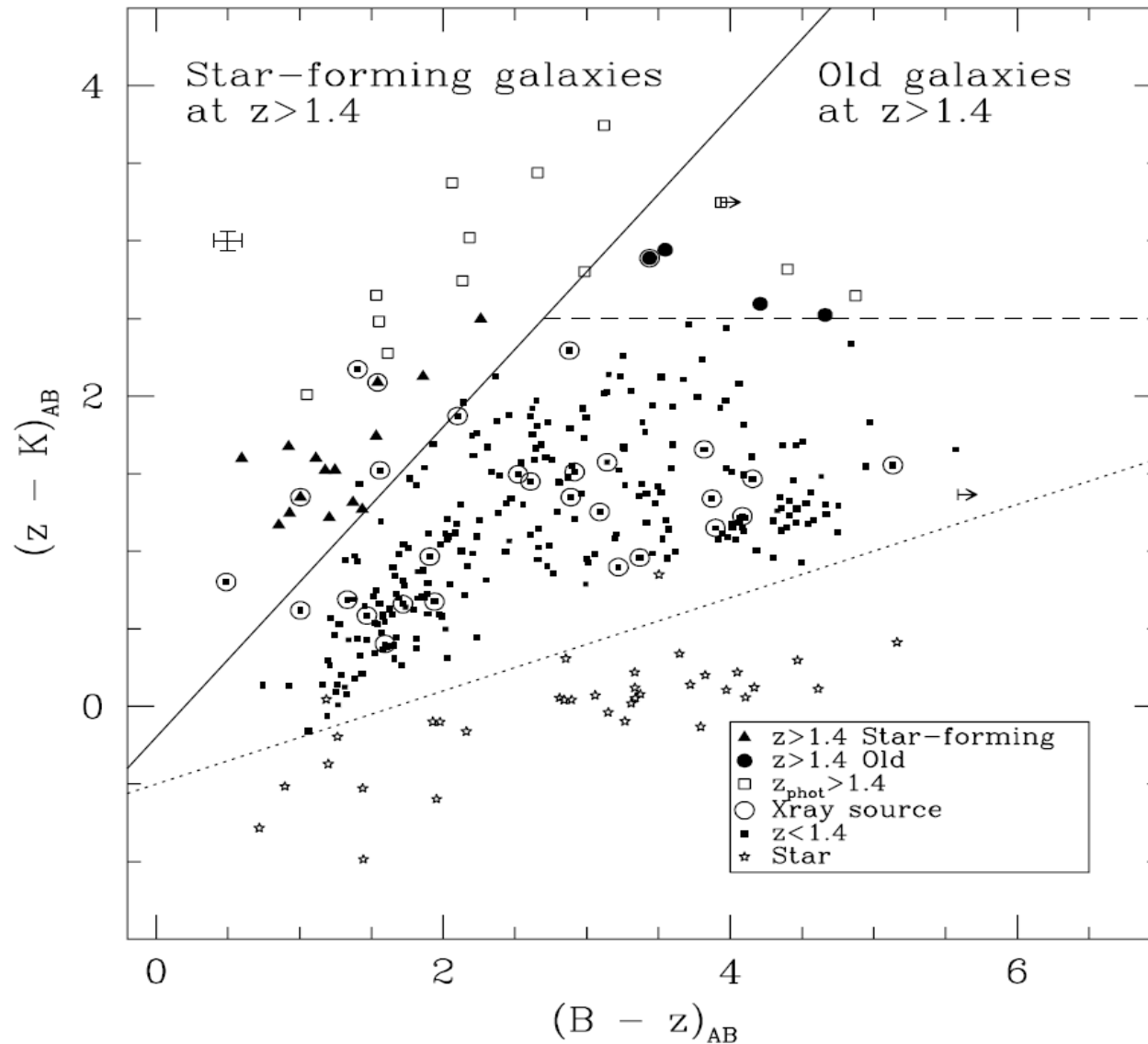
Galaxy Selection Criterion

- Definition of *BzK* parameter



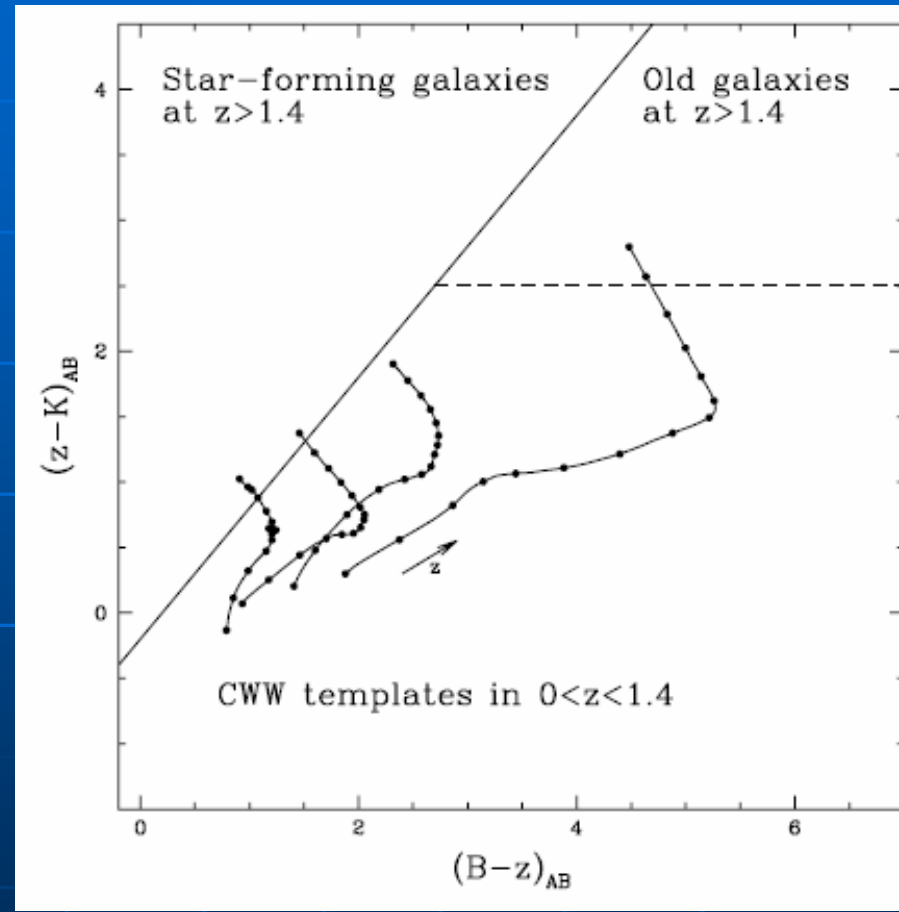
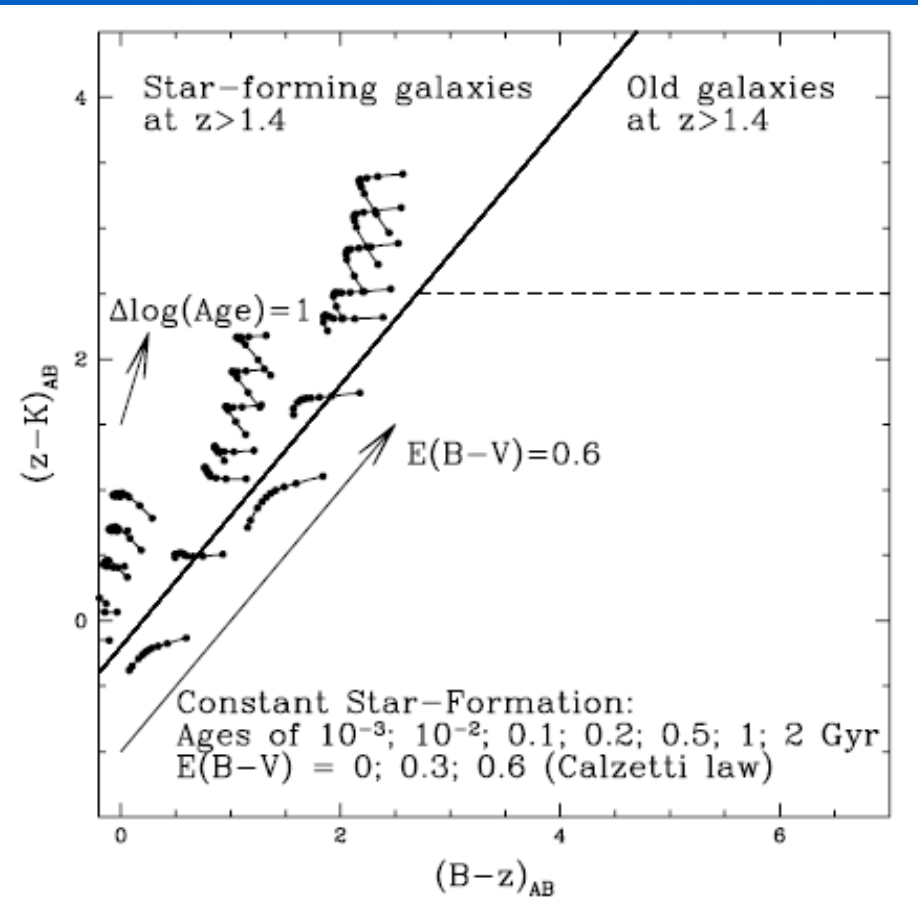
Galaxy Selection Criterion

- Validity of *BzK* parameter



Galaxy Selection Criterion

- Comparing to theoretical models

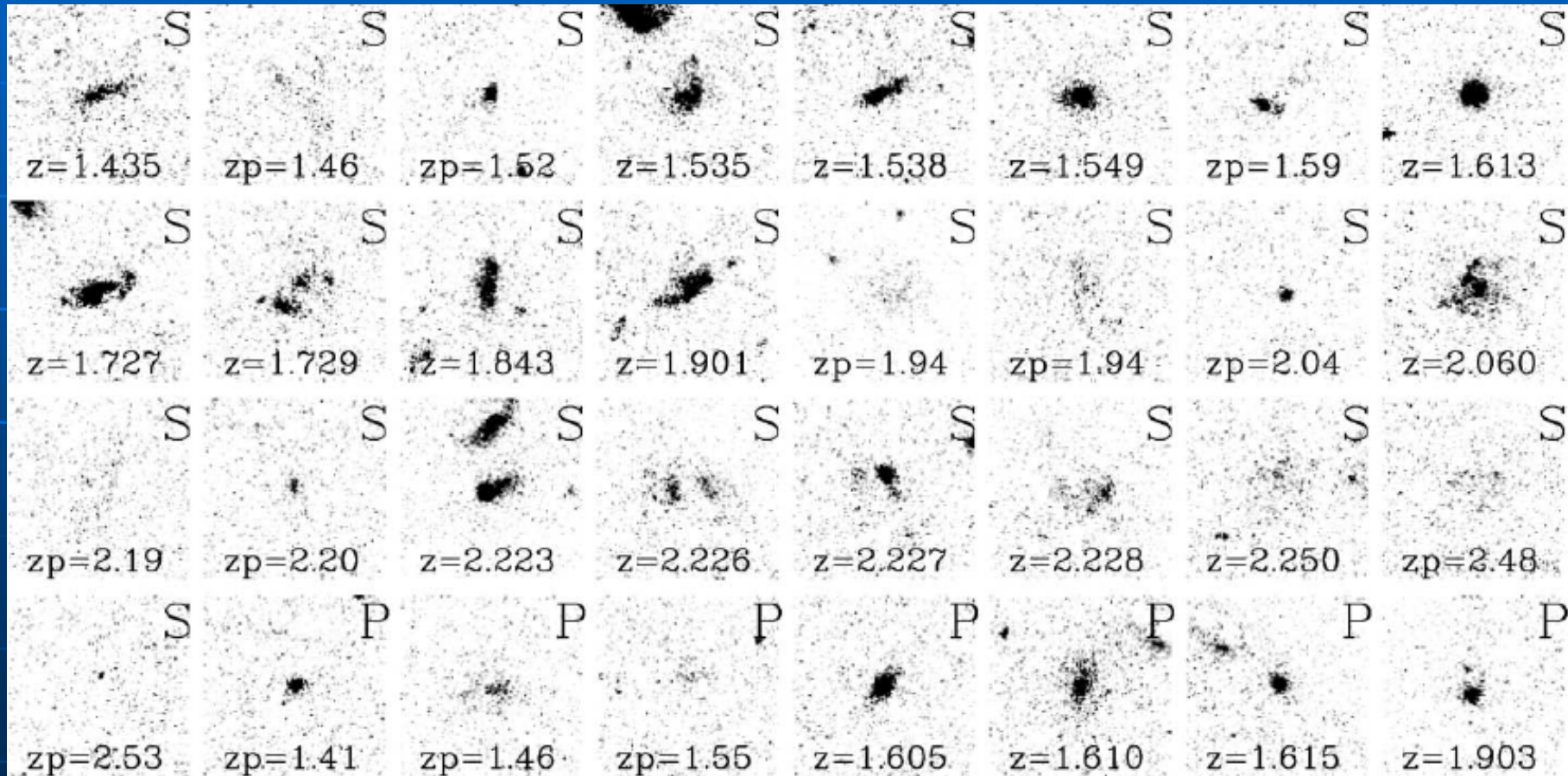




Galaxy Selection Criterion



- Galaxy morphology
- Star forming — irregular/merging like, large size
- Passive — regular, compact



Galaxy Parameter Estimation

- Star formation rate
- UV extinction

$$E(B - V) = 0.25(B - z + 0.1)_{AB},$$

- Star formation rate $\sim 250 M_{\text{sun}} / \text{yr}$

$$\text{SFR} (M_{\odot} \text{ yr}^{-1}) = L_{1500 \text{ \AA}} (\text{ergs s}^{-1} \text{ Hz}^{-1}) / (8.85 \times 10^{27}).$$

- Consistent with X-ray & radio estimations

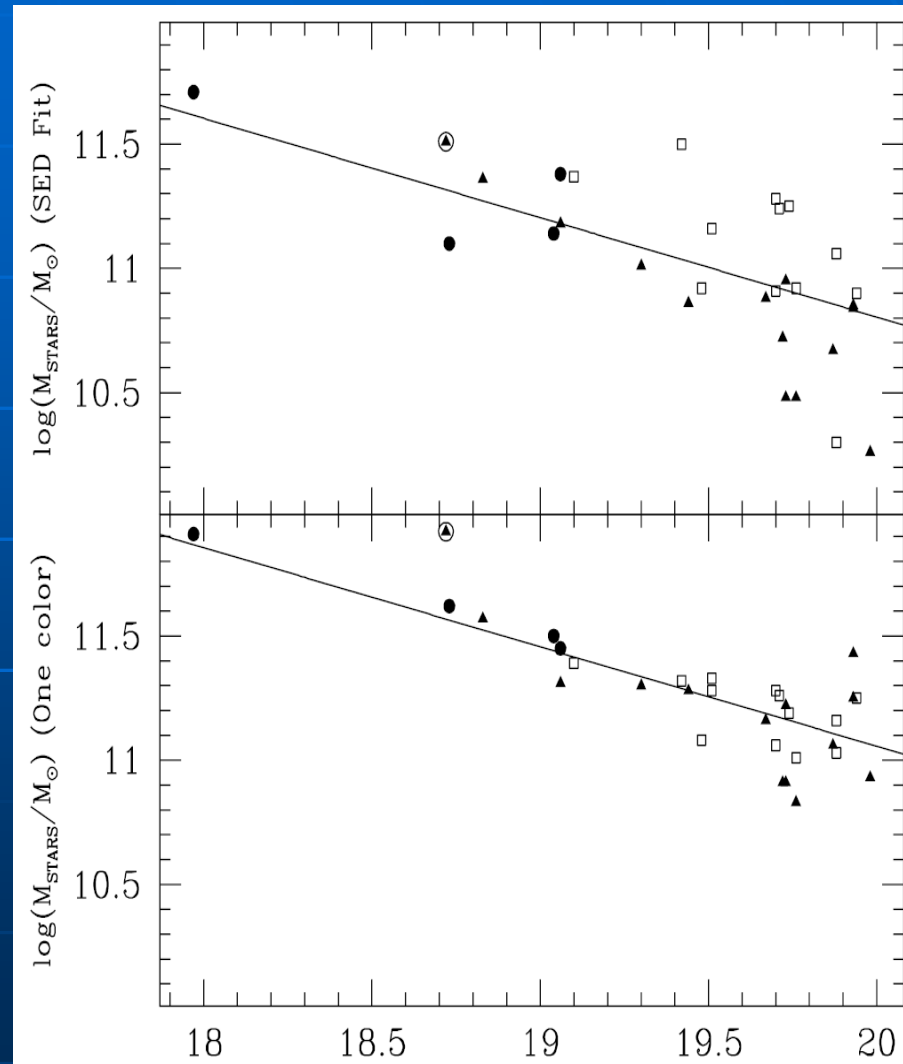
Galaxy Parameter Estimation

- Stellar mass of the galaxies
- Mass vs. K -band luminosity

$$\log(M_*/10^{11} M_\odot) = -0.4(K^{\text{tot}} - K^{11}),$$

- Mass dispersion

$$\Delta \log M_* = 0.218[(z - K)_{\text{AB}} - 2.29],$$



Extension of the New Criterion

- *BzK* Criterion is based on the rest-frame colors of star-formation & passive galaxies.
 - for different redshifts, choose different set of bands that samples the same rest-frame wavelengths

- *RJL* Criterion for redshift range $2.5 \leq z \leq 4$

$$RJL \equiv (J - L_{3.6})_{AB} - 1.4(R - J)_{AB}$$

- Checking for this new extended criterion
 - GOODS ACS + ISSAC + *Spitzer* data sets



Summary & Discussion

- The new *BzK* criterion provides a fairly accurate and economic way which can be used to large sample of galaxies to identify both active star-forming and passive galaxies, and to distinguish them.
- The *BzK* galaxies at $z \sim 2$ have quite high mass ($10^{11} M_{\text{sun}}$), star formation rate ($200 M_{\text{sun}} \text{ yr}^{-1}$), and densities (volume density 10^{-4} Mpc^{-3} , sky density 1 arcmin^{-2} , SFRD $0.044 M_{\text{sun}} \text{ yr}^{-1} \text{ Mpc}^{-3}$).
- The *BzK* galaxies at $z \sim 2$ might be the precursors of $z \sim 1$ passively evolving EROs and $z = 0$ early-type galaxies.