

# Several intergalactic ionized gas in clusters of galaxies

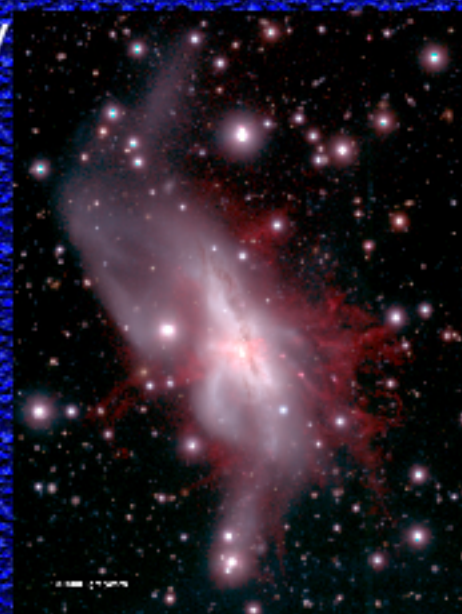
YAGI, Masafumi  
(National Astronomical  
Observatory of Japan )

# Intergalactic ionized gas

Detected in (redshifted)  $H\alpha$  narrow-band images.

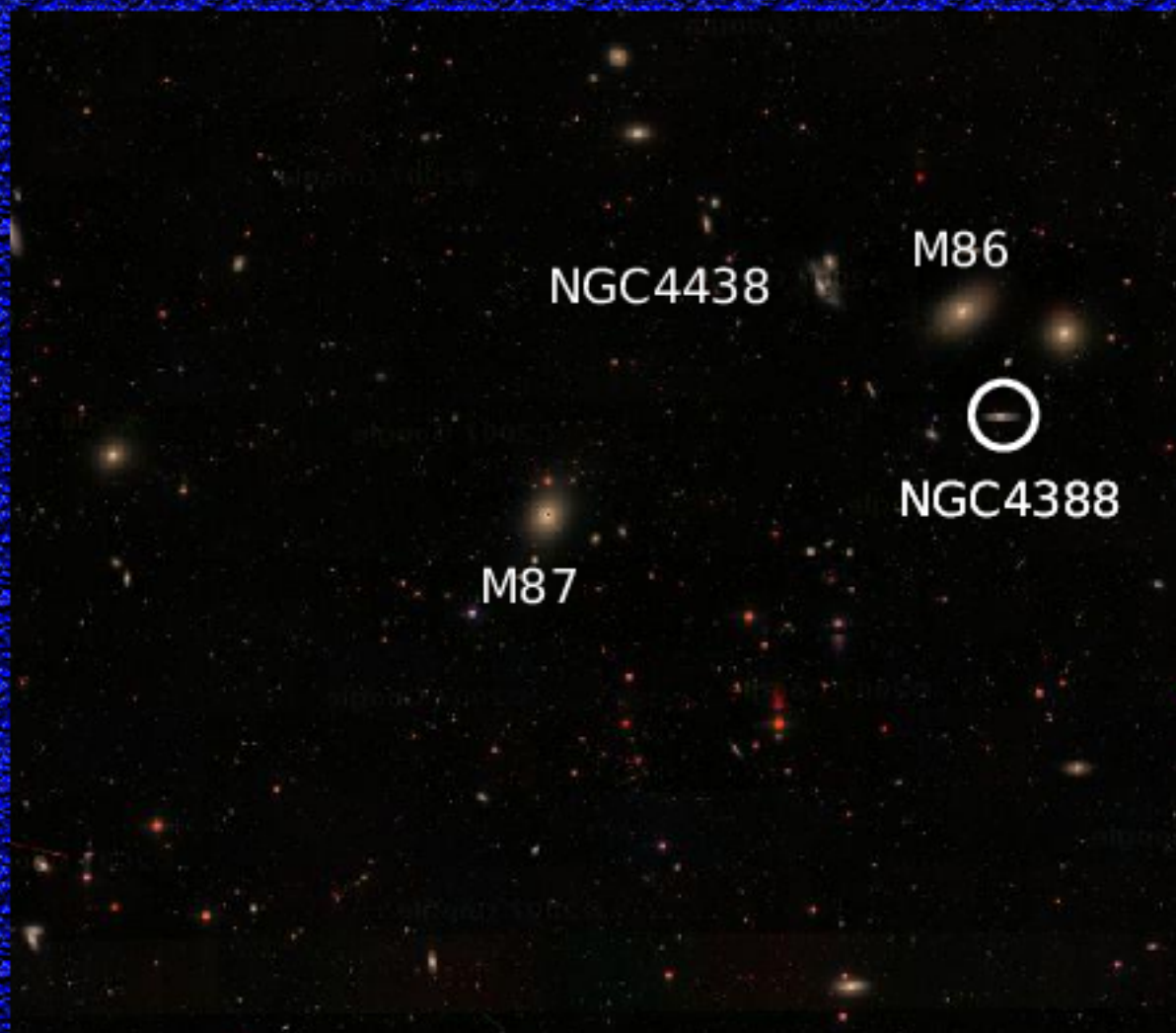
They are...

- Ram pressure stripped tail from a galaxy
  - Intergalactic star-forming regions
  - AGN outflow
  - Galactic wind
- and rare ones
- Apparently no connection with galaxy,
  - Tail from group of galaxies?
  - Intergalactic planetary nebula
- etc.



B,R, $H\alpha$   
Yoshida+(2016)

# Ex. 1: NGC 4388 (Virgo)



Google sky



NGC4388  
in Virgo

Blue:[OIII]  
Green: V  
Red: H $\alpha$

H $\alpha$ @659nm  
(z~0.005)

Yoshida+2002



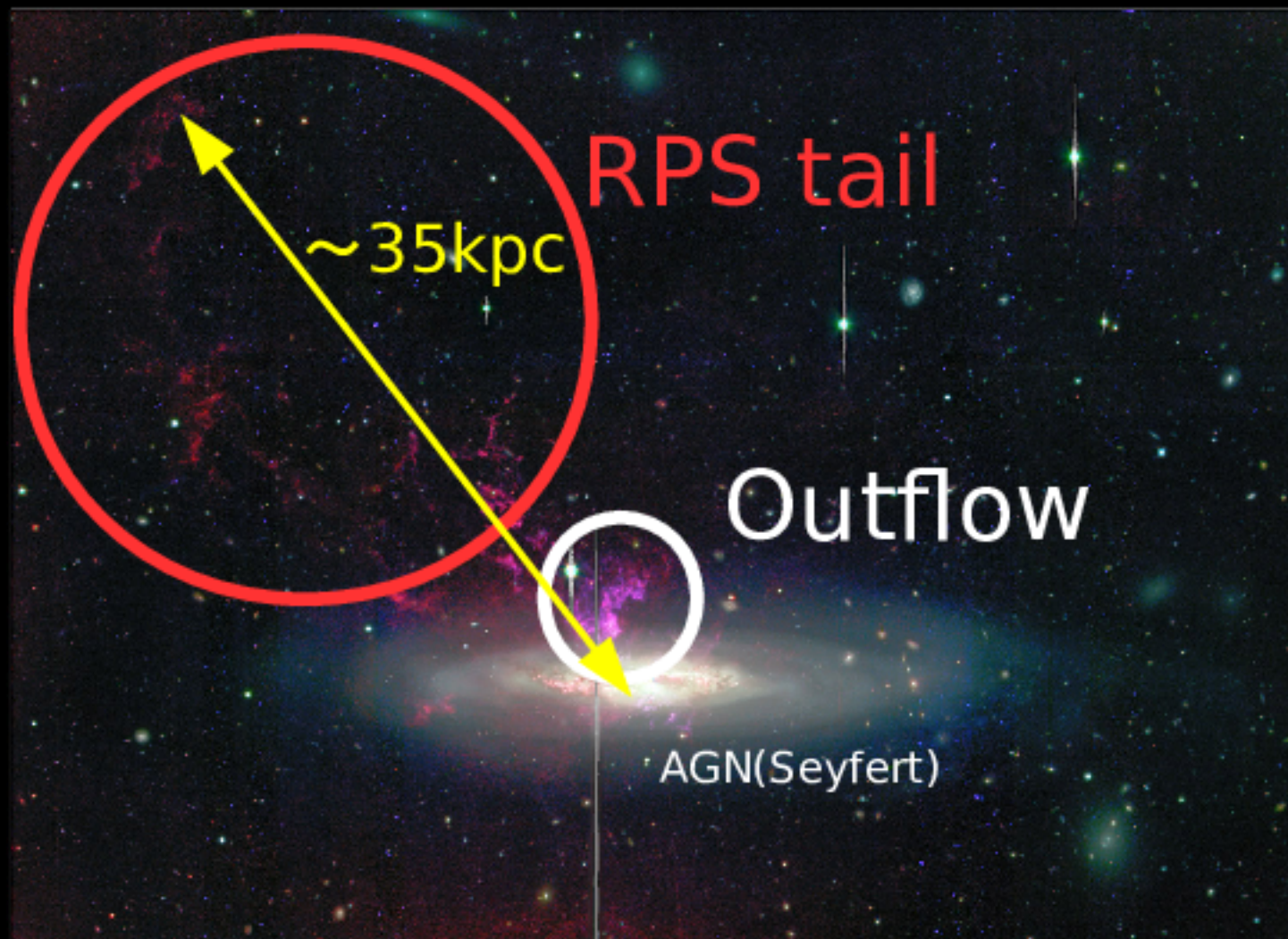
**Active Galaxy NGC 4388**

Subaru Telescope, National Astronomical Observatory of Japan

Suprime-Cam (OIII, V, H $\alpha$ )

April 15, 2002

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NGC4388  
in Virgo

[OIII],V,H $\alpha$

Yoshida+2002

What ionizes  
the tail?

See also  
Veilleux+1999  
about outflow.



**Active Galaxy NGC 4388**

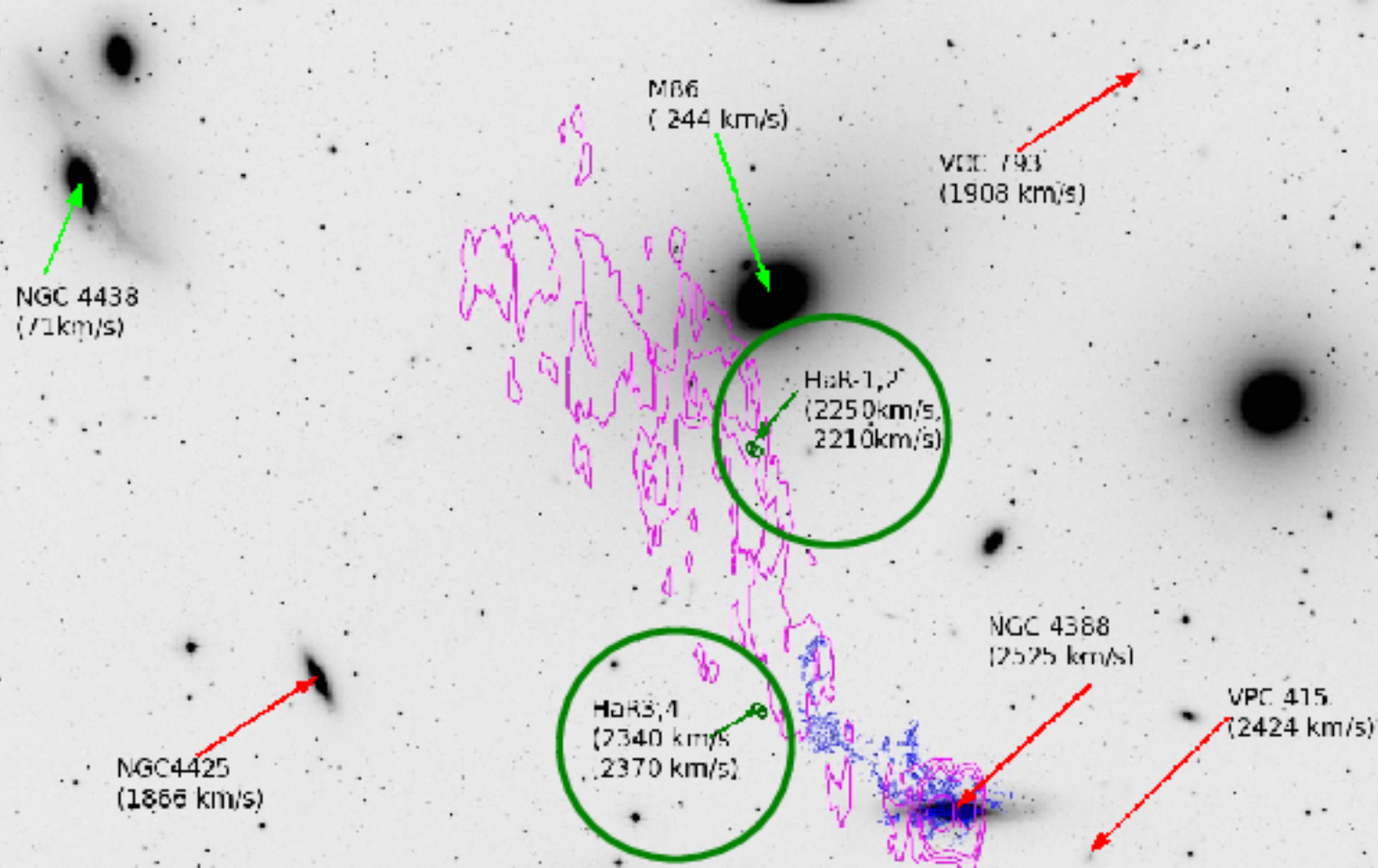
Subaru Telescope, National Astronomical Observatory of Japan

Suprime-Cam (OIII, V, H $\alpha$ )

April 15, 2002

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# Intergalactic starforming regions



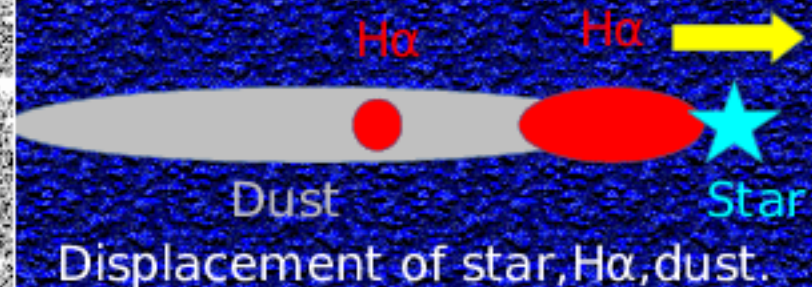
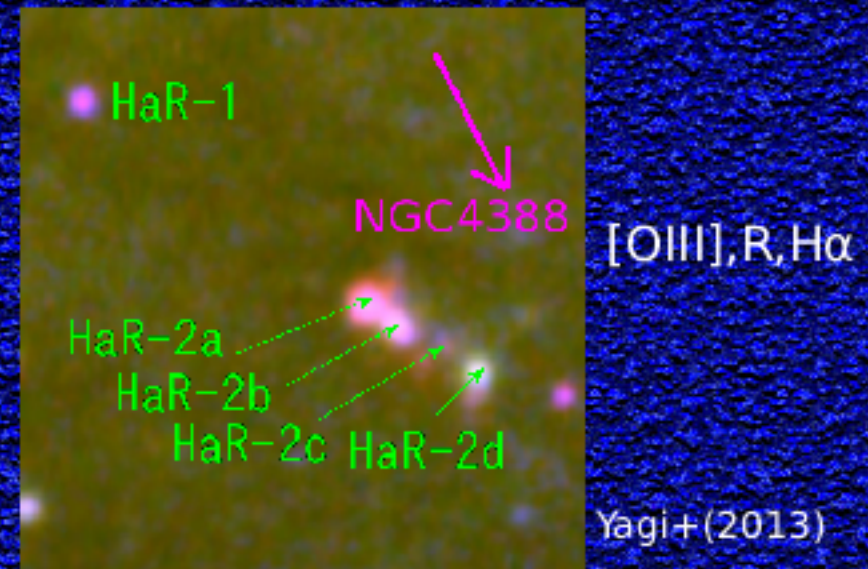
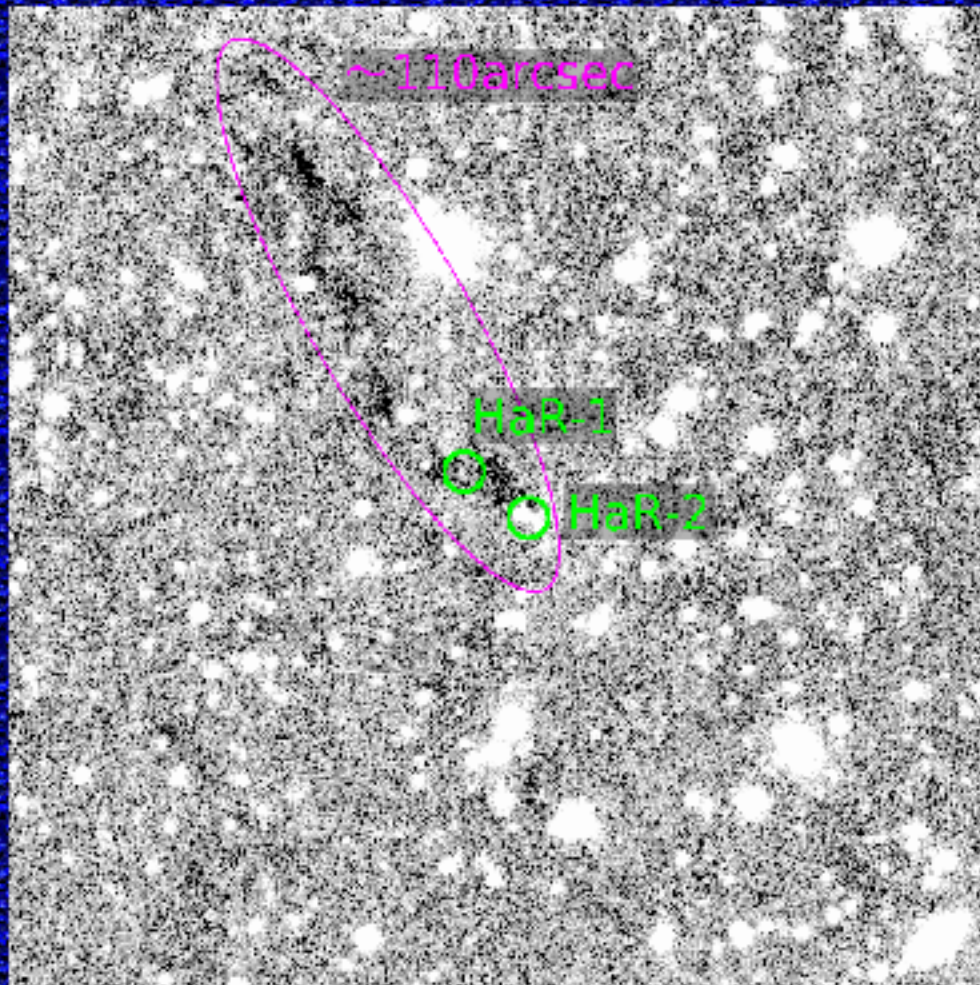
Gray:  
DSS

Magenta: HI  
Oosterloo &  
van Gorkom  
(2005)

Blue: H $\alpha$   
Yoshida +  
(2002)

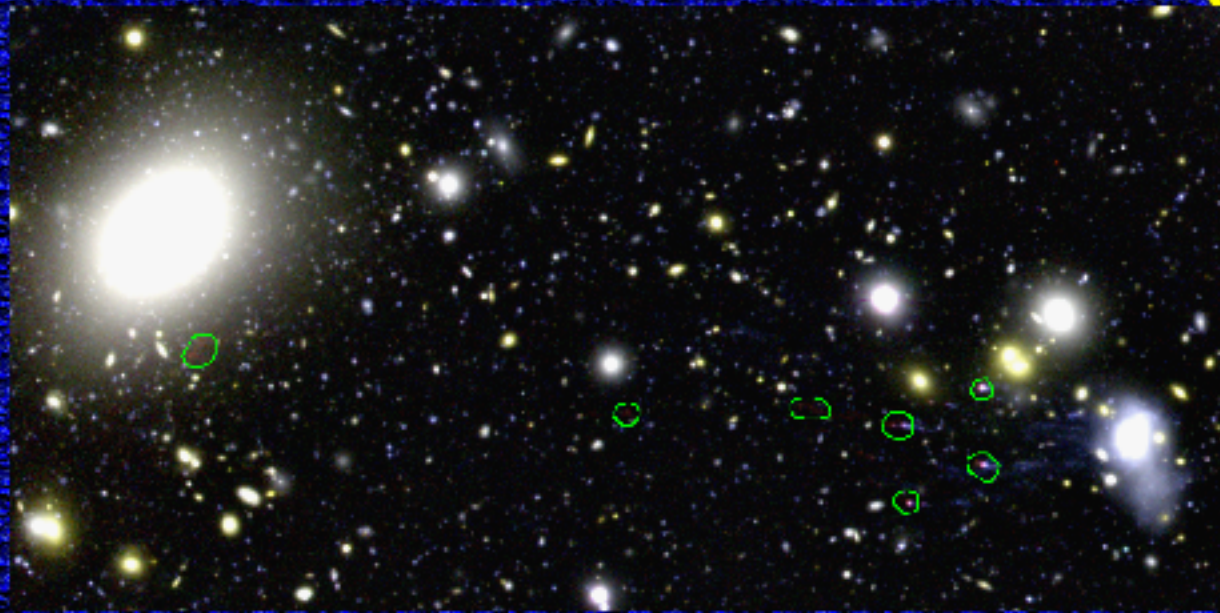
Green: H $\alpha$   
Yagi + (2013)

# Intergalactic starforming regions

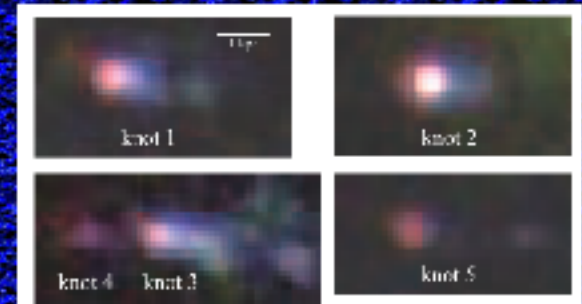


※CO detected by Verdugo+(2015)

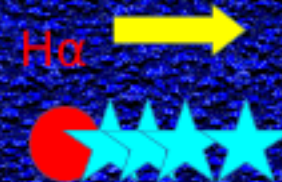
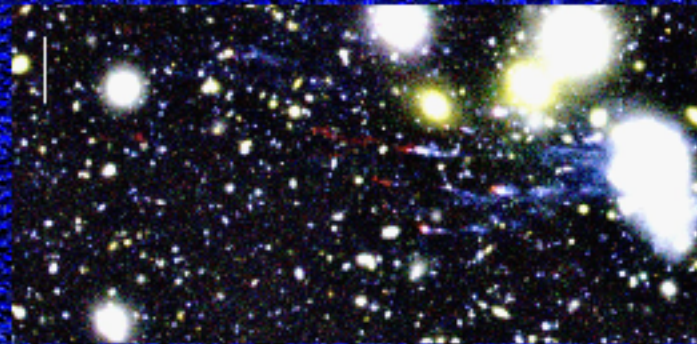
# Ex.2:RB199 (Coma)



B, R, H $\alpha$



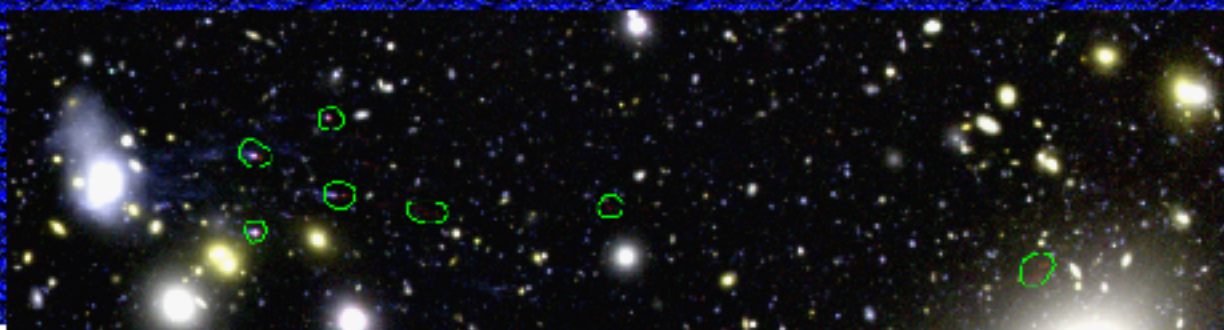
Yoshida+(2008)  
Yagi+(2010)



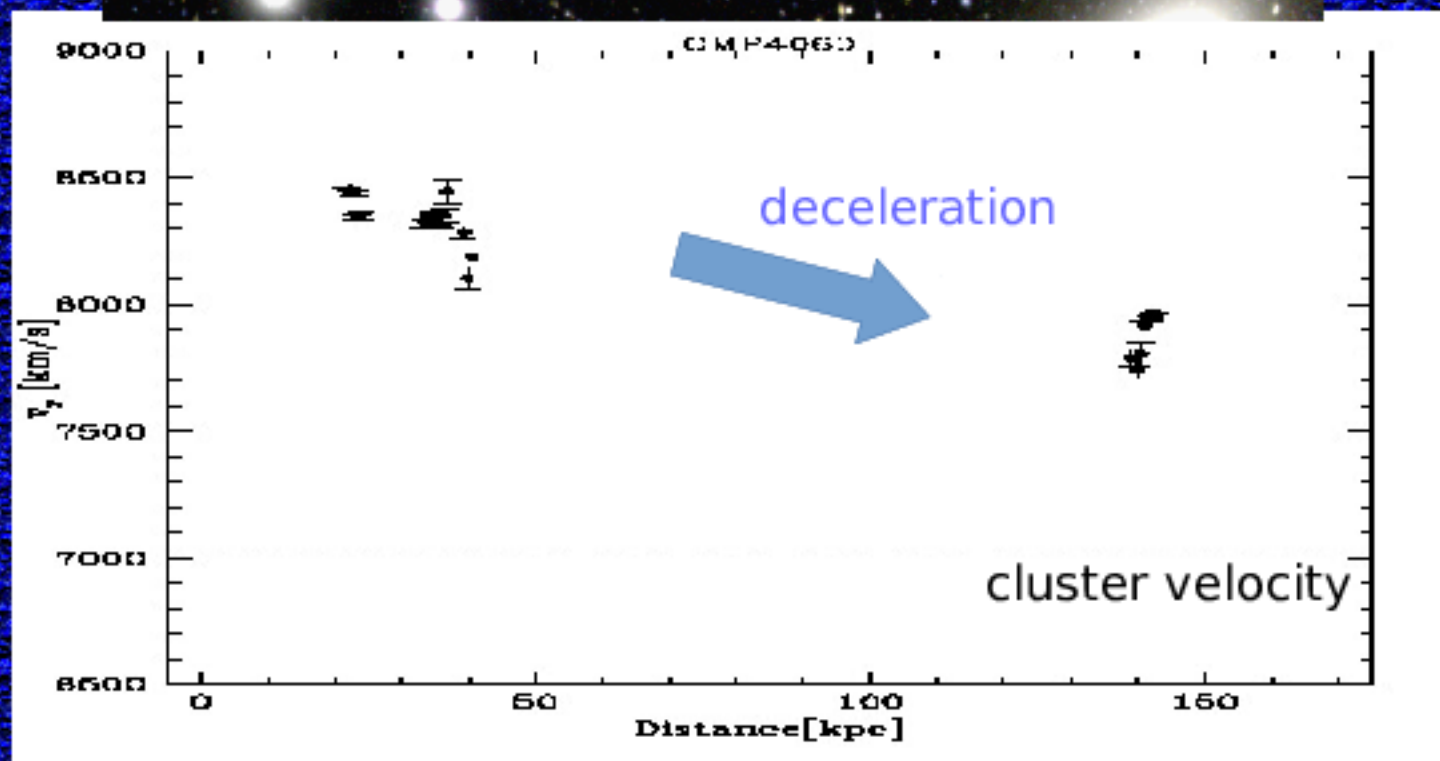
Ionized only by young stars?

But, how about distant ones?



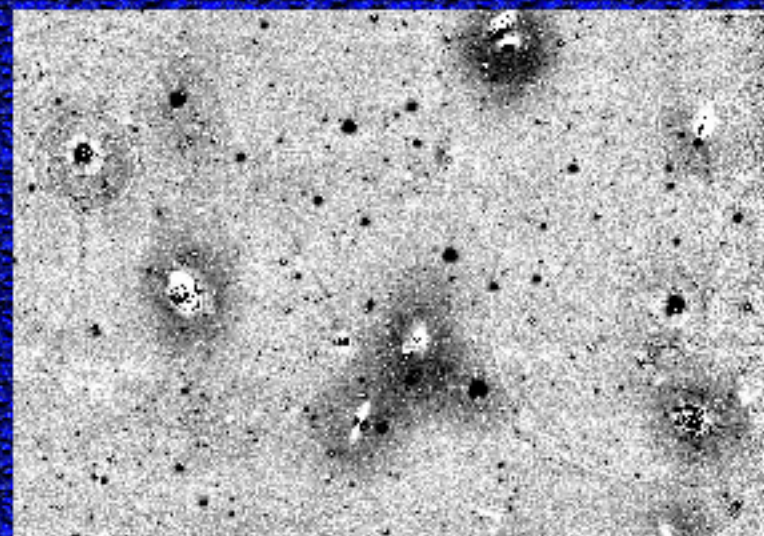
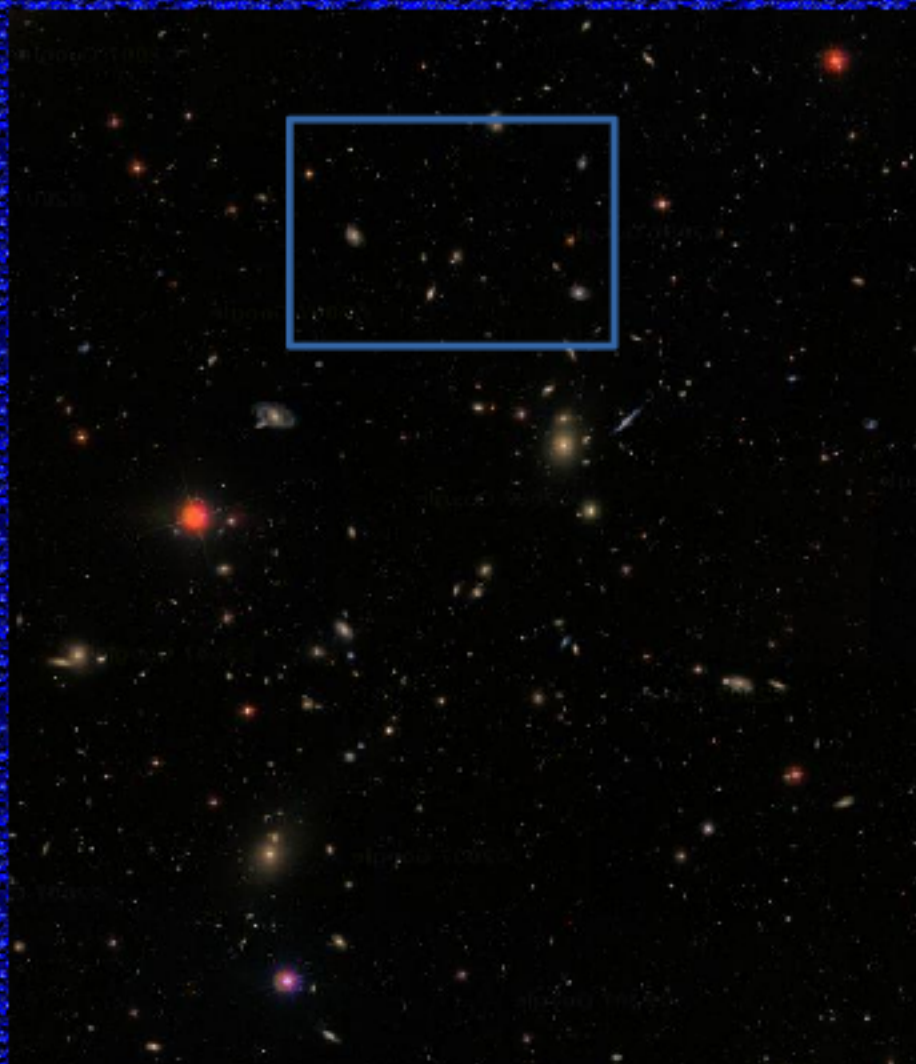


※Image 180 rotated



(Yoshida + in prep.)

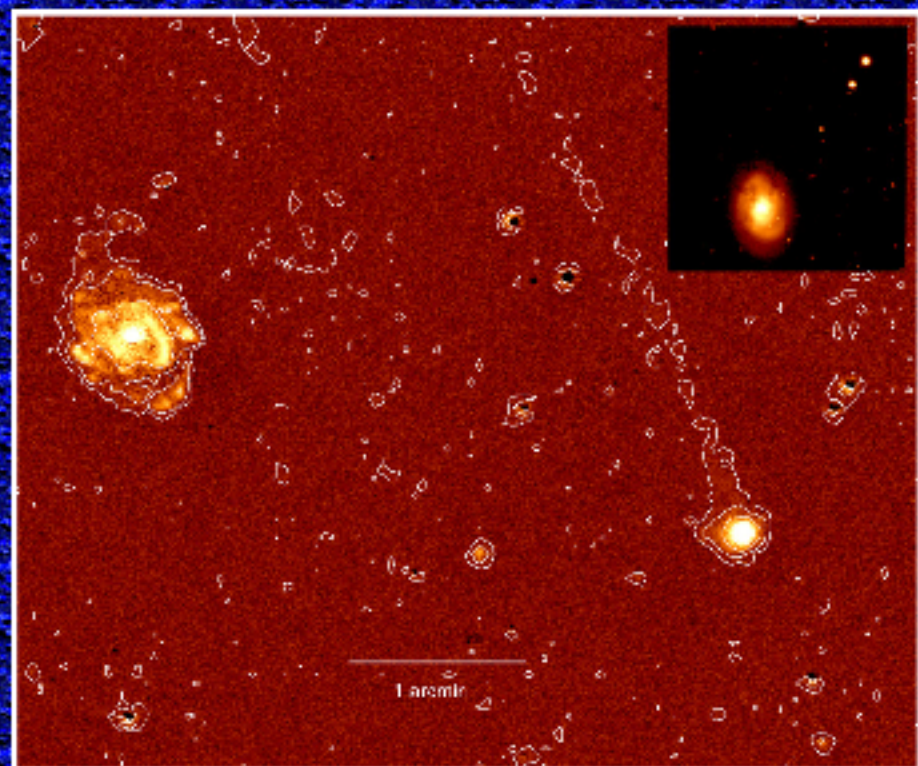
# Ex.3: Orphans (A1367)



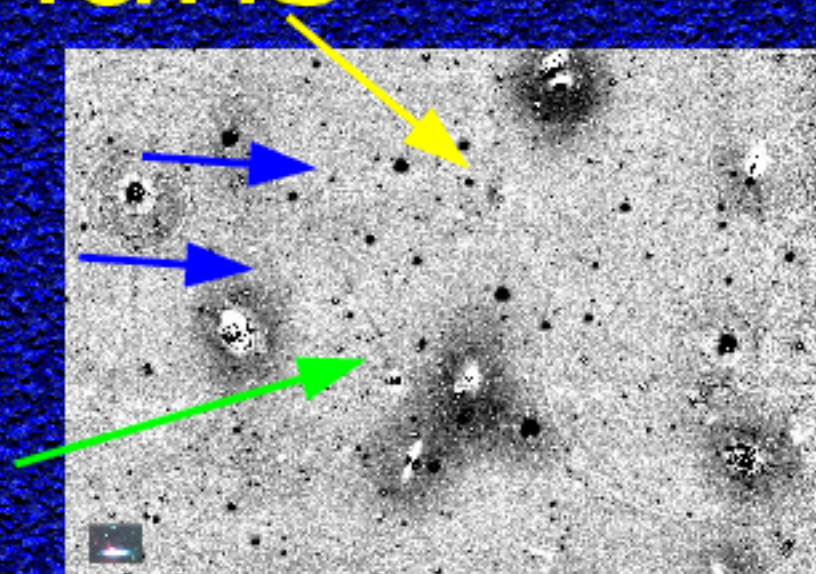
H $\alpha$  (NB-BB), emission in black

Google sky

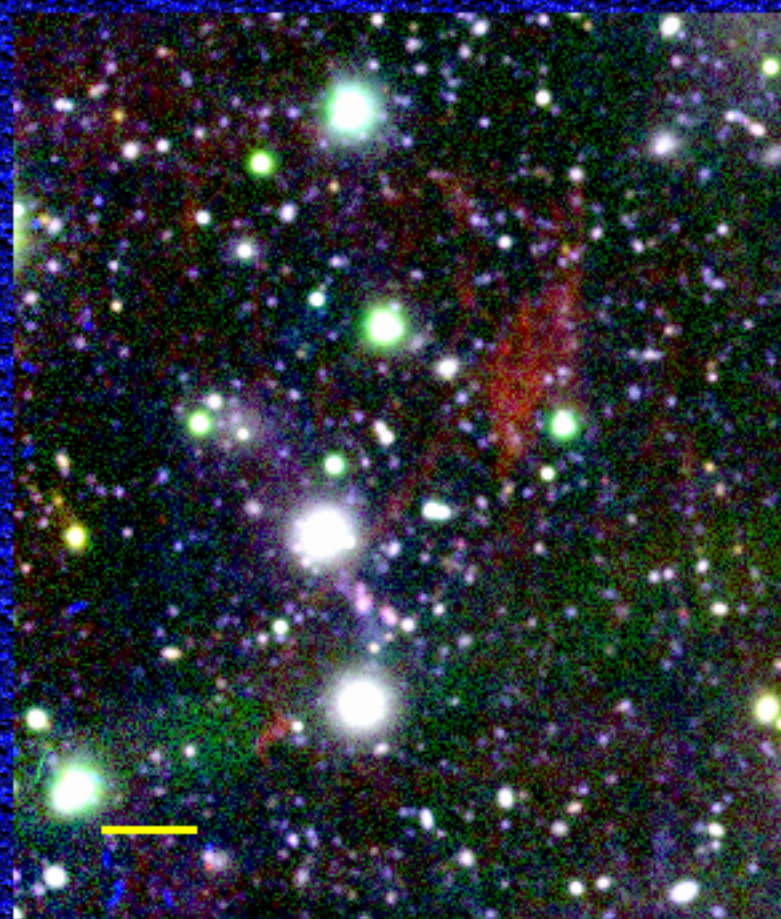
# Orphans



Gavazzi+(2017)



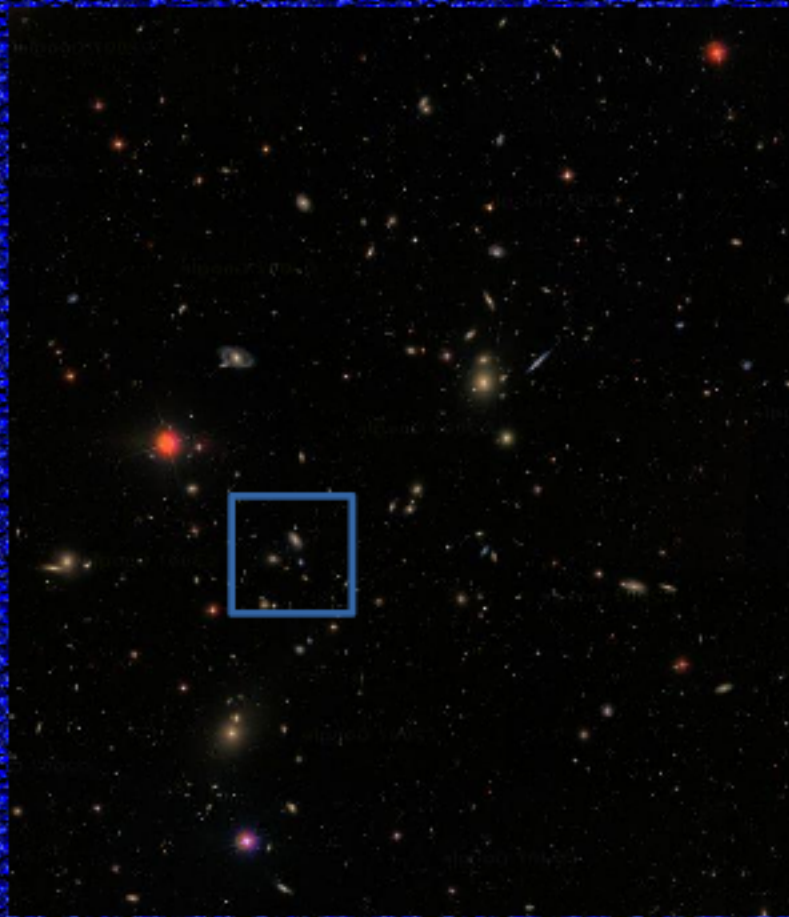
# Orphans



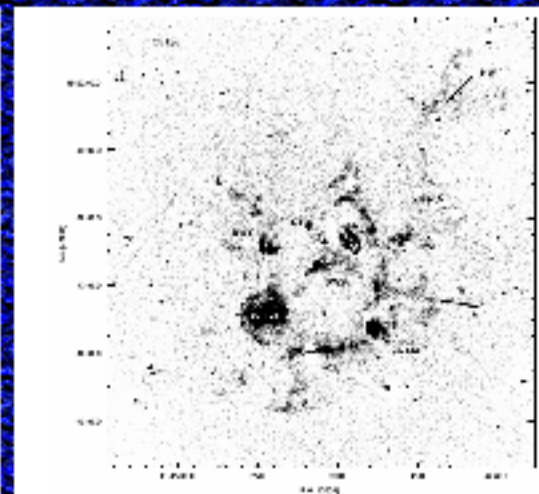
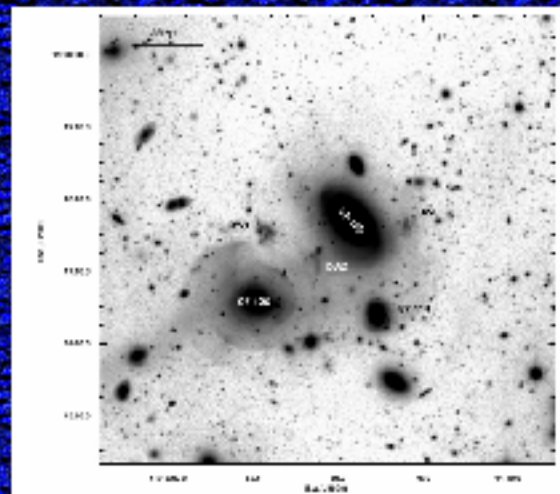
Isolated H $\alpha$  clouds  
~35x10 kpc in A1367  
No apparent parent  
Galaxy; no giant within  
80kpc.

Where are they from?  
What keeps them  
ionized??

# Ex.4: BIG tail(A1367) (blue infalling group)

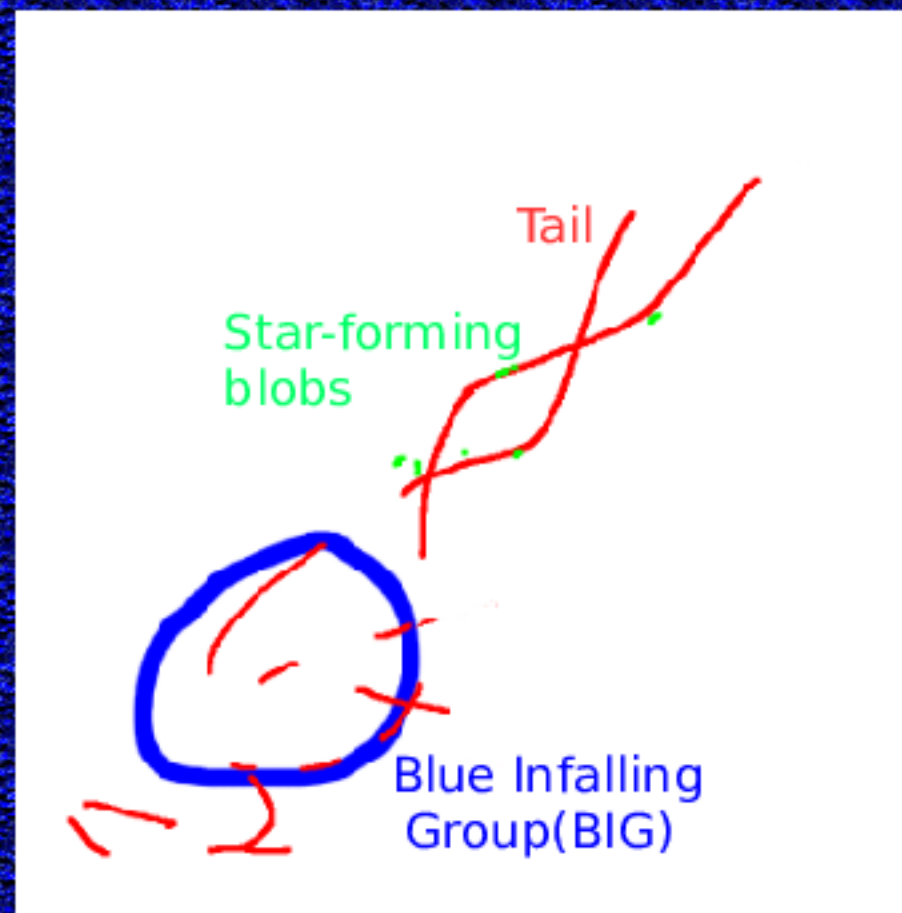
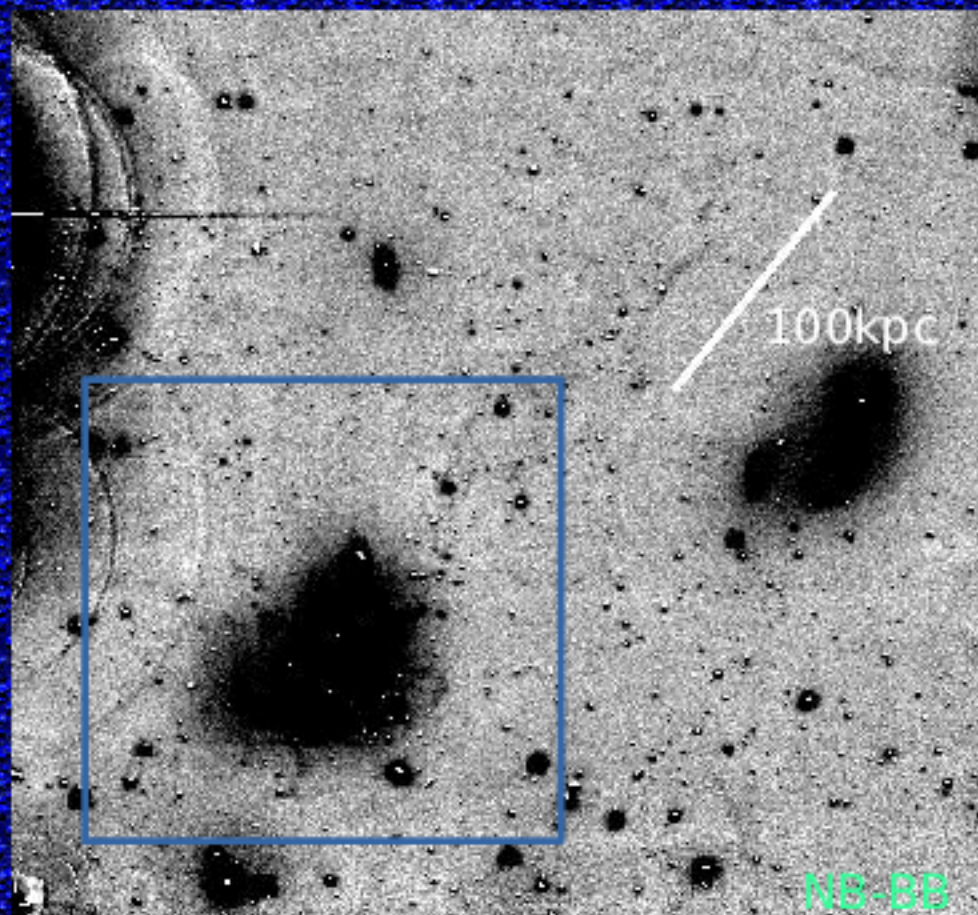


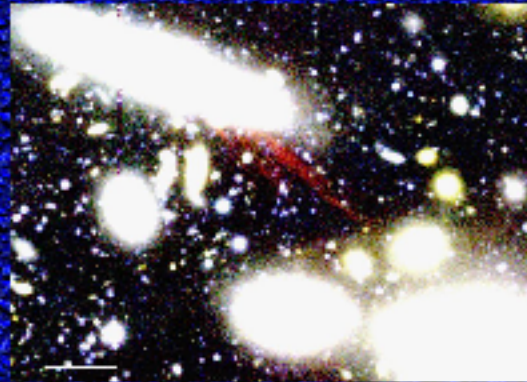
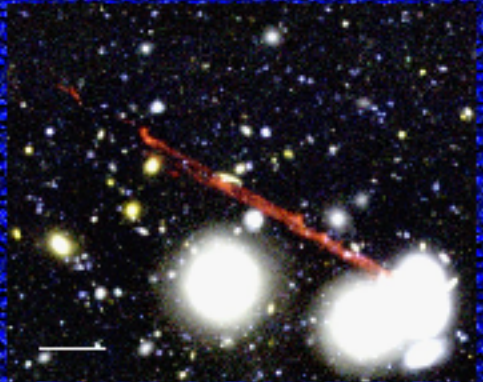
Google sky



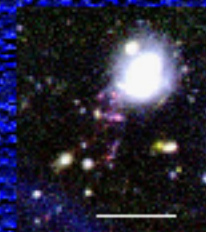
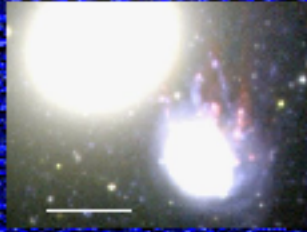
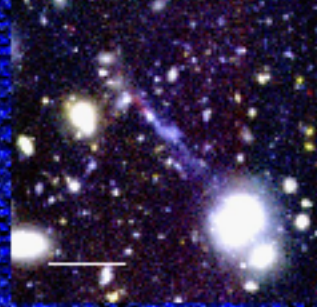
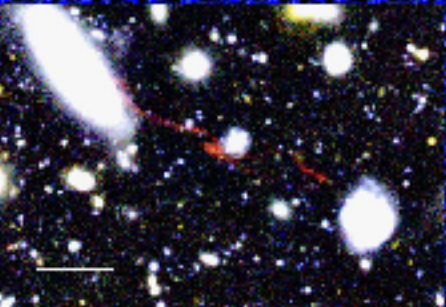
(Cortese+2006)

# Long tail from BIG





Coma  
B,R,H $\alpha$   
composites



Yagi+(2010)

# Summary

- $H\alpha$  (at the cluster's redshift) imaging enables us to detect intergalactic ionized gas.  
It's effective for target selection of spectroscopy.
- They are various in size and morphology.  
Some are connected to the parent galaxy, some are not.  
Some are straight, some are curved.
- Some have stars and/or star-forming regions.  
Some don't have.

Can these variety be explained by some parameters?

- Spectroscopy will be very useful, but difficult to get telescope time...