Lyman/Balmer-Break & Lyα Emitting Galaxies around NEP

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&

AKARI Extragalactic Survey Collaboration

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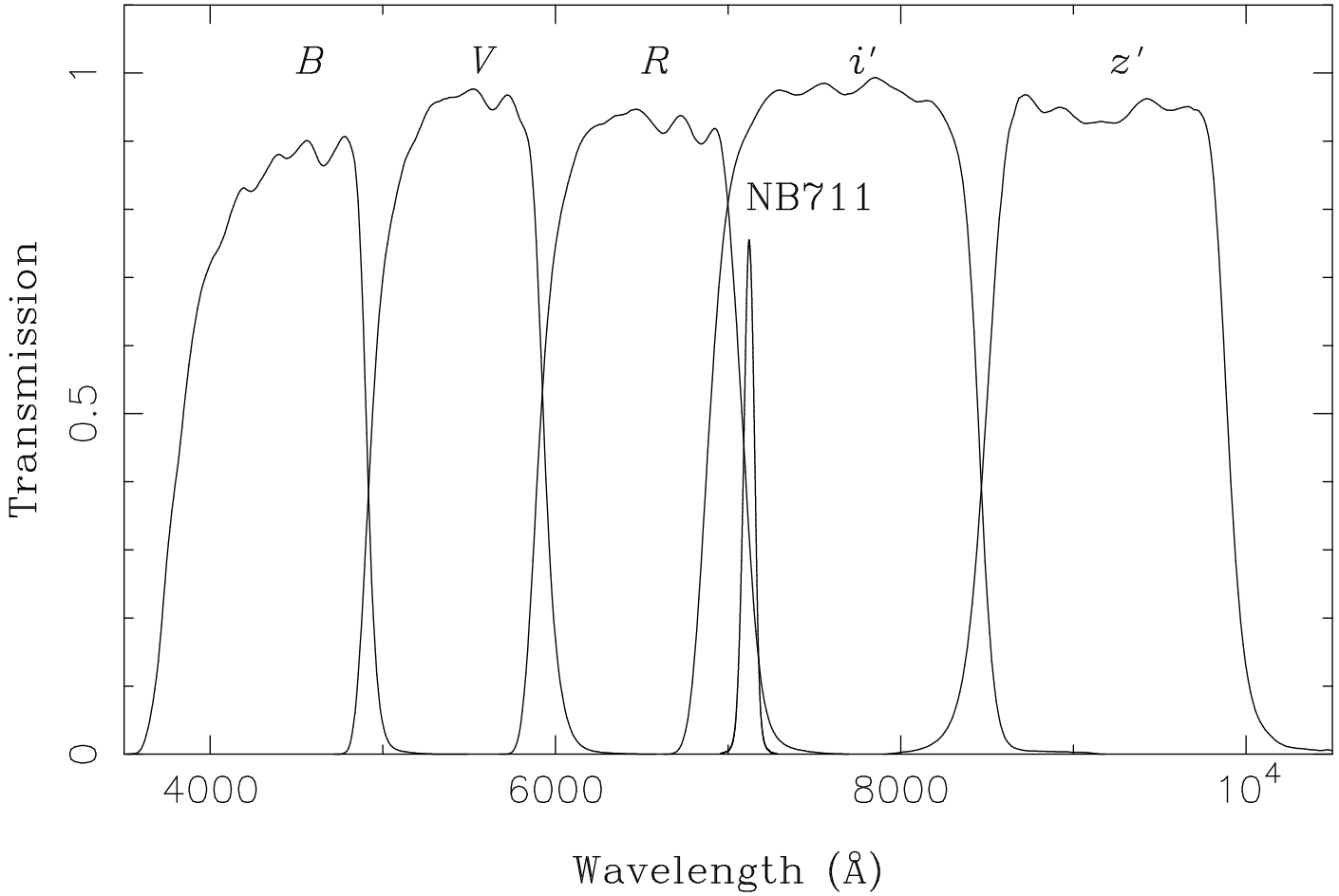
Diversity of ProtoGalaxy Candidates

- Lyman Break Galaxy (LBG) @$z > 3$
- Narrow-band Selected Galaxies
  - Lyman α Emitter (LAE) @$z > 3$ Dust-Free?
  - [OII], Hβ, [OIII], & Hα Line Emitters @$z < 1$
- Balmer(4000Å) Break Galaxies @$z = 1 - 2$
  Extremely Red Object(ERO), Distant Red Galaxy(DRG), p/sBzKs
  = Massive Old Stellar Systems $\rightarrow$ AKARI
- SubMm Bright Galaxy (SMG)
  = High-z Dusty Starbursts @$z \simeq 1 - 3 \rightarrow$ AKARI,AzTEC?

Used Filters in S-Cam Obs. around NEP



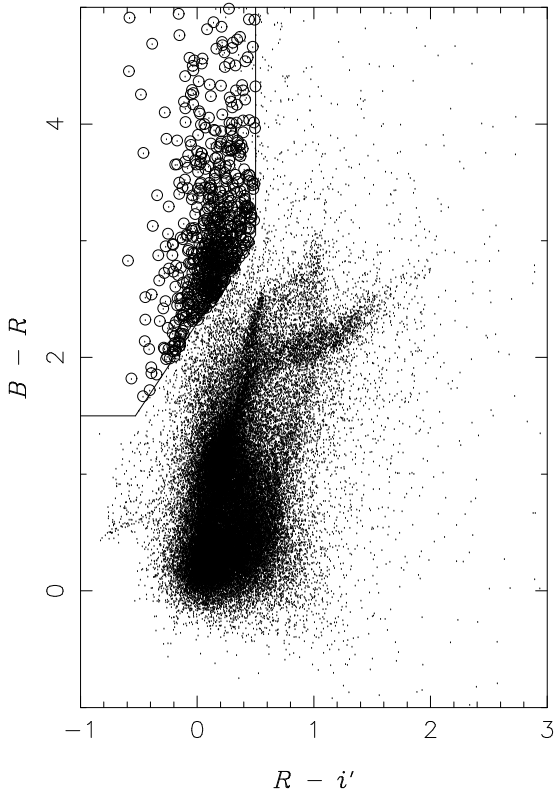
Filter Transmission Only

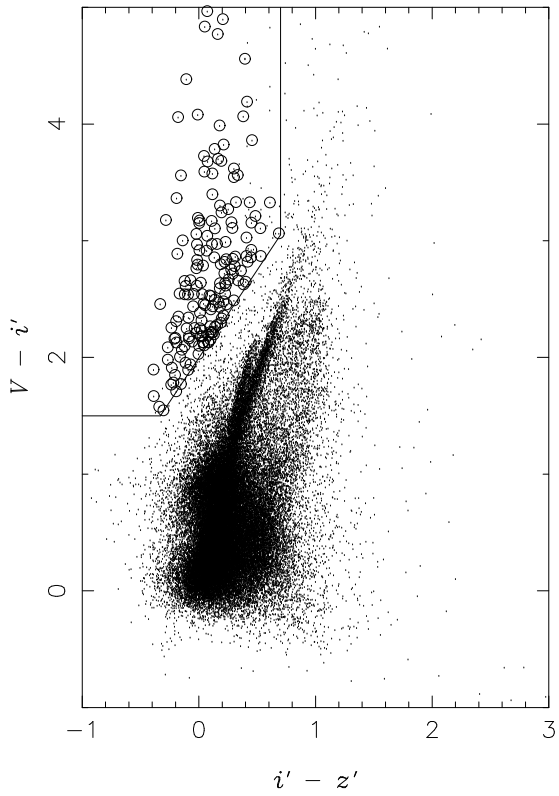
Obtained Photometric Data with S-Cam

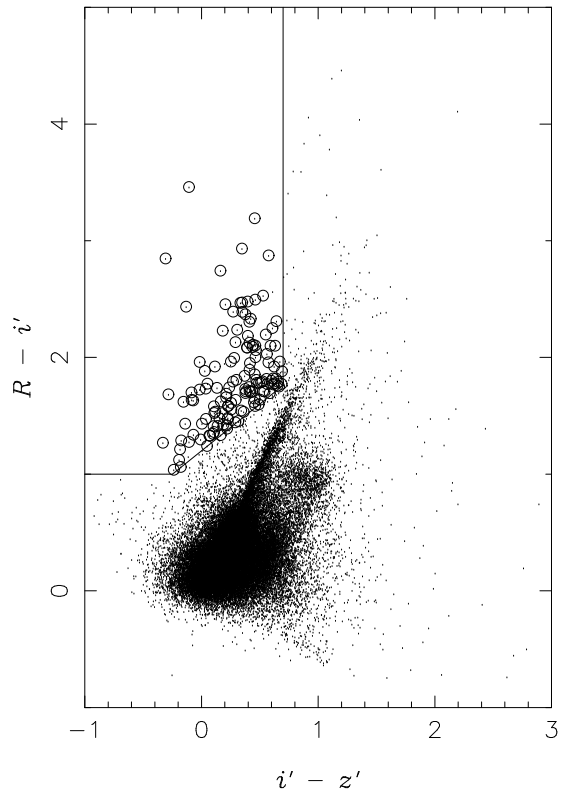
- B, V, R, i', z', and $NB711$(Δ73Å@ 7126 Å)

Band	Ex./Frame (sec)	Total Ex. (min)	Limit. Mag (AB mag/SN3)
NB711	1200	260	26.7
B	720	208	28.2
V	$600 + 360$	118	27.6
R	300	114	27.5
i'	300	115	27.1
z'	180	169	26.3

$BRi'/Vi'z'/Ri'z'$-LBGs @$z \simeq 4, 4, 5$



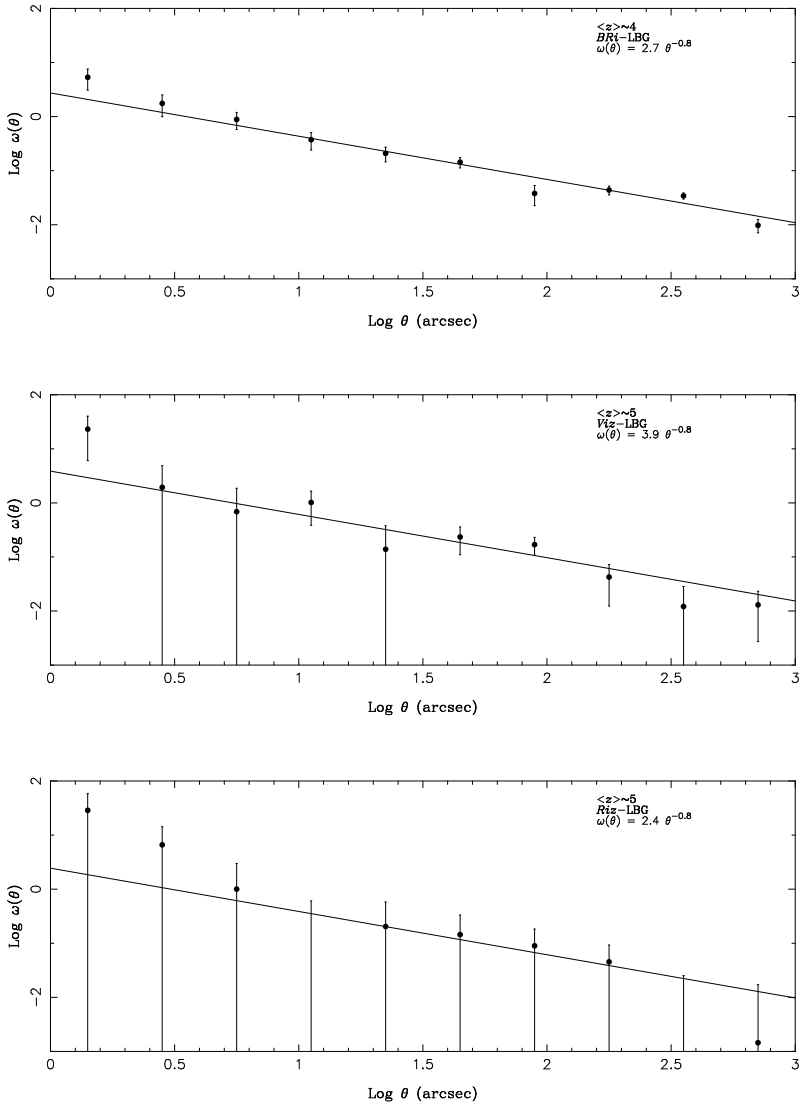




Selection of LBGs

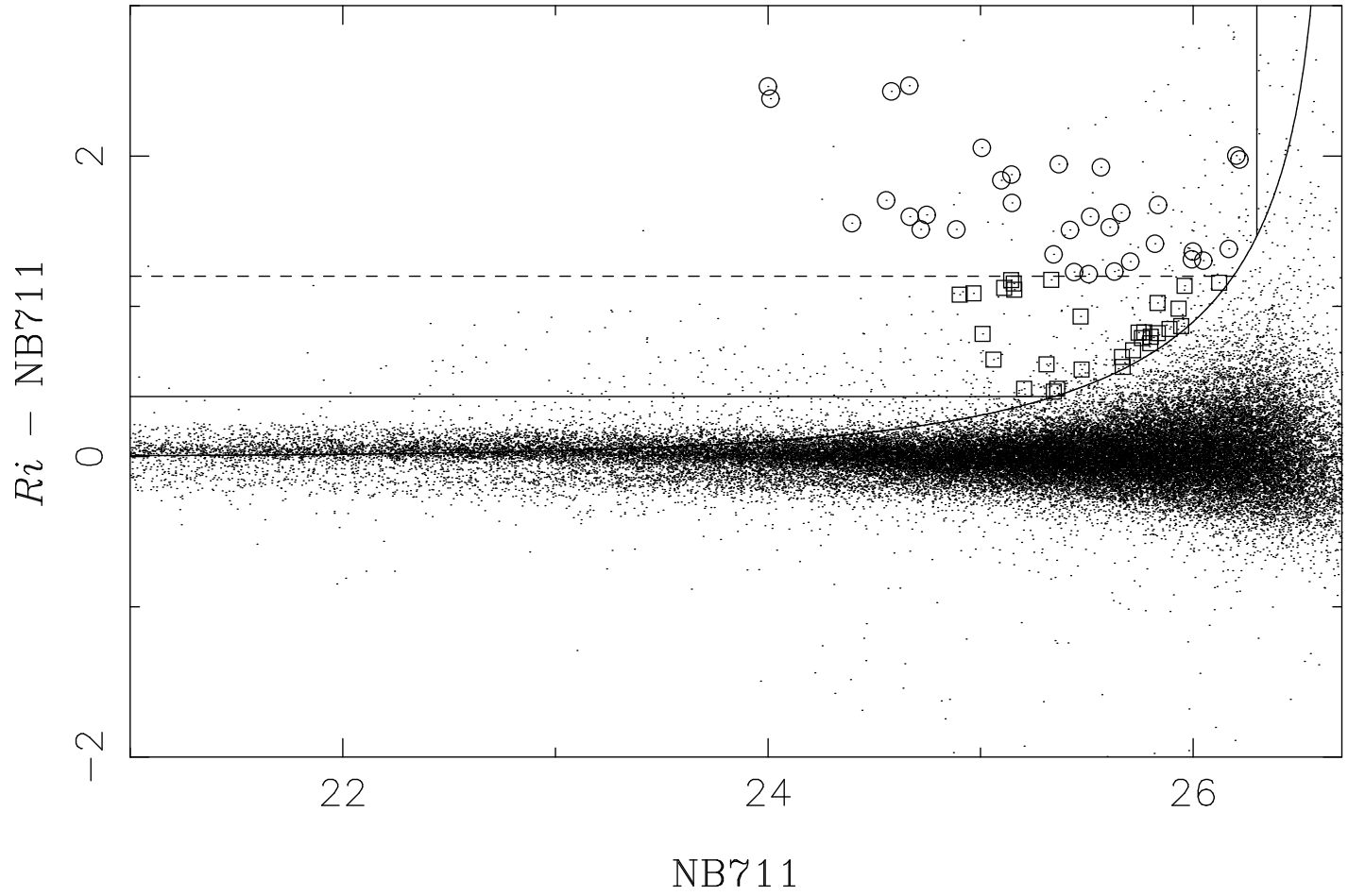
- 827 BRi' LBGs @ $z \simeq 4$
  - $B - R > 1.5$, $R - i' < 0.5$
  - $B - R > 1.5(R - i') + 2.3$
- 212 $Vi'z'$ LBGs @ $z \simeq 4$
  - $V - i' > 1.5$, $i' - z' < 0.7$
  - $V - i' > 1.5(i' - z') + 2.0$
- 135 $Ri'z'$ LBGs @ $z \simeq 5$
  - $R - i' > 1.0$, $i' - z' < 0.7$
  - $R - i' > 0.8(i' - z') + 1.2$

Clustering of LBGs in NEP



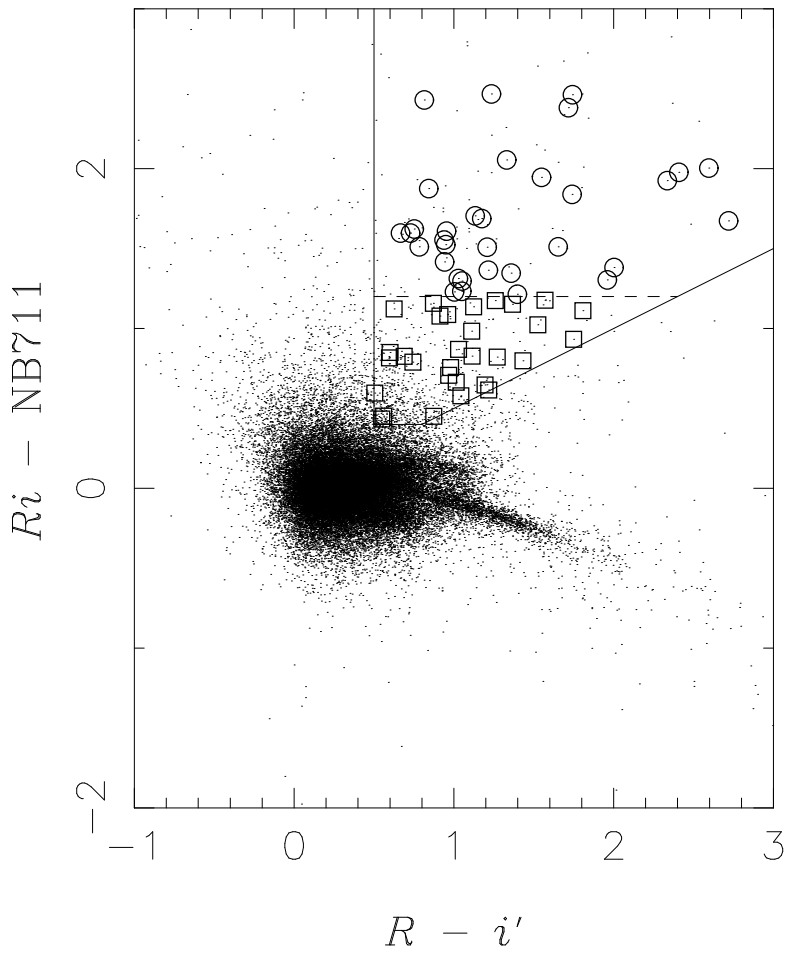
Similar to Other Blank-Sky Fields; SDF and SXDF

Selection of LAE @$z \simeq 4.8$ 1/2



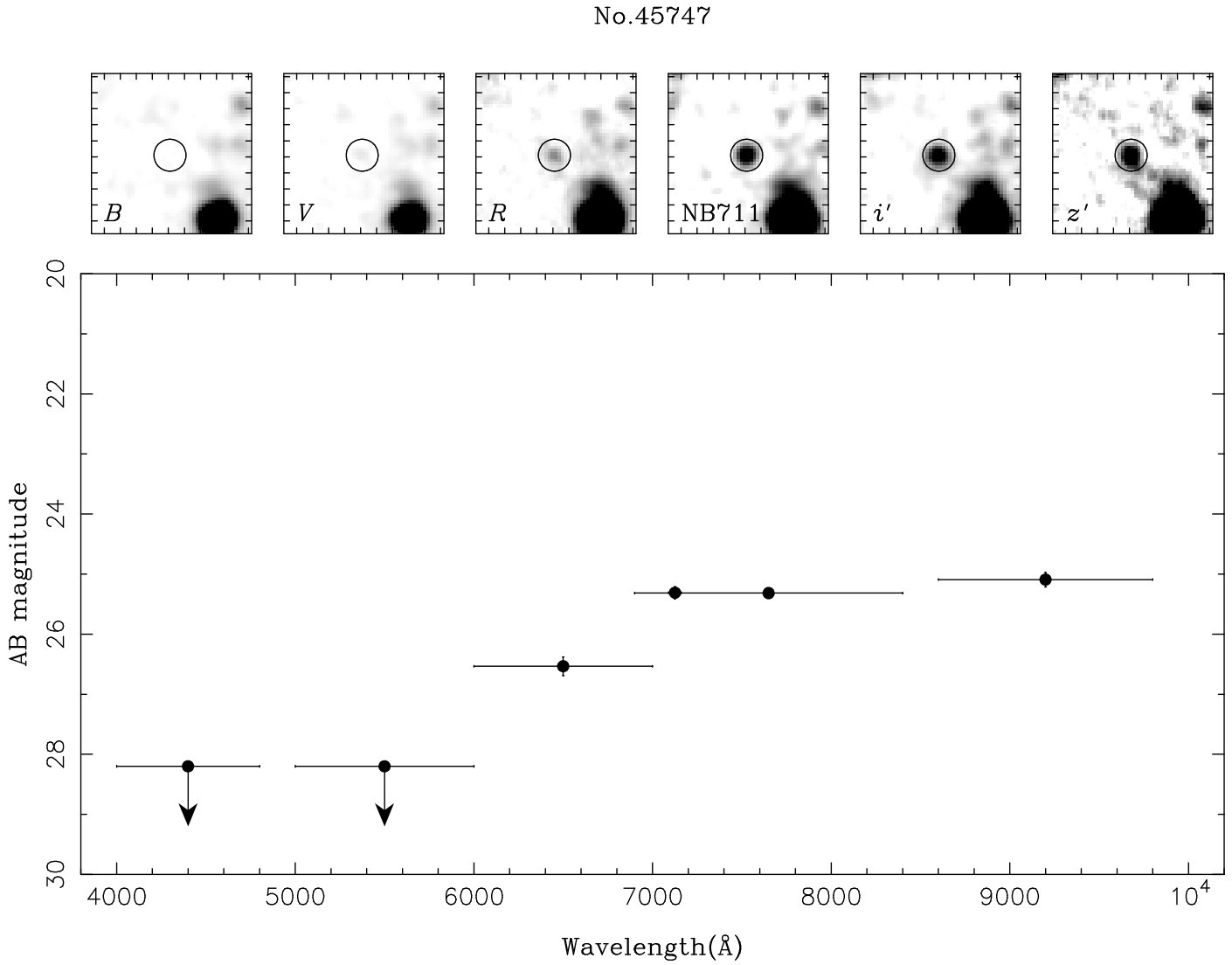
1. NB711 < 26.3
2. $Ri - \mathrm{NB711} = 0.4 - 1.2(\mathrm{Weak}/30), > 1.2(\mathrm{Strong}/33)$
3. SN$> 3\sigma$, where $Ri = (R + i')/2$

Selection of LAE @$z \simeq 4.8$ 2/2

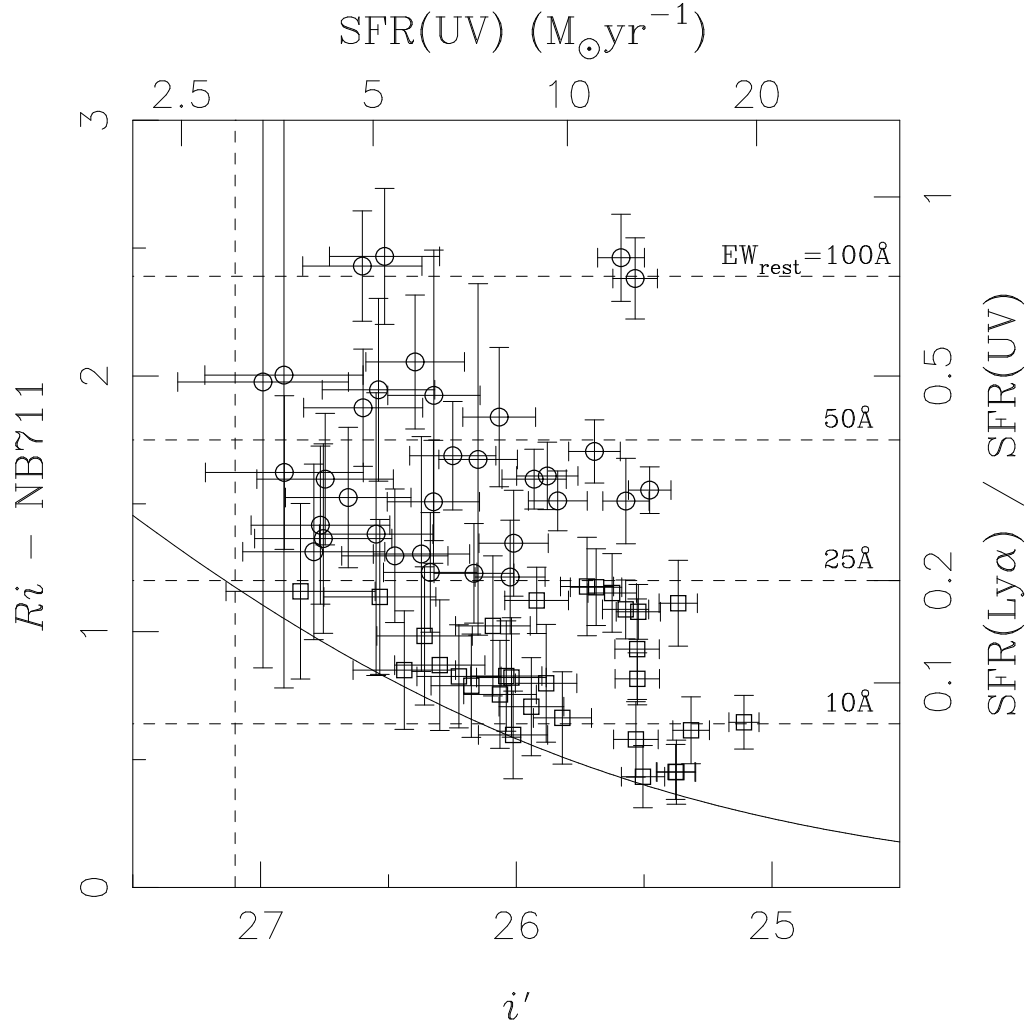


1. $R - i' > 0.5$
2. $i' - NB711 > 0.0$
3. $B > 28.2$

Spectral Energy Distribution of An LAE

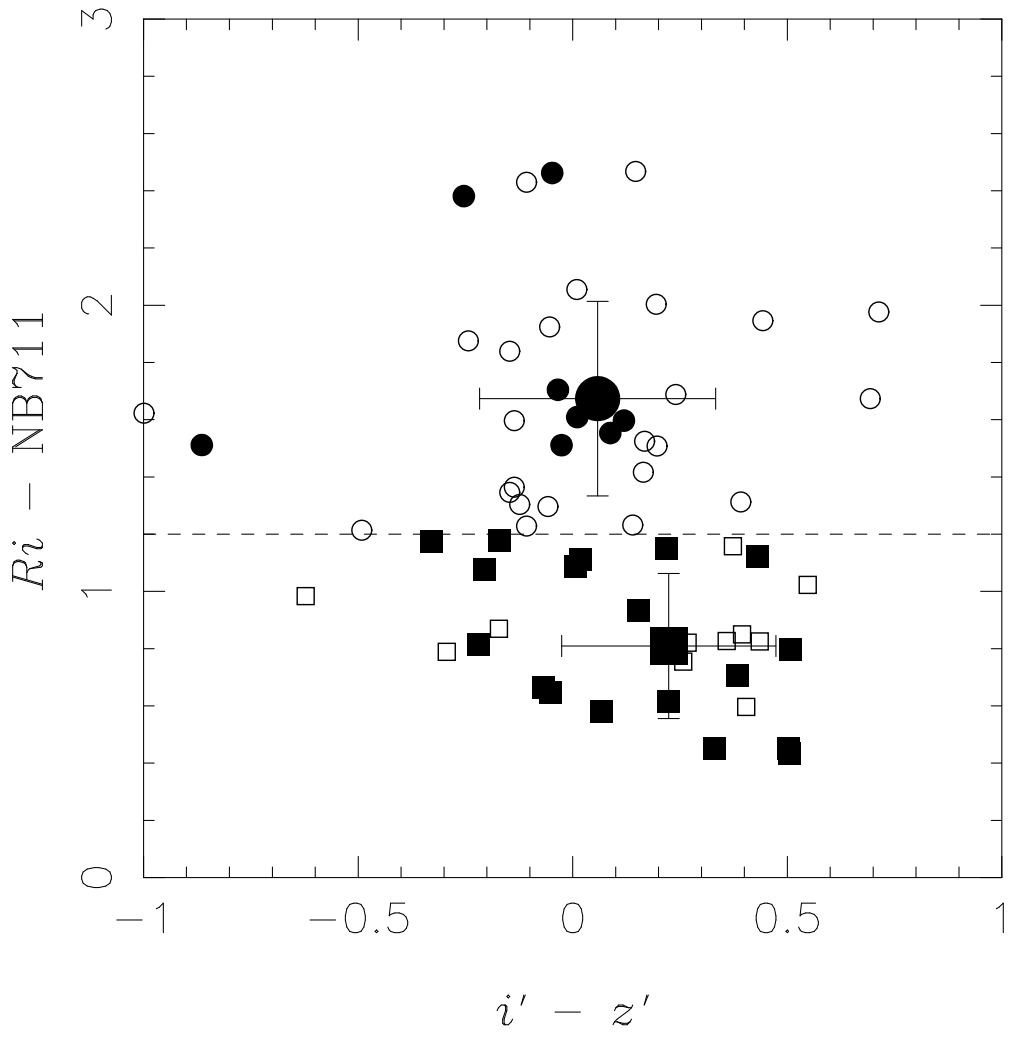


Lyα Depletion in UV Bright LAEs?



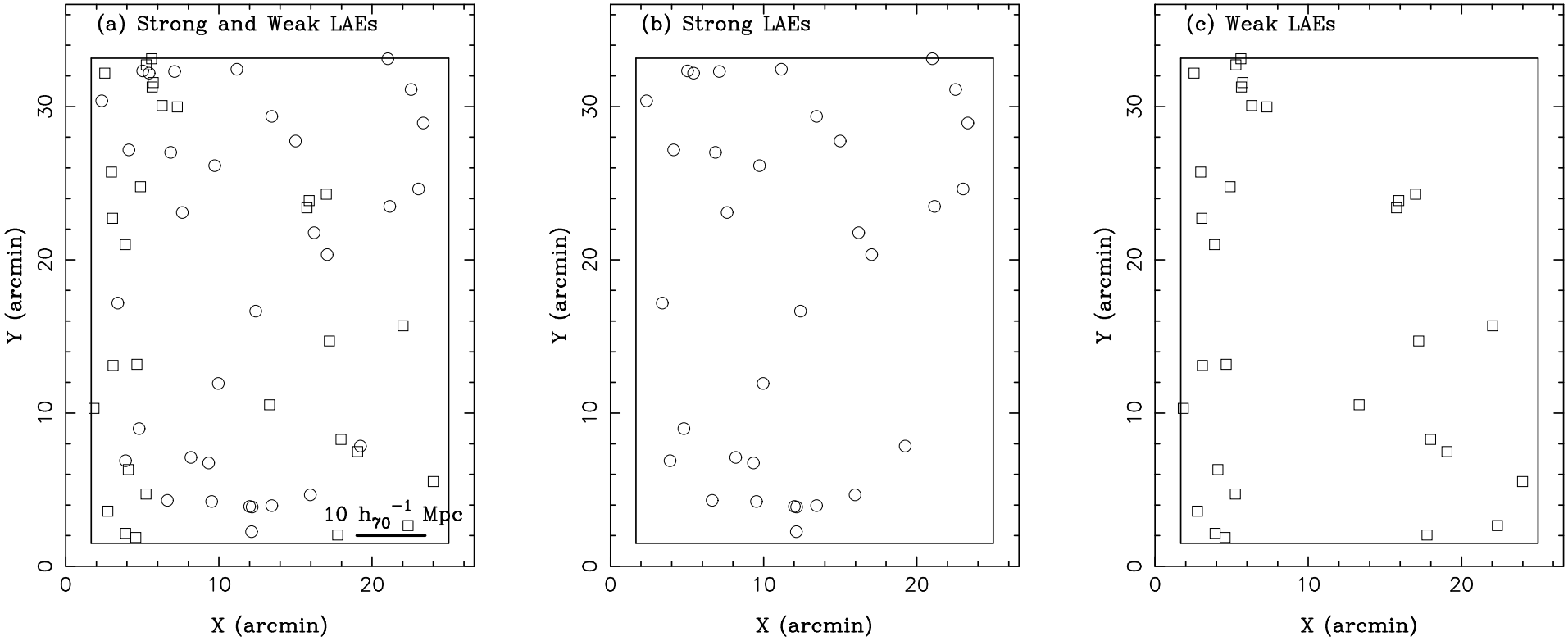
Solid Curve: NB excess $> 3\sigma$, Verical Line: $> 3\sigma$ Limit for i'

Lyα Depletion with Dust Extinction?



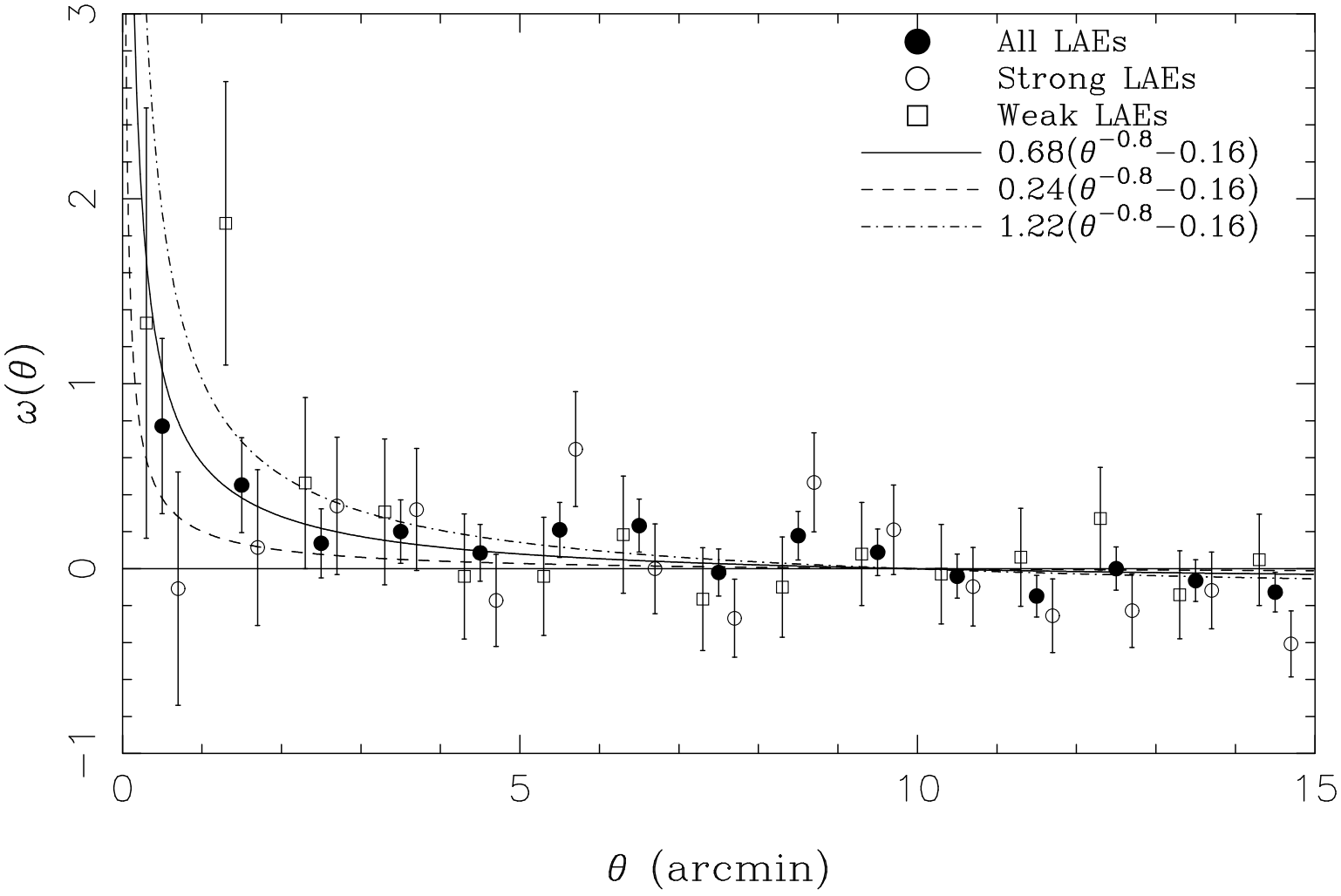
Dashed Line: Ri − NB711 = 1.2

Distribution of LAEs @$z \simeq 4.8$ in NEP



Circles: Strong, Square:Weak

Clustering of LAEs @$z \simeq 4.8$ in NEP



Circles: Strong, Square:Weak

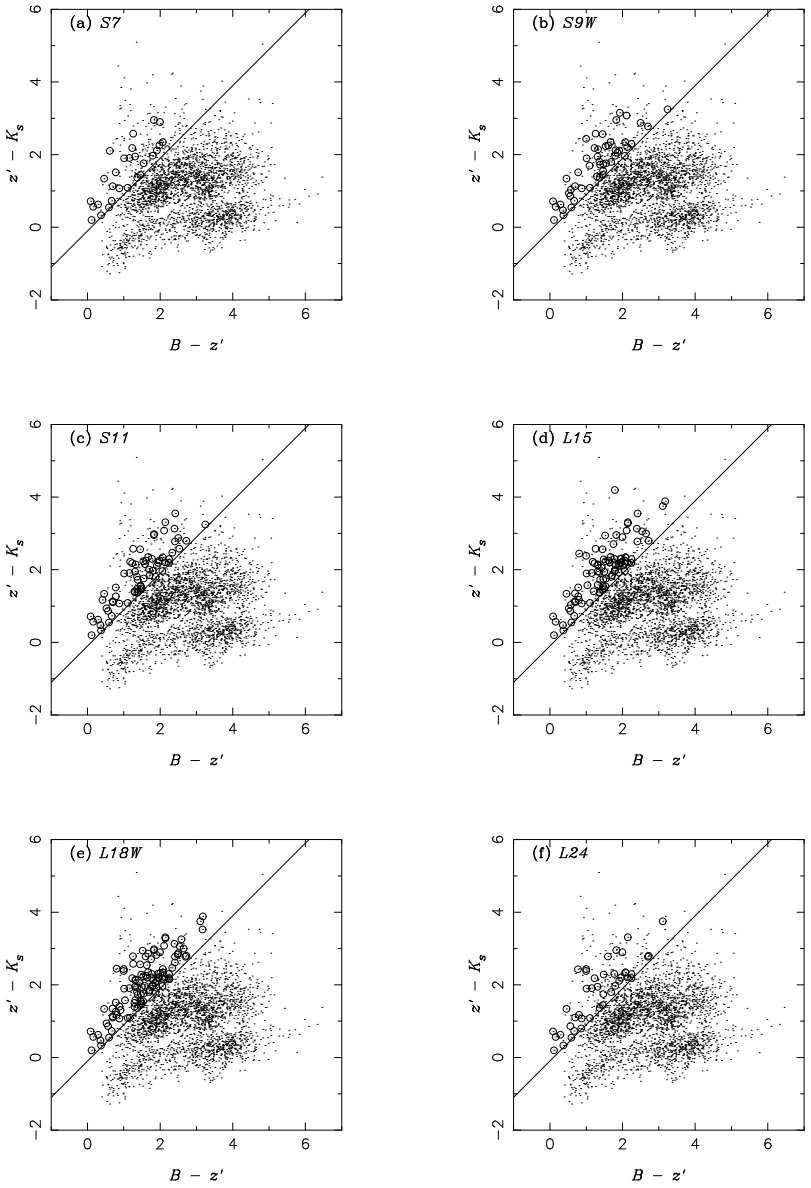
SFR and Biasing in LAEs @$z \simeq 5$

- Lyα Depletion in LAEs
  - Dust Extinction/Chemical Enrichment ?
- SFR of Weak LAEs
  - < 20 $M_\odot$ yr^{-1} without Correction of Extinction
  - ~ 100 $M_\odot$ yr^{-1} with Correction of Extinction
  - **SFR of Weak LAEs $\simeq$ SFR of LBGs**
- Clustering of Weak LAEs $\simeq$ Clustering of LBGs
  - Bias $\leftrightarrow$ Halo Mass
  - **Mass of Weak LAEs $\simeq$ Mass of LBGs**

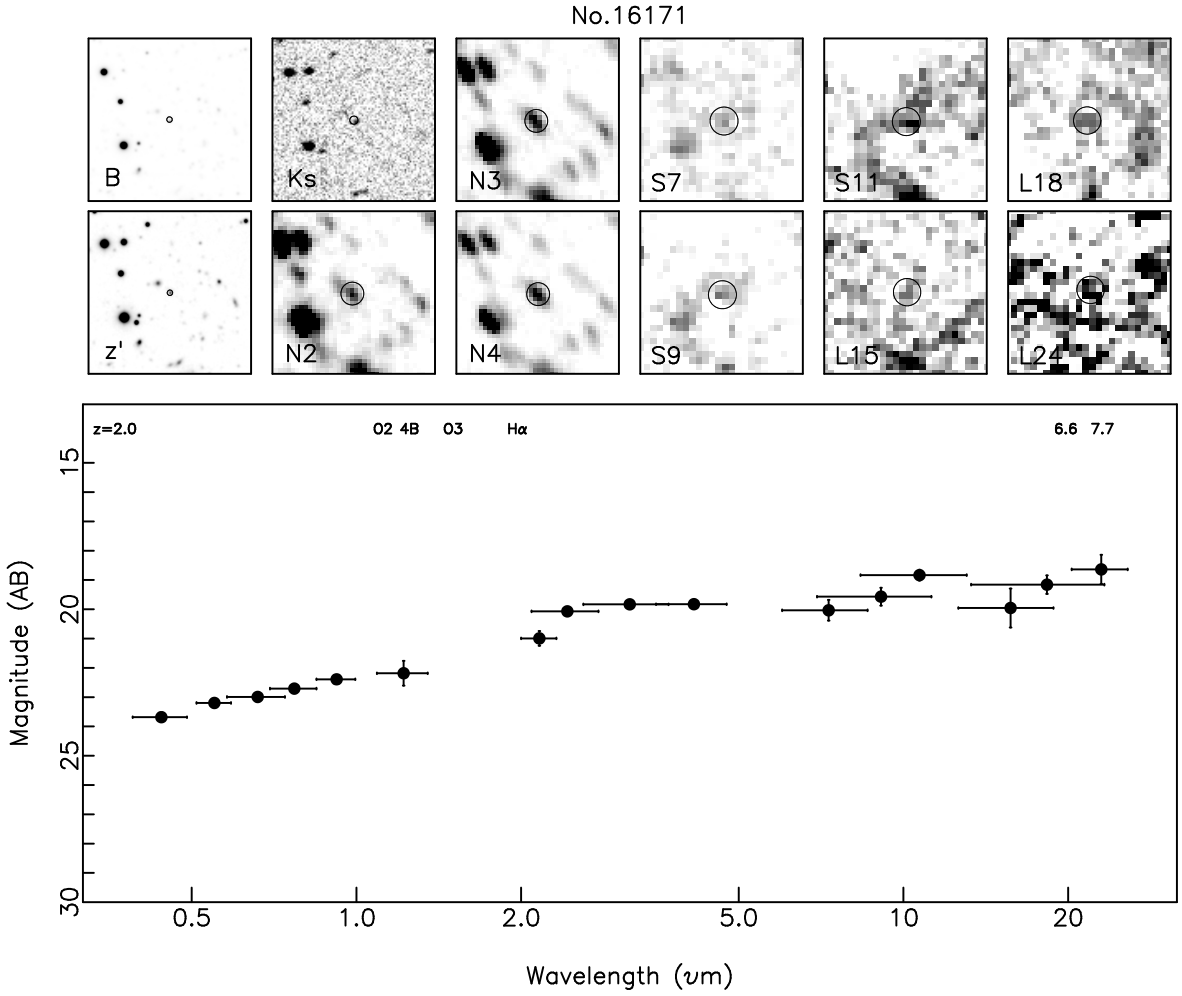
Imprecation from LAEs & LBGs

- **Weak LAEs $\simeq$ LBGs ?**
  - Similar Photometric SEDs: Weak LAEs $\simeq$ LBGs with EW<10ÅLy α
    ($\simeq$ Spectroscopic Results by Ando et al. 2004)
  - Similar Spatial Correlation
- **Evolved Systems are Dust Enriched ?**

BzKs with FLMG/AKARI in NEP

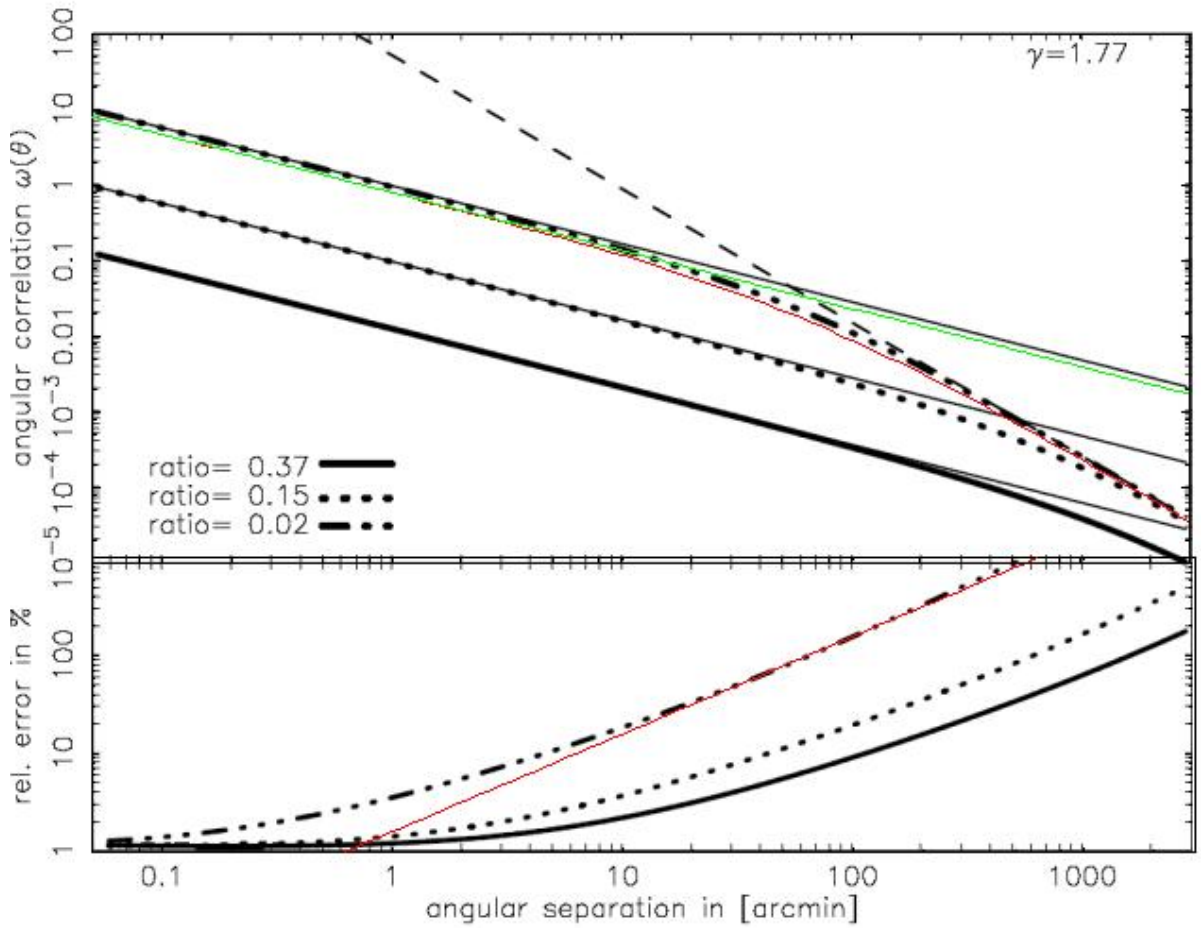


Spectral Energy Distribution of An BzK



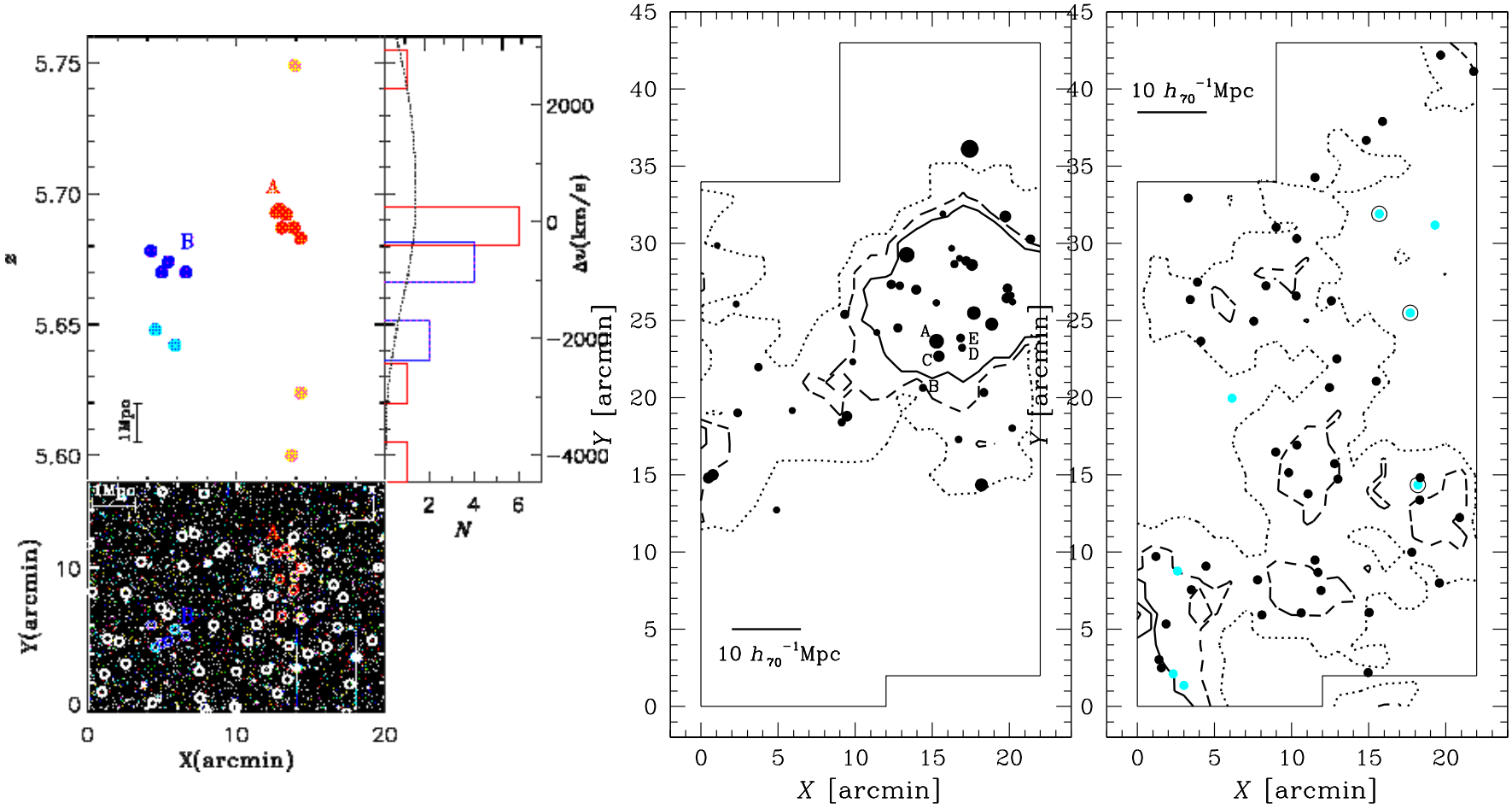
"Red Galaxies" Special Session in Spring Meeting of ASJ

Clustering in Real Space from ACF



$NB711$; $\sigma/r_m \simeq 0.001 \rightarrow \theta_{\rm break} \simeq 4$ arcmin

Field-to-Field Variance of LAEs?



- Large Scale-Structure @$z = 4.86$ $\leftrightarrow$ No Clustering @$z = 4.79$ in SDF
- Clustering of LAEs in SXDF

Selection of Line Emitters @ Low-z

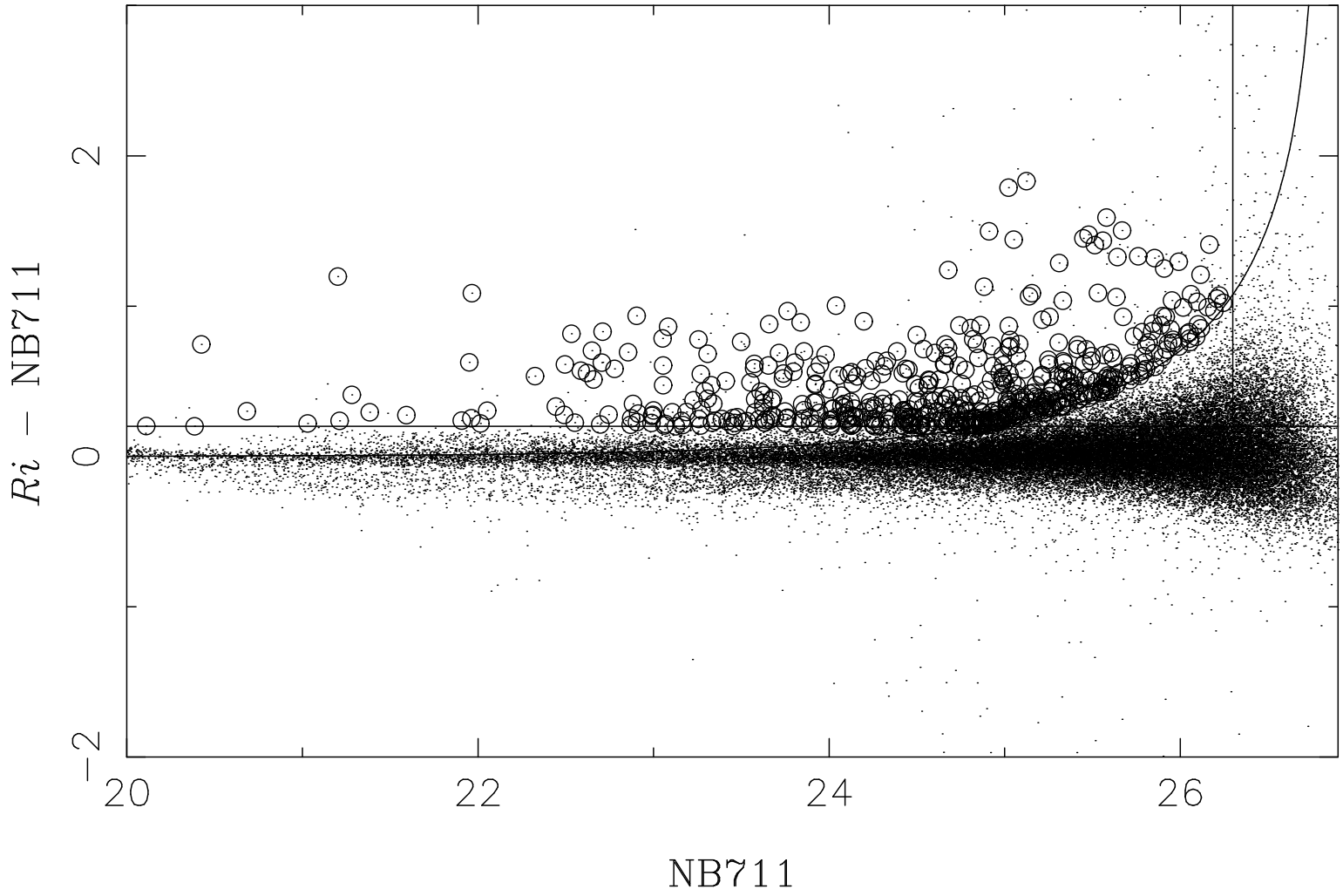
1. [OII] $\lambda 3727$ @$z = 0.9$ with
   $V - R_c < 1.7(R_c - i') \cup V - R_c < 0.82(R_c - i')$

2. Hβ @$z = 0.46$

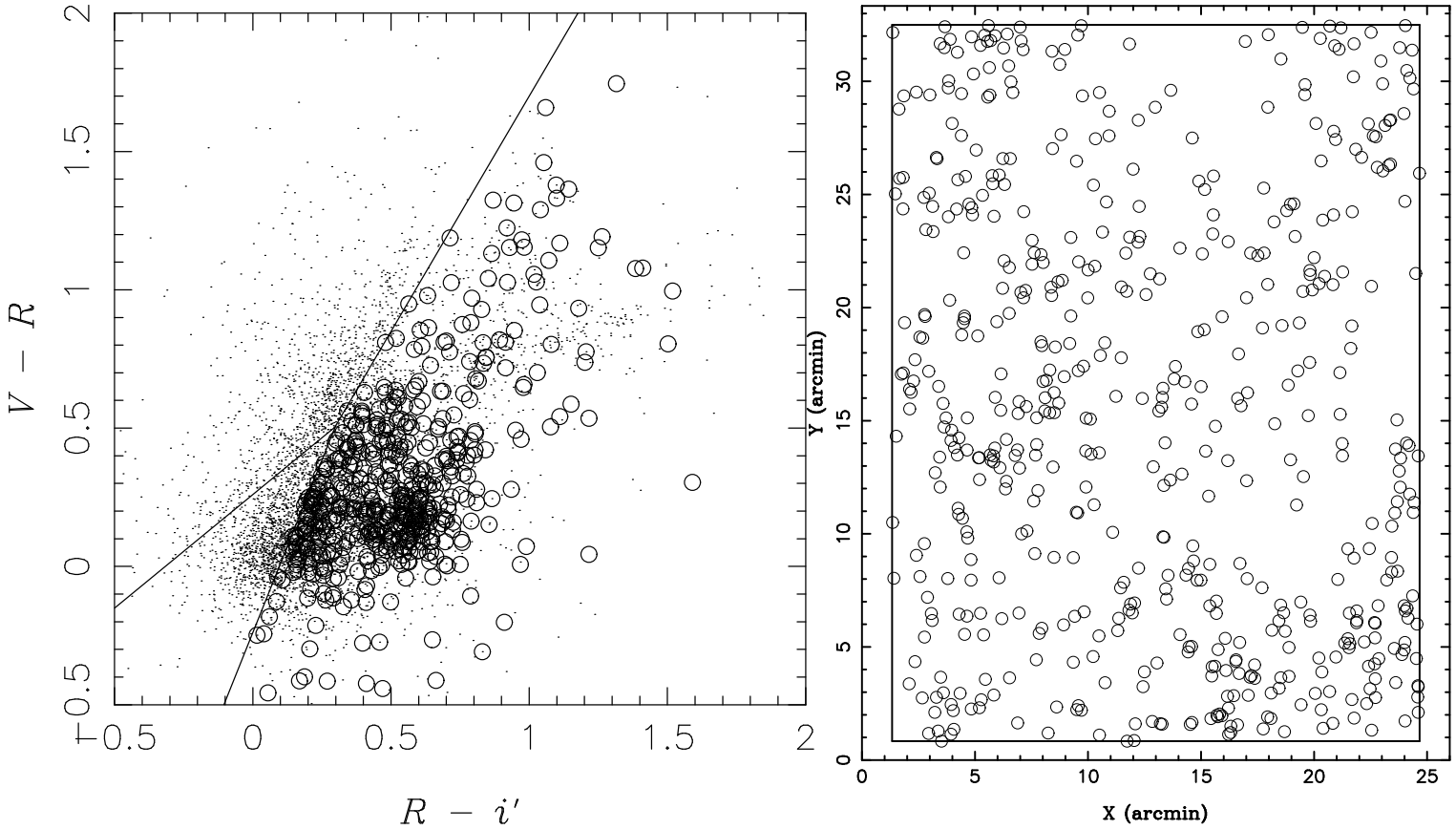
3. [OIII] $\lambda 4959$, 5007 @$z = 0.42$ with
   $V - R_c > 1.7(R_c - i') \cup V - R_c > 0.82(R_c - i') + 0.26$

4. Hα @$z = 0.08$ with remaining sources

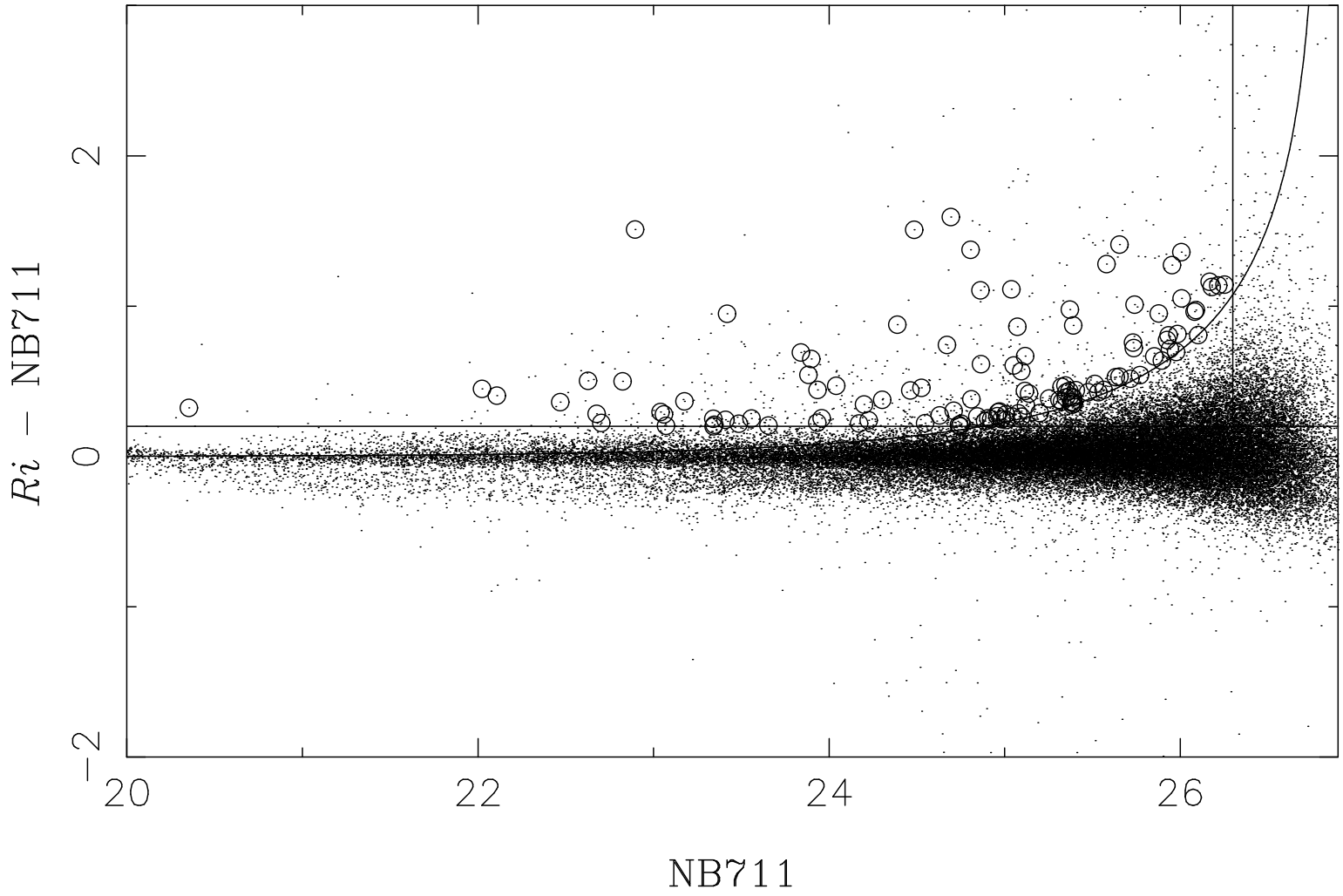
[OII] λ3727 Emitters @$z = 0.9$ 1/2



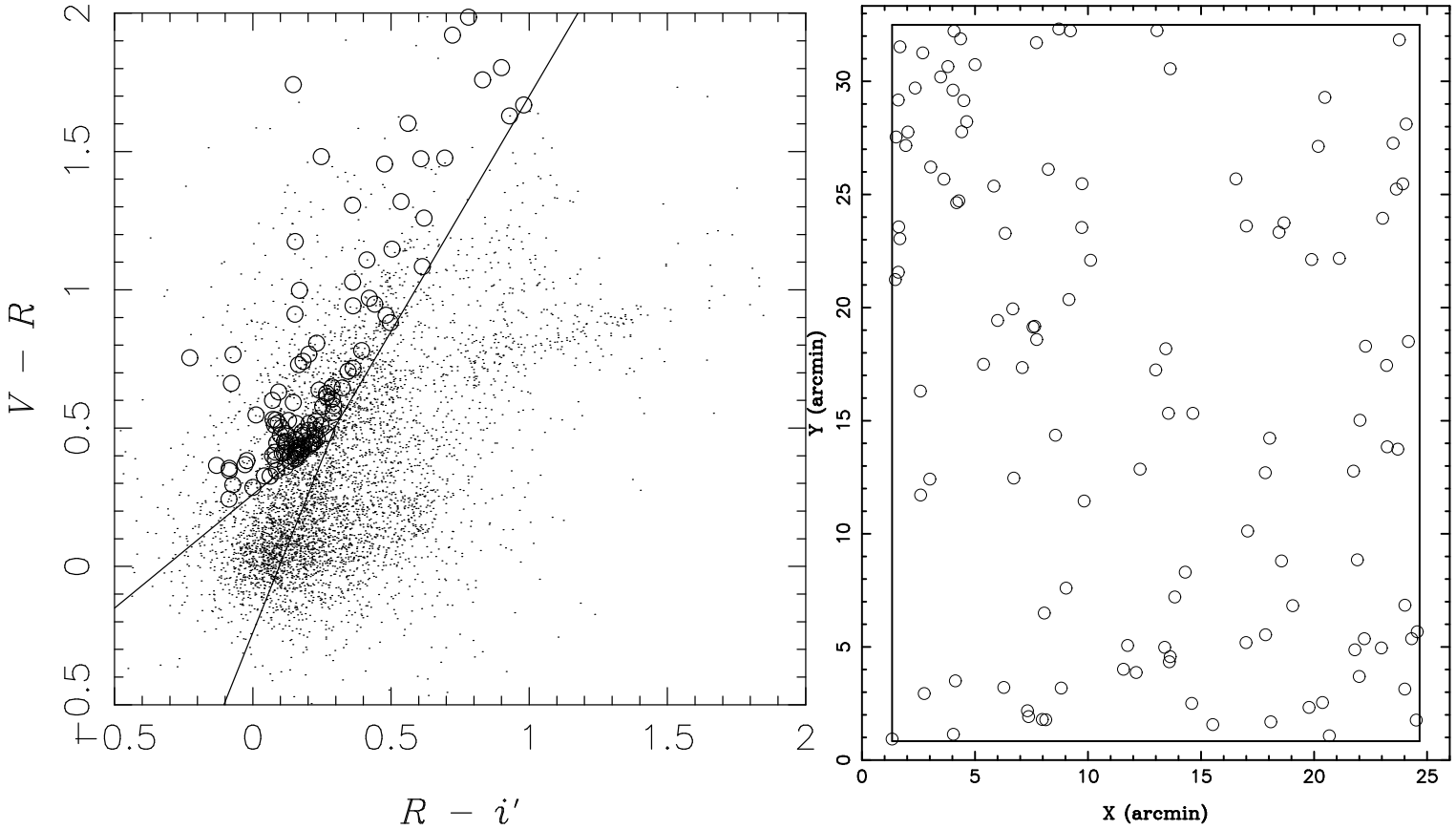
[OII] λ3727 Emitters @$z = 0.9$ 2/2



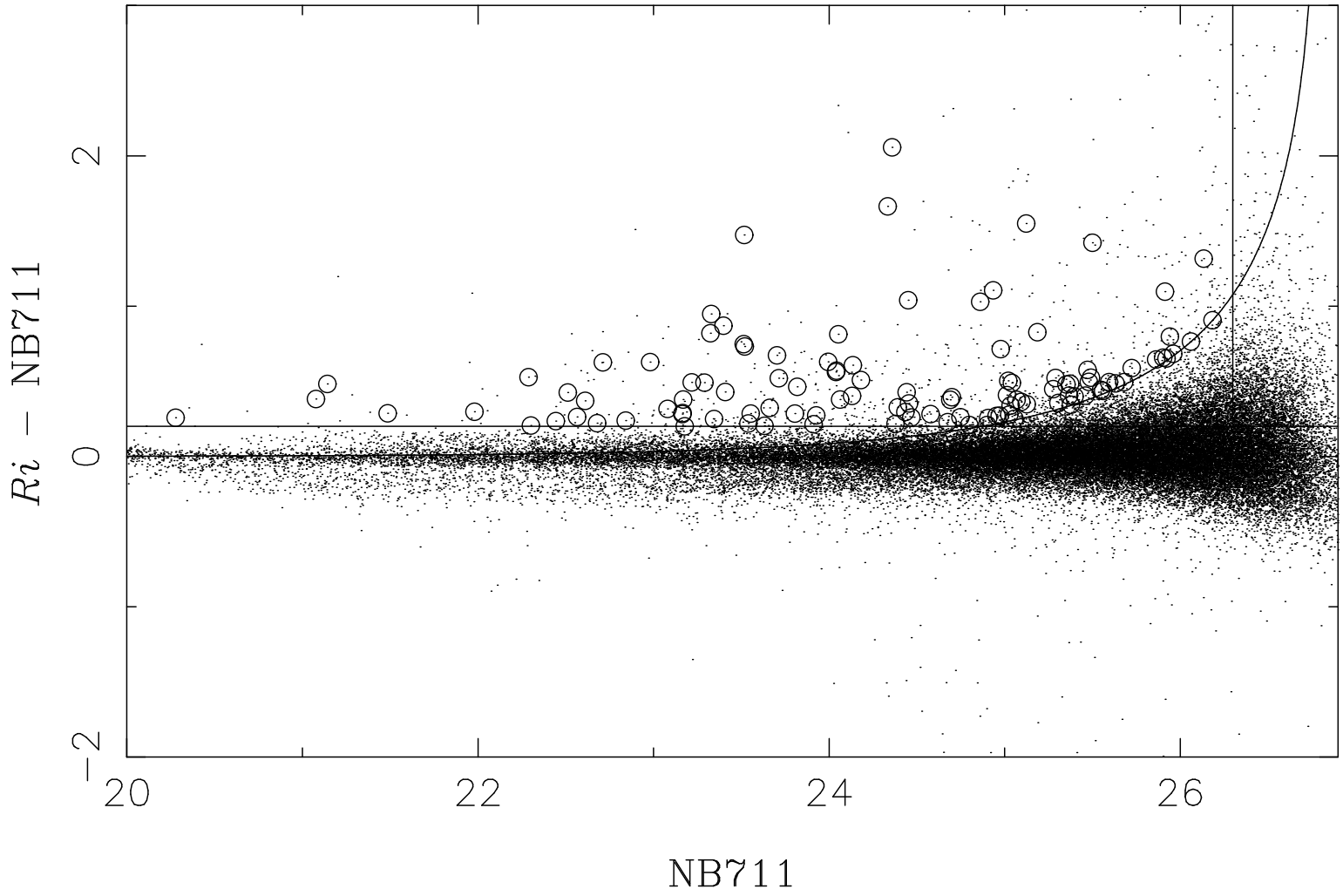
[OIII] λ4959, 5007 @$z = 0.42$ 1/2



[OIII] λ4959, 5007 @$z = 0.42$ 2/2



$\mathbf{H}\alpha@z = 0.08$ **1/2**



$\mathbf{H}\alpha@z = 0.08$ **2/2**