

the environmental dependence of galaxy properties at $z=2$

outline

- 1 – introduction
- 2 – PKS1138 at $z=2.15$
- 3 – galaxy properties at $z=2.15$
- 4 – summary

Masayuki Tanaka





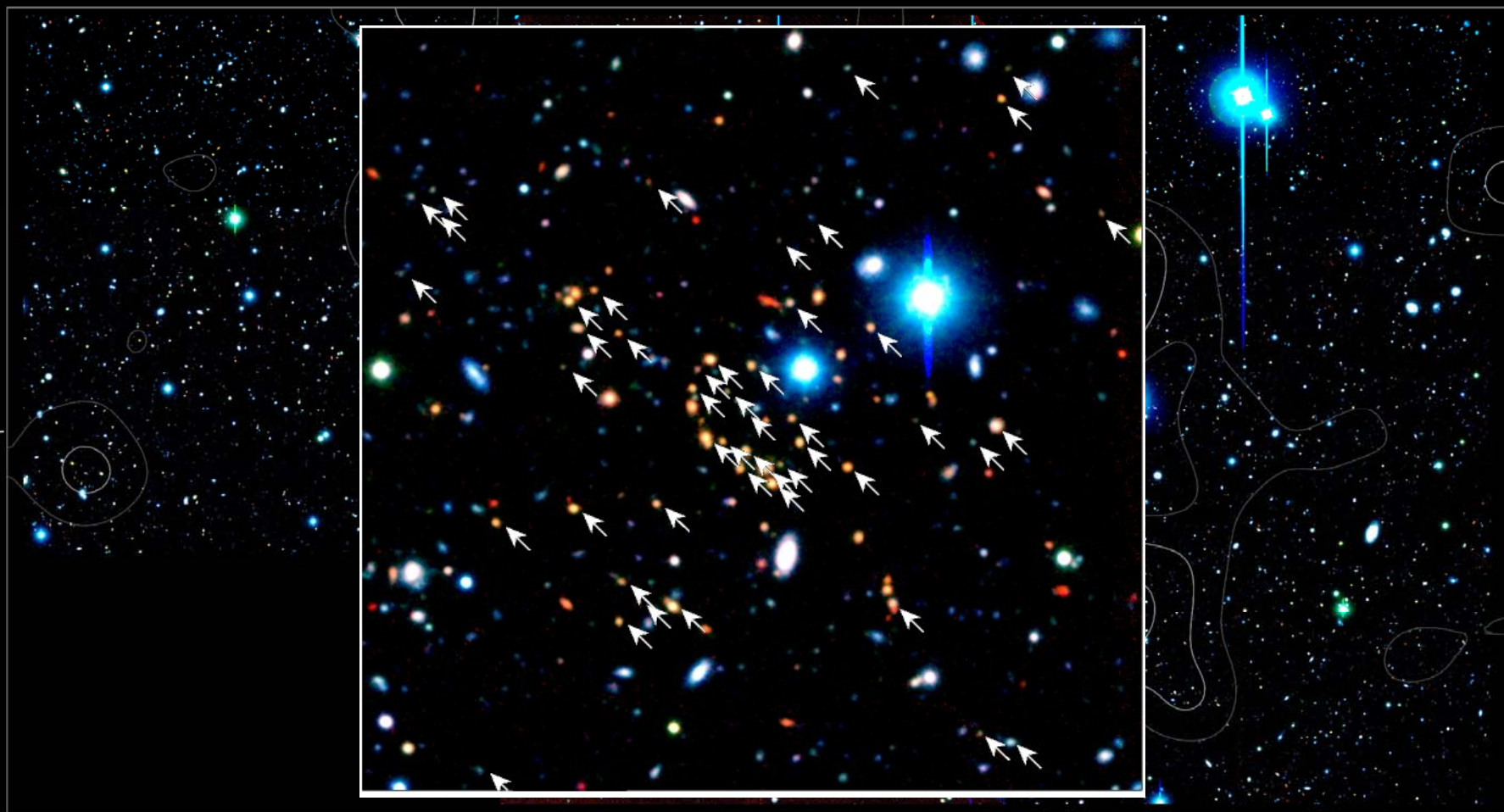
NGC5668



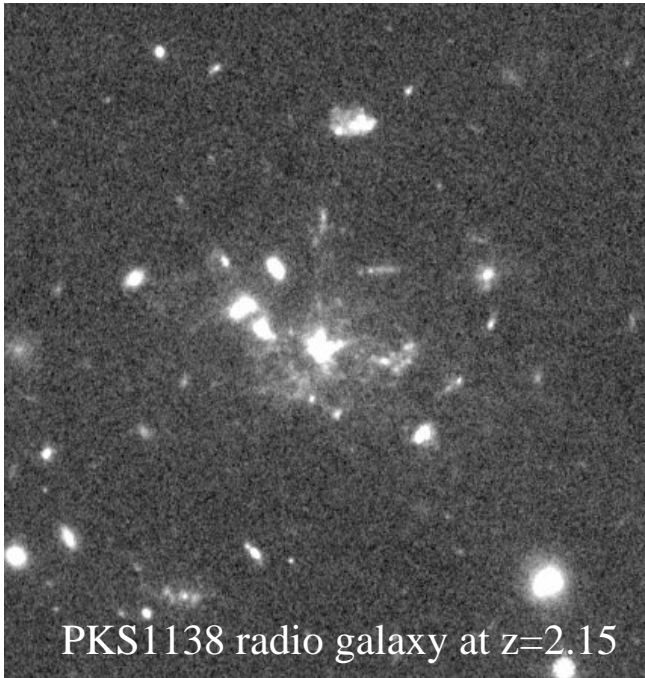
Coma cluster



RDCSJ0910 at $z=1.1$



RDCSJ0910 at $z=1.1$



PKS1138 at $z=2.15$

- is a powerful radio galaxy
- has several lines of evidence for galaxy over-density around it
- is one of the most promising (proto-)clusters at $z>2$

M. Tanaka, C. De Breuck, B. Venemans, J. Kurk A&A submitted

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2 – PKS1138 at $z=2.15$



PKS1138 at $z=2.15$

PKS1138

U : LRIS/Keck

g : ACS/HST

R : FORS/VLT

I : ACS/HST

z : FORS/HST

J : MOIRCS/Subaru

H : SOFI/NTT

Ks: MOIRCS/Subaru

ch1-3: IRAC/Spitzer

GOODS

U : WFI/2.2m

B : ACS/HST

R : ACS/HST

i : ACS/HST

z : ACS/HST

J : ISAAC/VLT

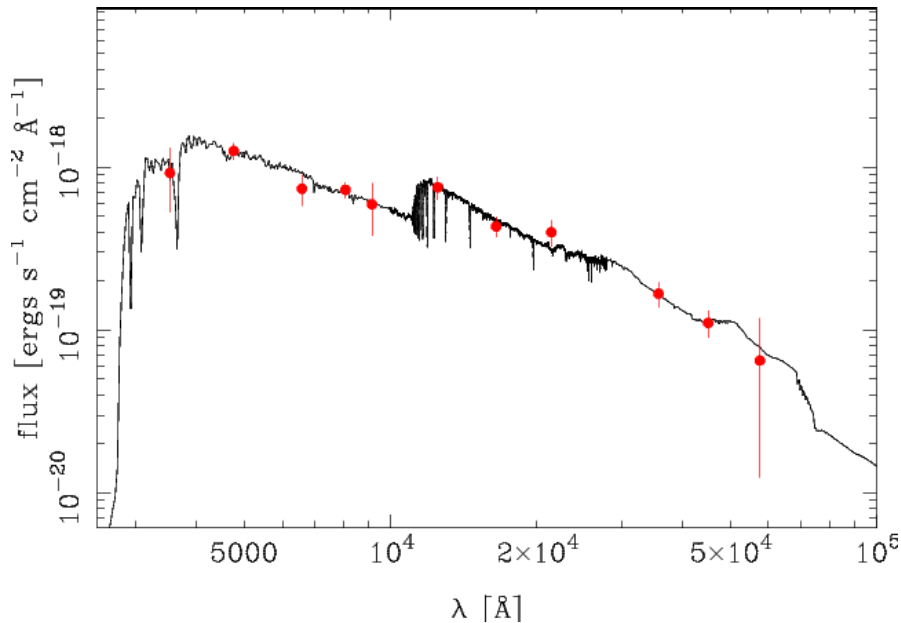
H : ISAAC/VLT

Ks: ISAAC/VLT

ch1-3: IRAC/Spitzer

PKS1138 at $z=2.15$

Fitting spectral energy distributions



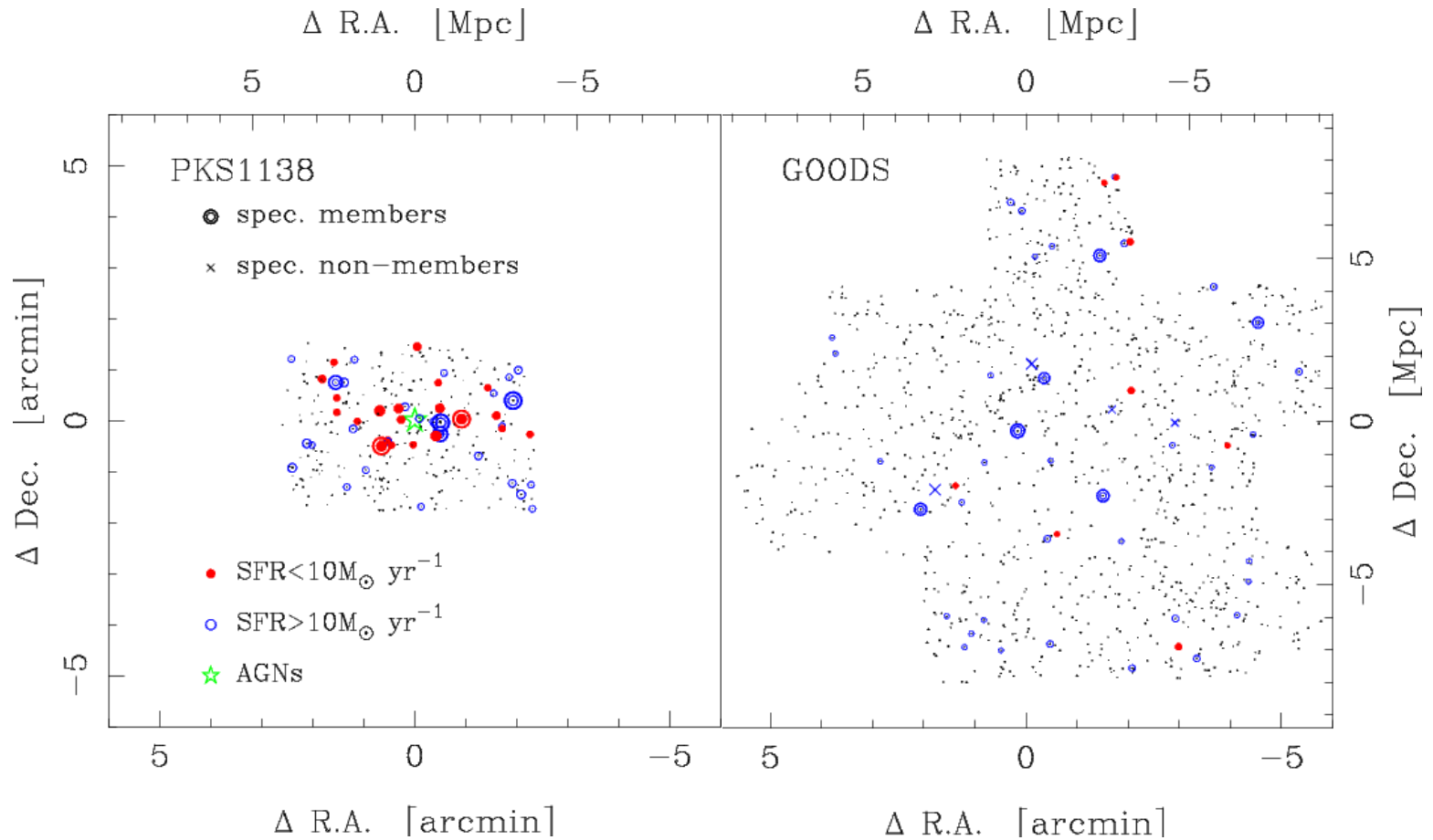
- ◆ Charlot & Bruzual 2007 models
- ◆ Salpeter IMF
- ◆ Solar/subsolar metallicities
- ◆ intergalactic extinction

- *redshift*
- *age*
- *star formation rate*
- *star formation time scale*
- *dust extinction*

We use two data sets with almost the same wavelength samplings, feed them to the same SED fitting code with the same set of templates, and compare *relative* differences between the two samples.

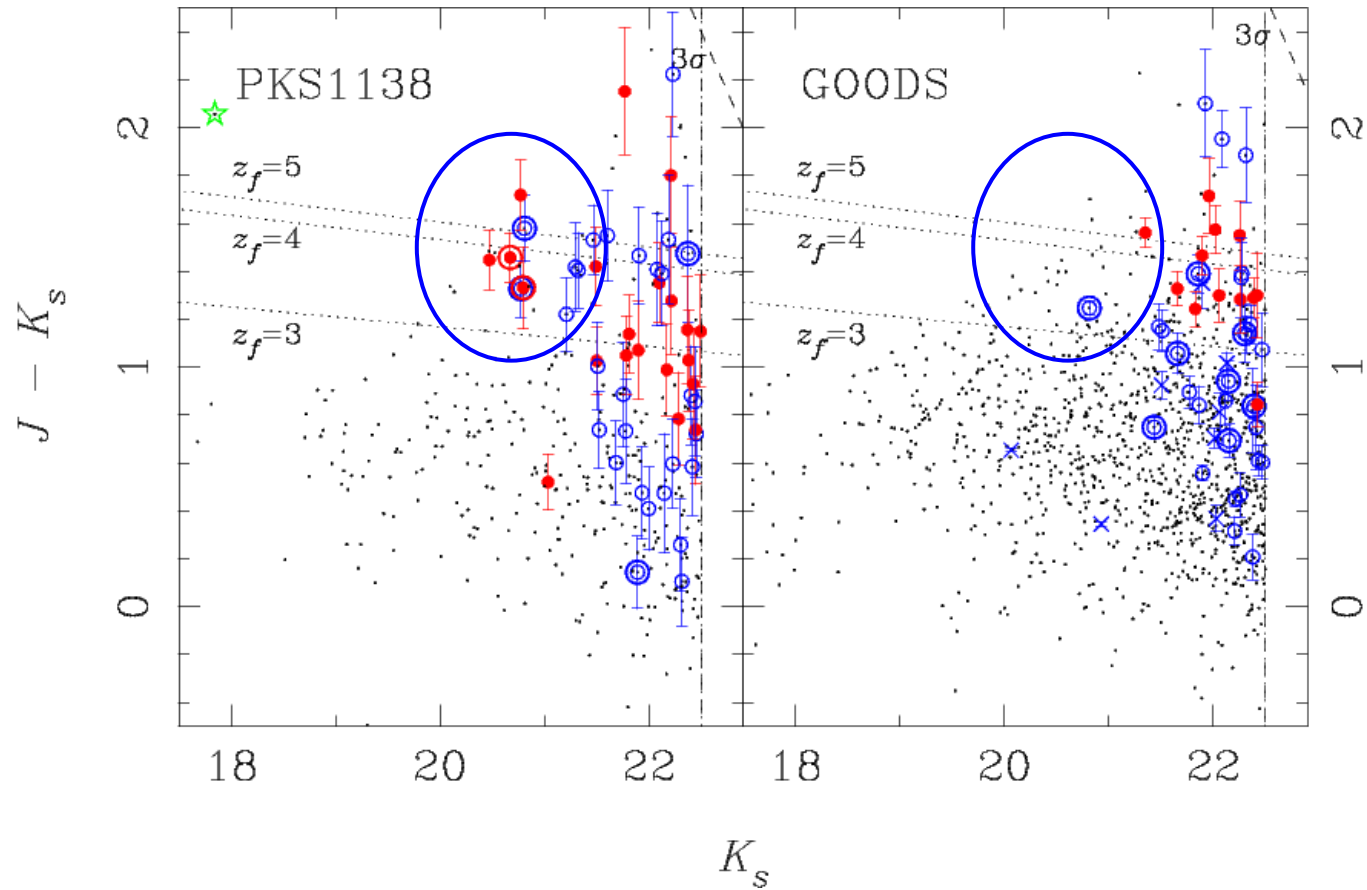
Question : is PKS1138 really an over-density region at $z=2.15$?

Galaxy distributions at $z=2.15$



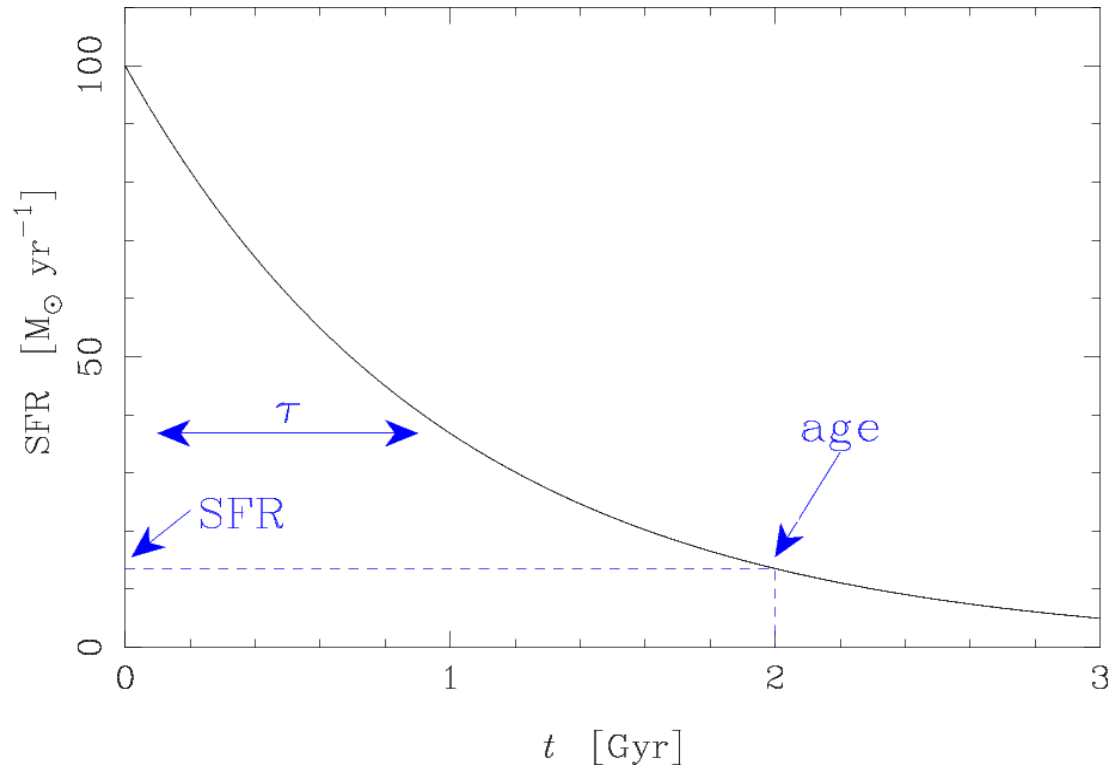
A factor of >10 over-density around the vicinity of the radio galaxy.

Color-magnitude diagrams



Question : is PKS1138 really an over-density region at $z=2.15$?

Answer : Yes.



outline

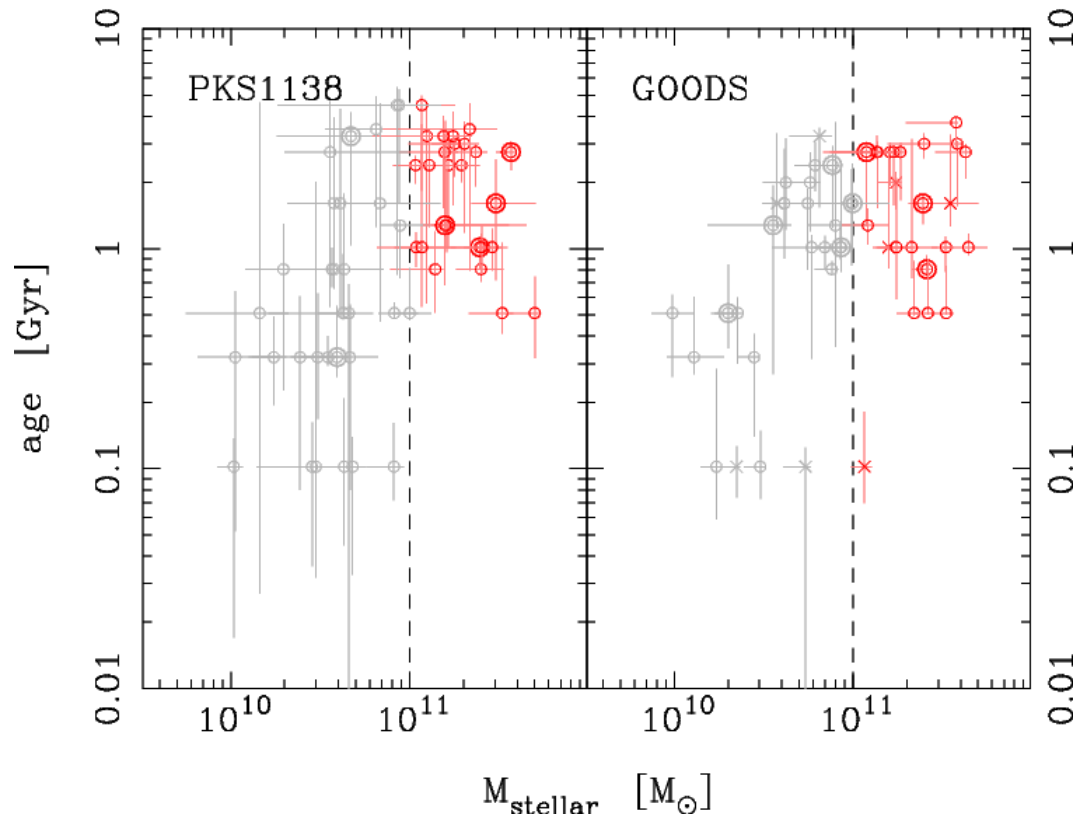
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3 – Galaxy properties at $z=2.15$

Question : do galaxy properties depend on environment at $z \sim 2$?

Age / tau / SFR / dust

(a)



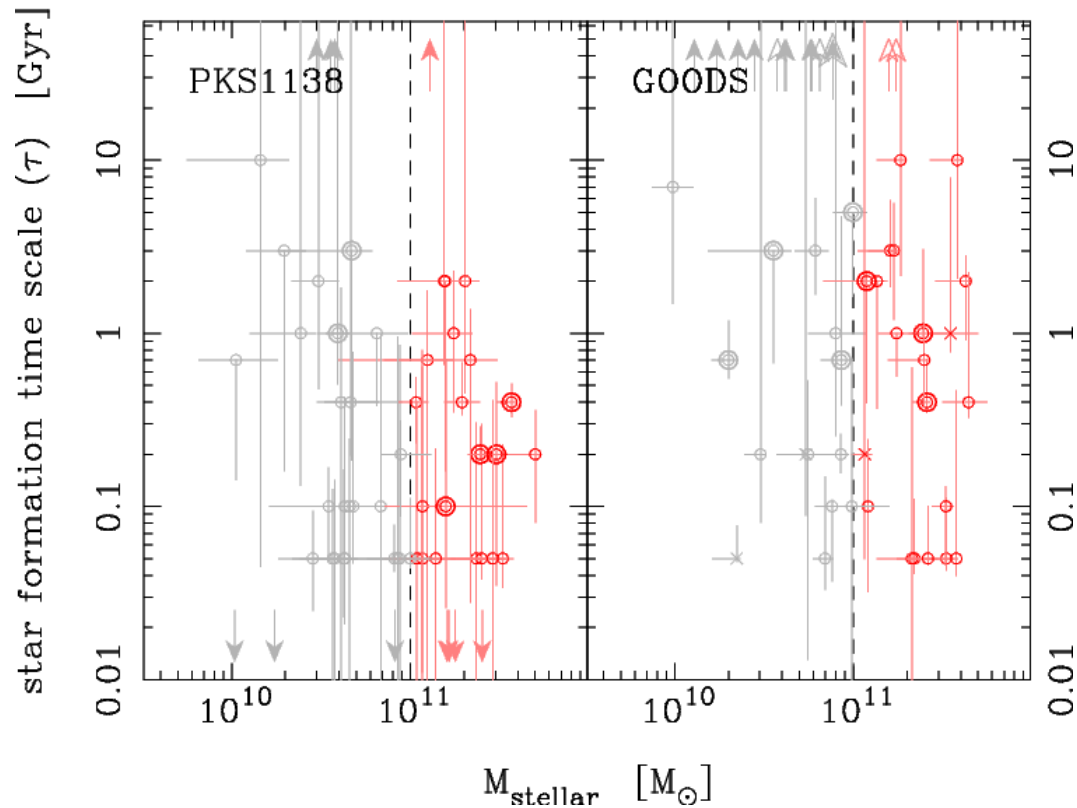
frac (age>2Gyr):

0.54 ± 0.18

0.42 ± 0.18

Age / τ / SFR / dust

(b)

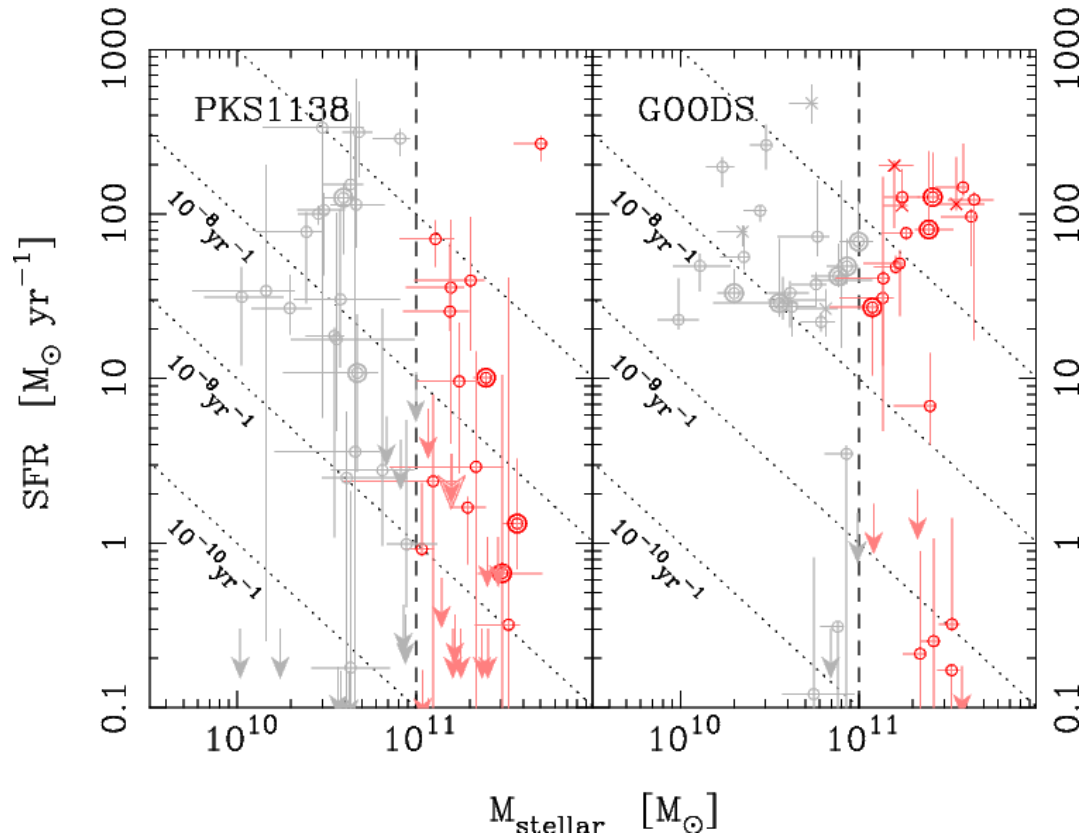


frac ($\tau < 0.5 \text{Gyr}$): 0.73 ± 0.22

0.43 ± 0.16

Age / tau / SFR / dust

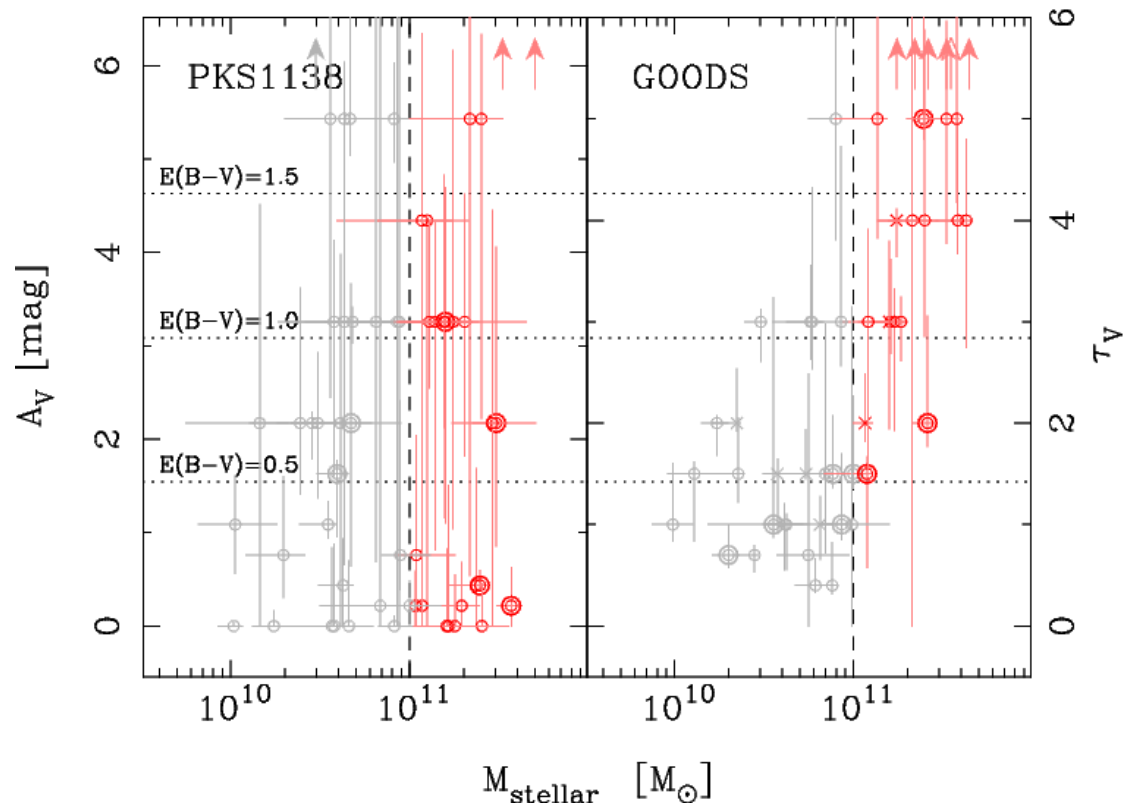
(c)



frac (SFR<10): 0.62 ± 0.20 0.29 ± 0.13

Age / tau / SFR / dust

(d)



frac ($A_V < 1$):

0.42 \pm 0.15

0

Question : do galaxy properties depend on environment at $z \sim 2$?

Answer : yes.

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4 – Summary

PKS1138

GOODS

Over-density :	yes	no
Red sequence :	yes	no
Age :	similar	similar
SF time scale :	shorter	longer
SFR :	lower	higher
Dust amount :	smaller	larger

