The quest for high redshift radio galaxies (just started…)

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HzRGs are important because they probe very massive galaxies in the early stages of their evolution (in Hz RL QSO we cannot see the host).

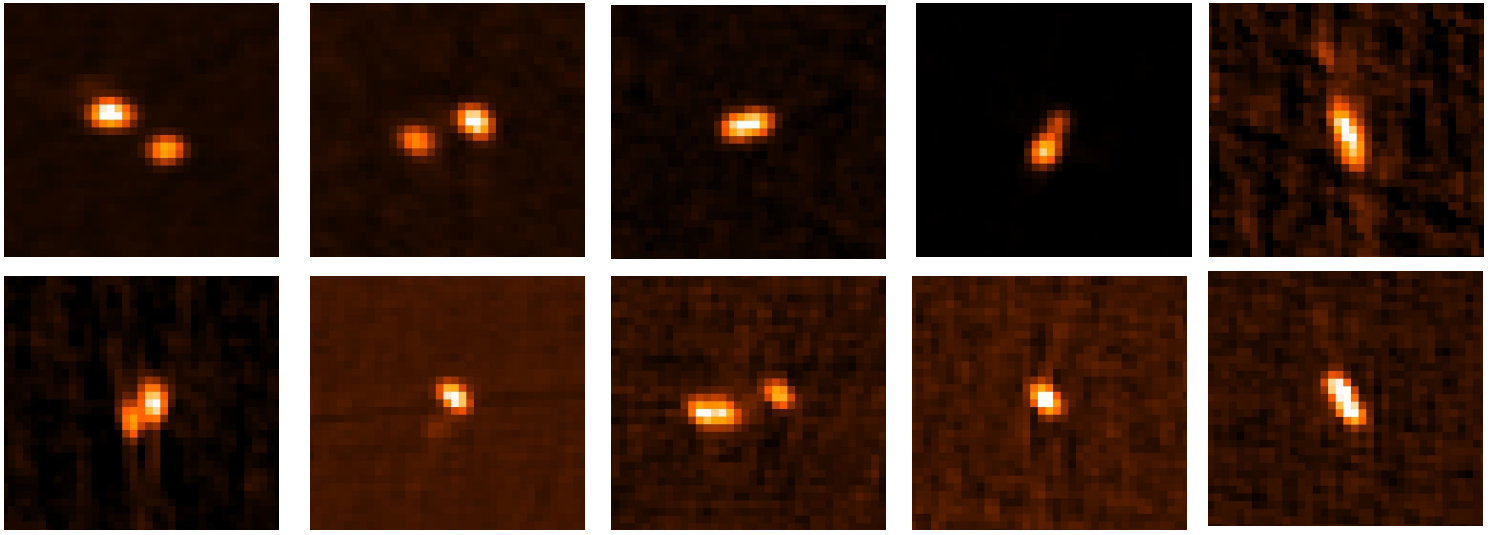
They are beacons to find proto-clusters.

Only ~10 RGs with z>4 have been found; about 200 RGs with z>2 are known, but they were selected with different and possibly biased methods (e.g., ultra steep sources).

They cannot be used to explore, e.g., their evolution with redshift or to measure the luminosity function.

We need larger samples and unbiased selection

How do HzRGs look like? (radio)

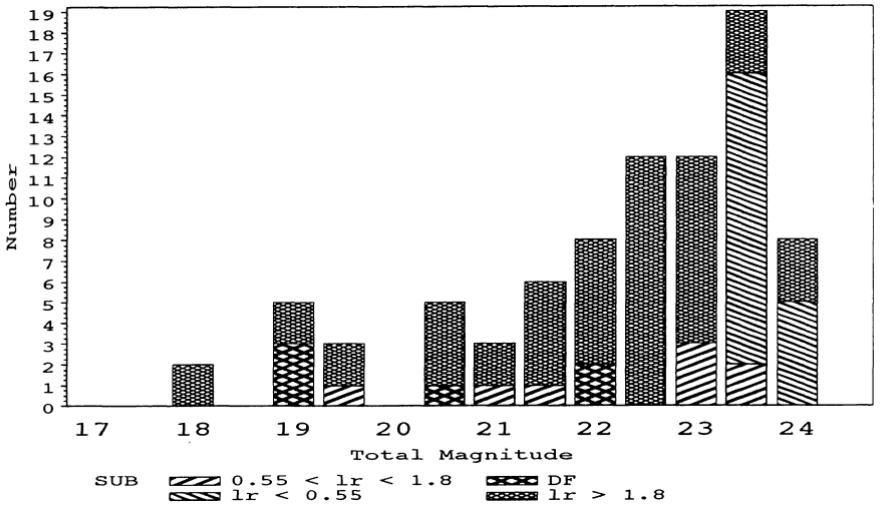


VLASS images (3 GHz, 2.5” resolution) of 10 RGs at z~3.7-4.4, F.O.V. = 30”

Five are double (with sizes ~5” - 12”), three are elongated (double below the resolution of the VLASS?) only 2 are point like.

A simple search for one-to-one optical counterparts does not work!

How do HzRGs look like? (optical)



RGs with z~2-3 have m_r~20-23

At z~4 are ~1-2 mag fainter.

Deep optical data over a large field are needed (SDSS and PanSTARRS are not deep enough)

The Subaru Hyper Suprime-Cam (HSC) survey and the Kilo Degree Survey (Kids)

The radio selection:

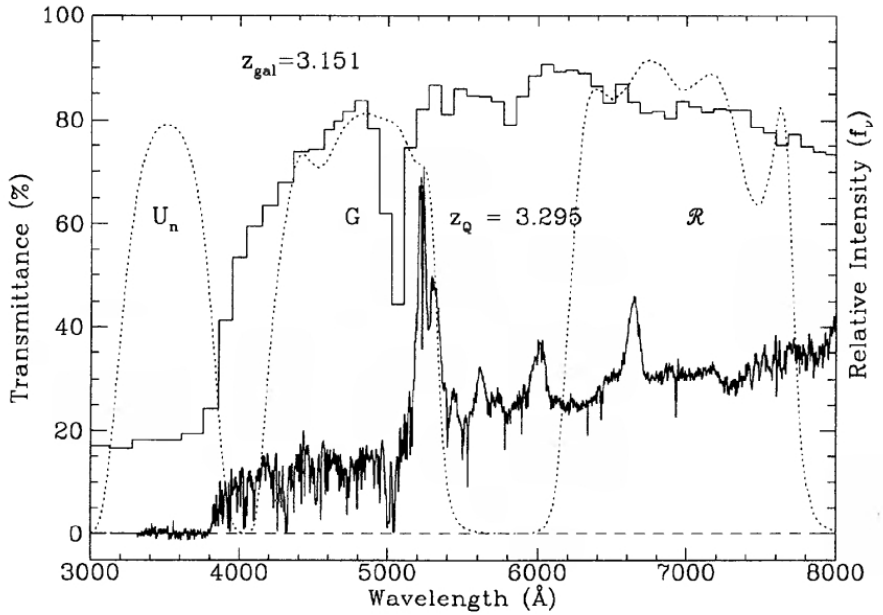
The GLEAM ExtraGalacticCatalog: 307,455 sources with DEC<+40^{o}
Flux >0.3 Jy at 74 GHz (analogues to 3C sources at z~0.5-1, moved at z~4)

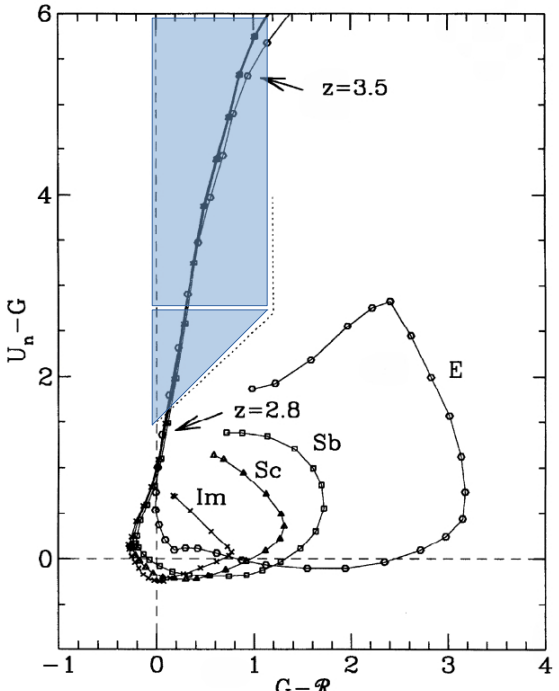
Improving the radio positions and radio structure:
VLASS covers DEC>-40^{o} at 3 GHz, resolution 2.5”
Extract from the catalog all sources within 30” from the GLEAM position

Search for host galaxy:
1) at each of the radio positions
2) at the mid-point of double sources

The dropout technique (in a nutshell)

Absorption reduces the emission below Lyα
→ large u-g colors

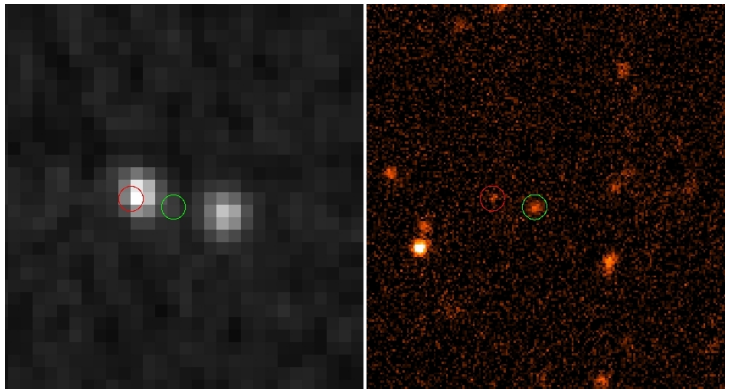




U-dropouts → z>2.7 candidates

Same method for redder bands for higher z

Looking for the host galaxy:

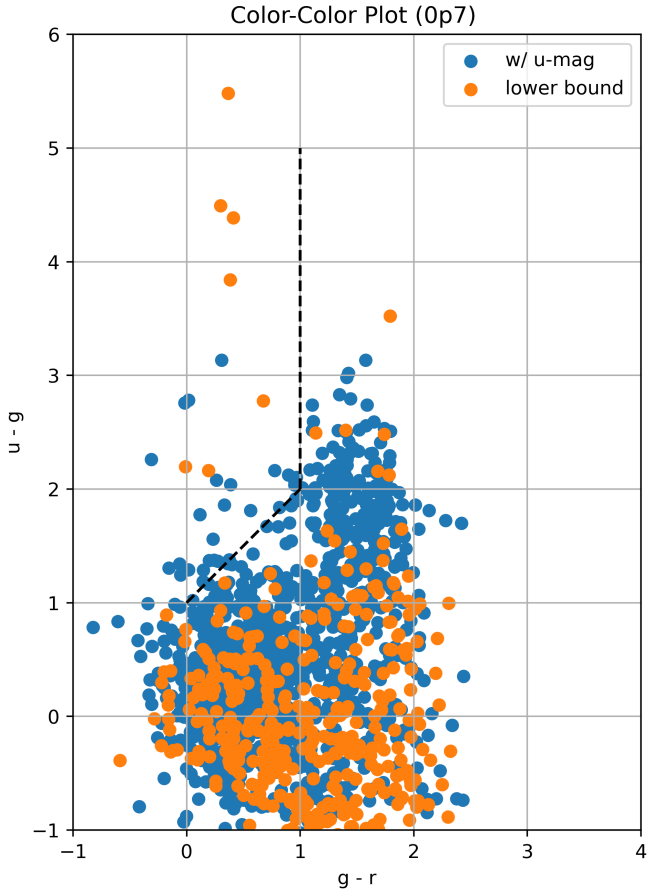


1) within 1” (HSC) or 1.5” (Kids) from radio position(s)

2) at the mid-points of each source pairs
(within 1/6 of their separation → arm ratio 1:3)

Look for dropouts (green circle)

Visually inspect radio and optical images in case of multiple optical IDs.



Kids

Two fields, ~1000 sq. degrees in total

Mag. Limits: u=24.8, g=25.4, r=25.2

In one field, ~3,000 GLEAM sources:

33 U-dropouts

28 confirmed as most likely host

Subaru HSC

(deeper than Kids, but no u band)

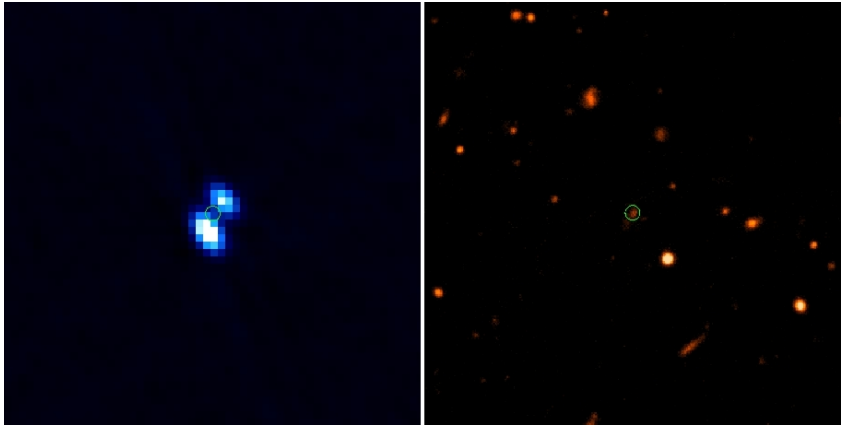
Magnitude limits g=26.5 r=26.1 i=25.9 z=25.1 over 1400 sq. degrees

It includes ~6000 GLEAM sources

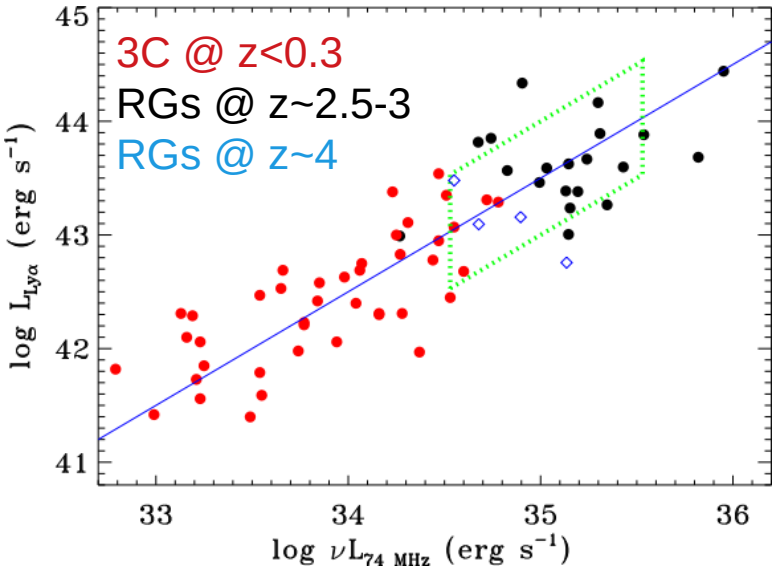
Search for g-dropouts: 120 sources

80 confirmed as most likely host

~1% of the GLEAM sources.



We need to obtain spectroscopic confirmations!



The ratio of Lyα and radio flux is constant

$2x10^{-16}$ erg s^{-1} cm^{-2} Jy^{-1} within a factor 3

Accessible with a 4m telescope for F>1 Jy

8m class for F>0.3 Jy

Three nights at the NTT for a pilot project (Aug 10-12)

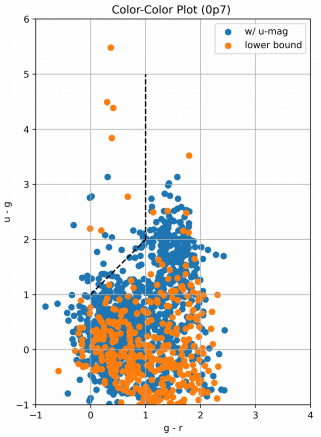
The future: LSST – Vera Rubin

The whole southern sky ~20,000 sq. degrees.
Magnitude limit r~27.5 after 10 years, r~26 after 1 y
Five bands: u,g,r,i,z: less (or no) upper limits!

Our search is (almost) completely automatic.

We expect to find ~1000 u- and g-dropouts (z~3 an
and ~300 r-dropouts (z~6)

Images deep enough to find proto-clusters.



THANK YOU