

# **Pandora's Cluster** **meets** **the CLASH**

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**Astrophysics**

**University of**  
**Heidelberg**



# Cluster cosmology

**Cosmic  
laboratories**

**Accessible to  
simulations**

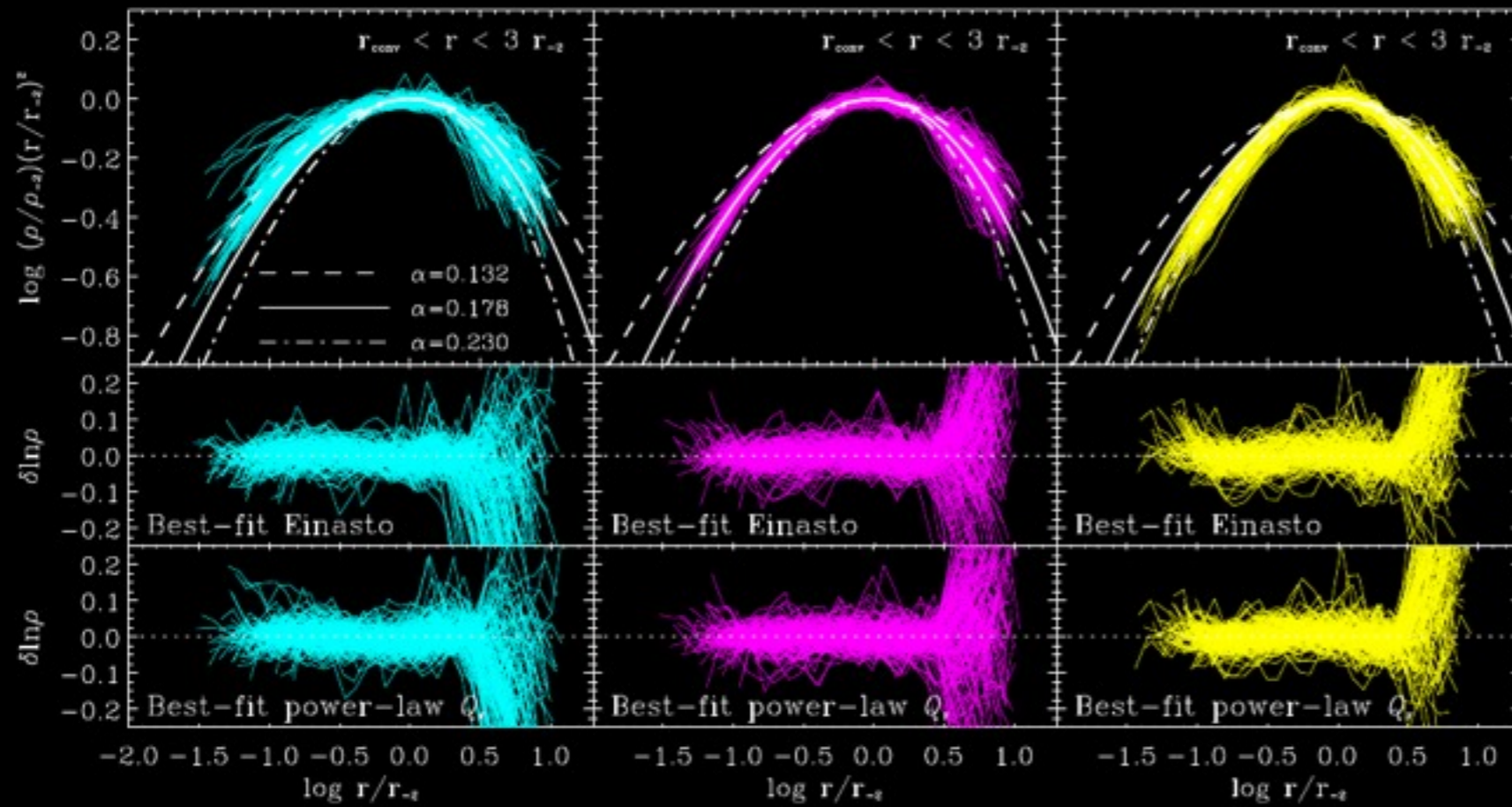
**All components  
“somehow”  
observable**

**We do not really  
understand them**



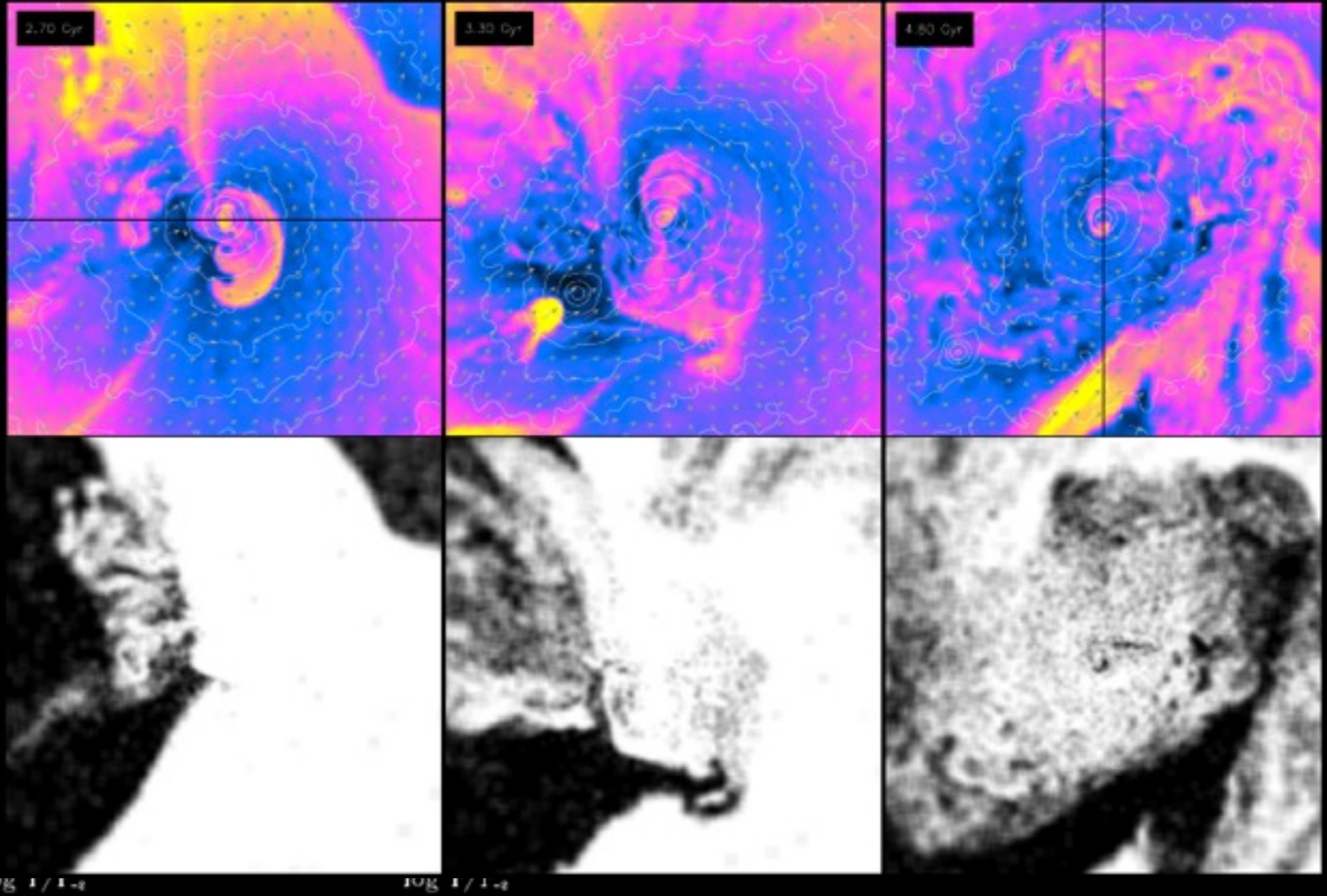
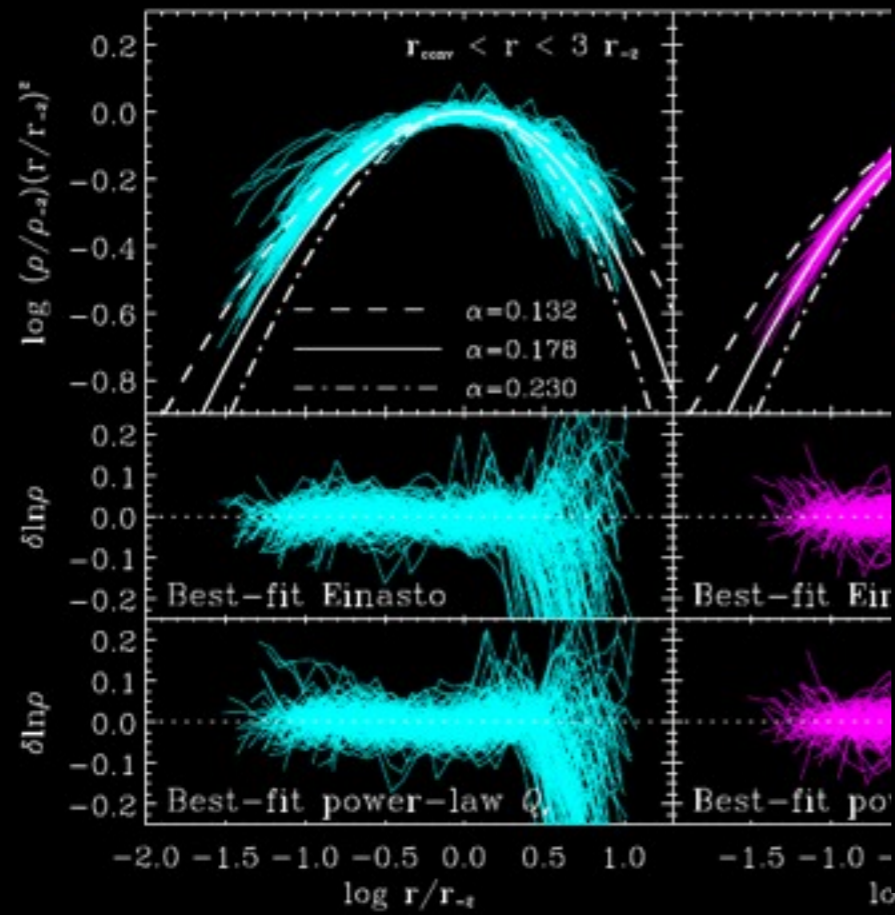
# Why not?

# Why not?



Ludlow+11

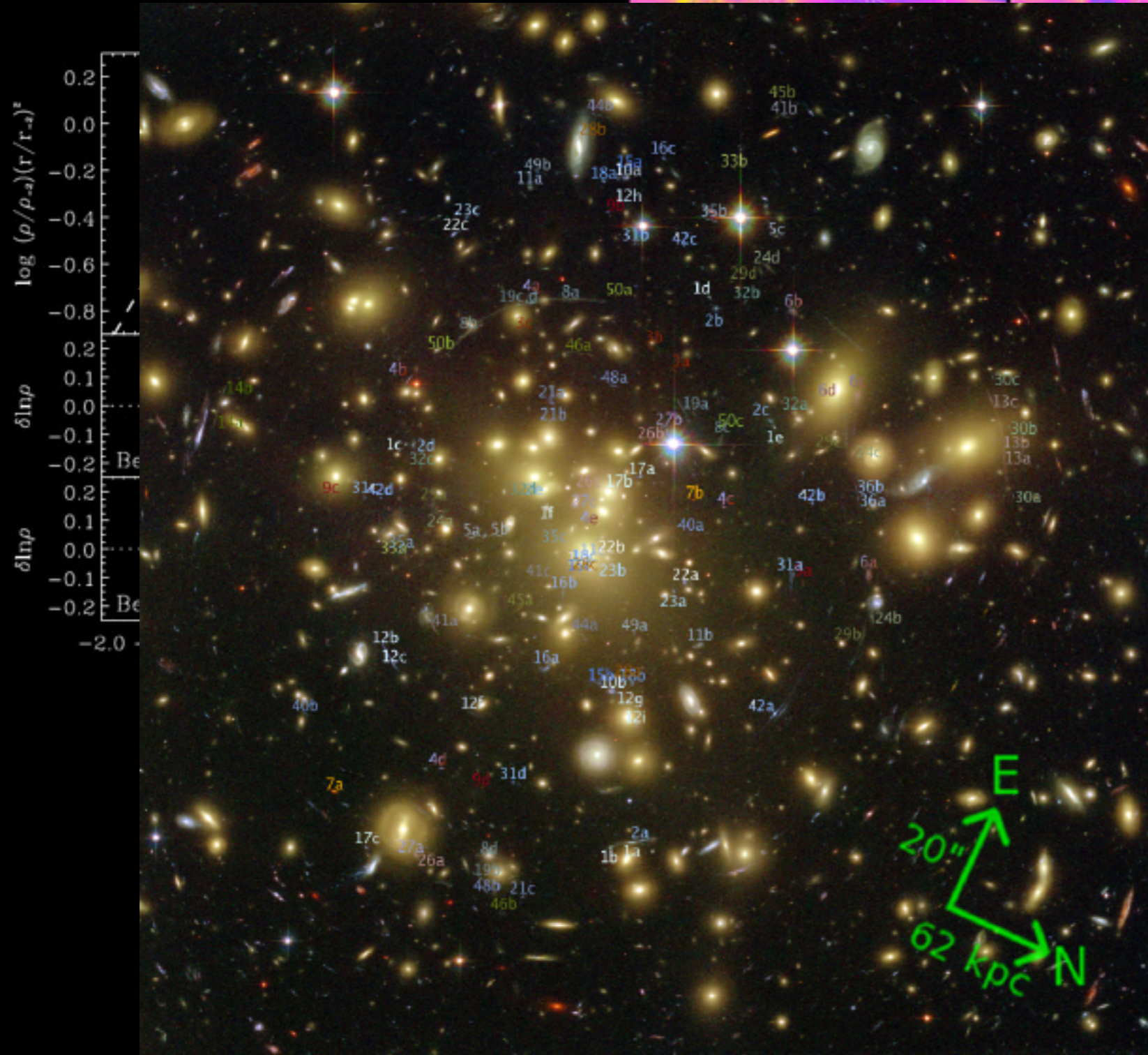
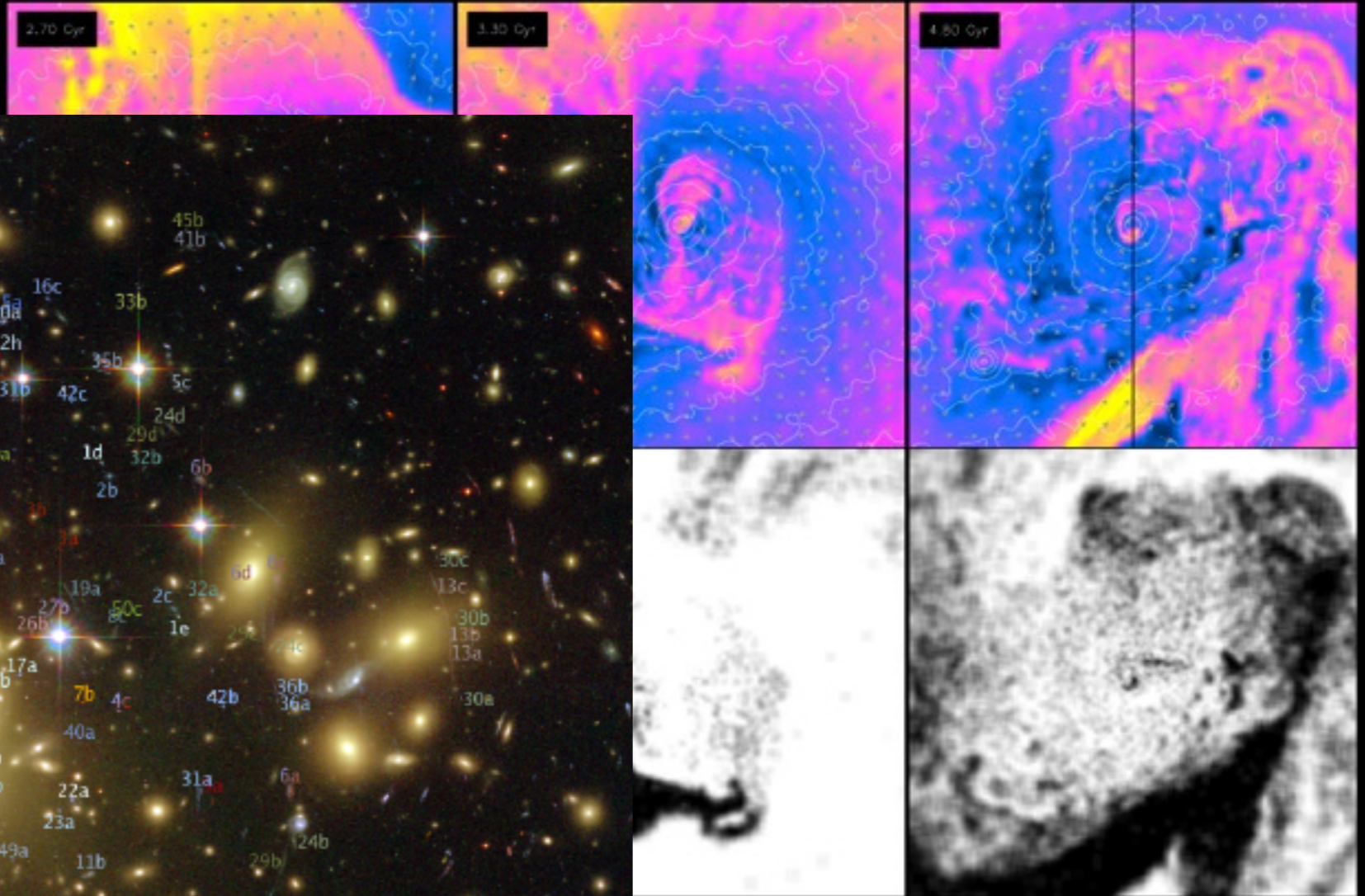
# Why not?



**Ludlow+ 11**

**Ascasibar+ 06**

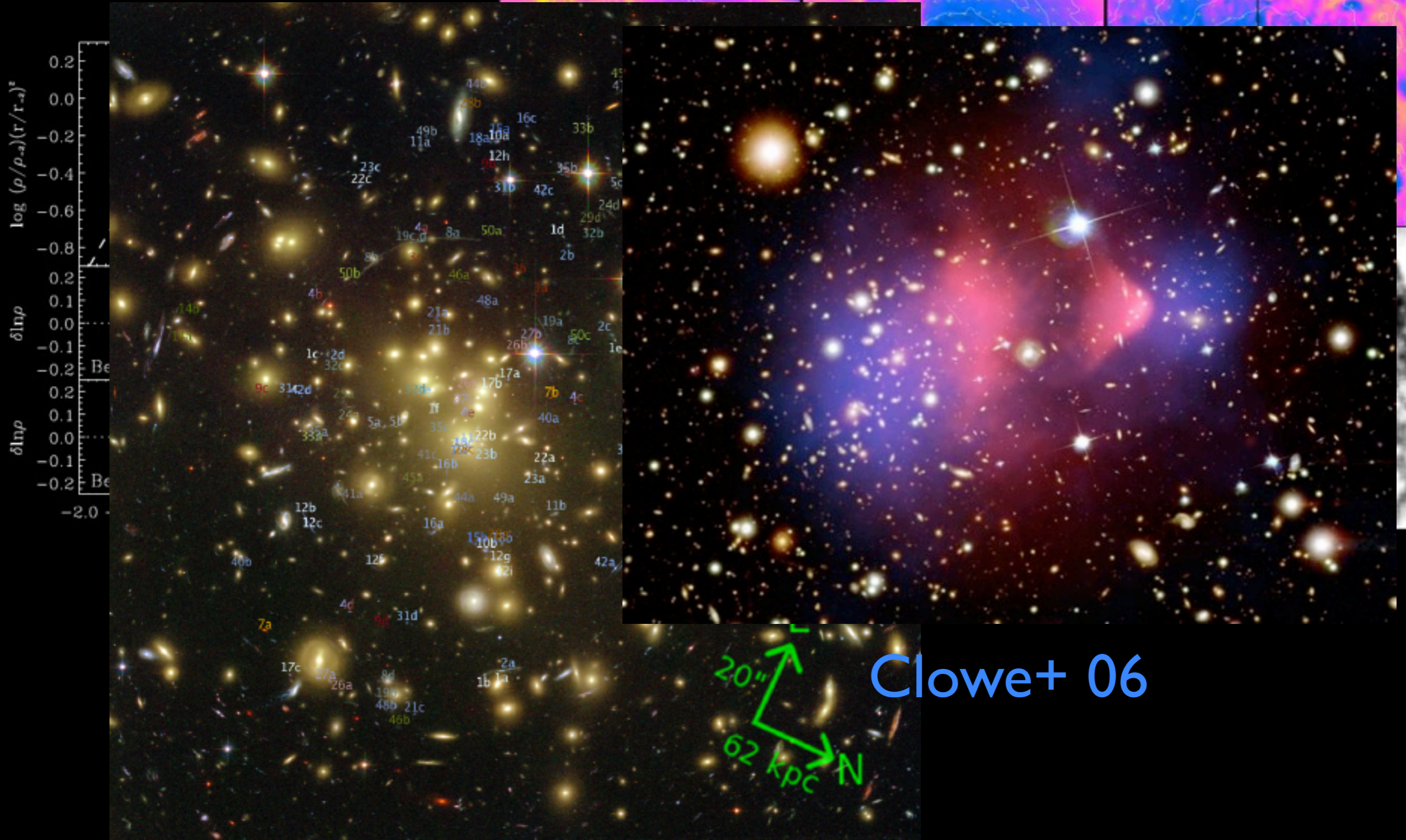
# Why not?



ibara+06

Coe+10

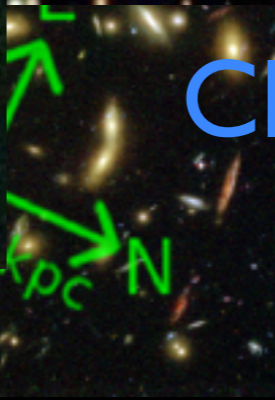
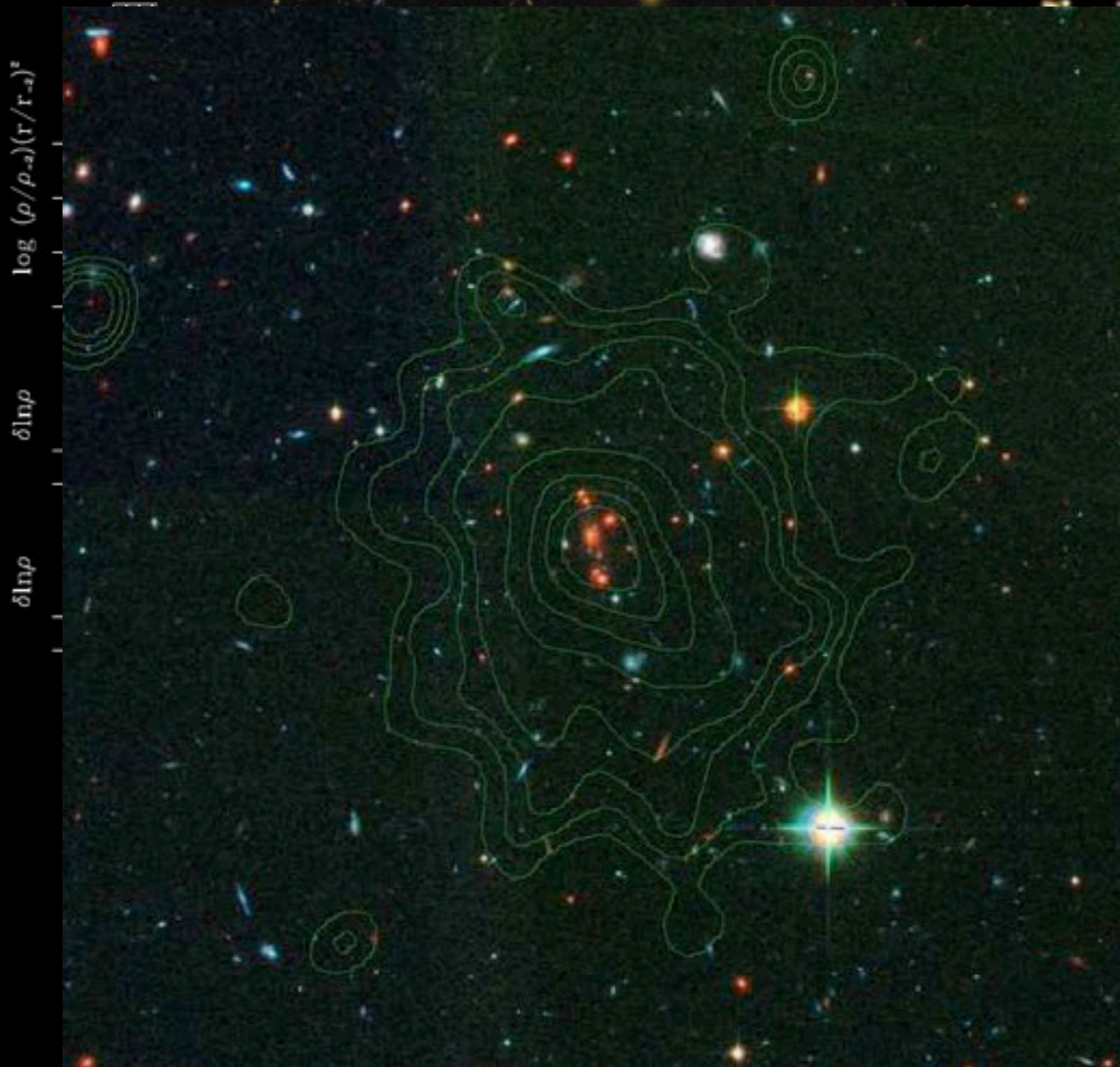
# Why not?



Clowe+ 06

Coe+ 10

# Why not?



Clowe+ 06

Rosati+ 09

Coe+ 10



# Two ways



# A pearl: Abell 2744



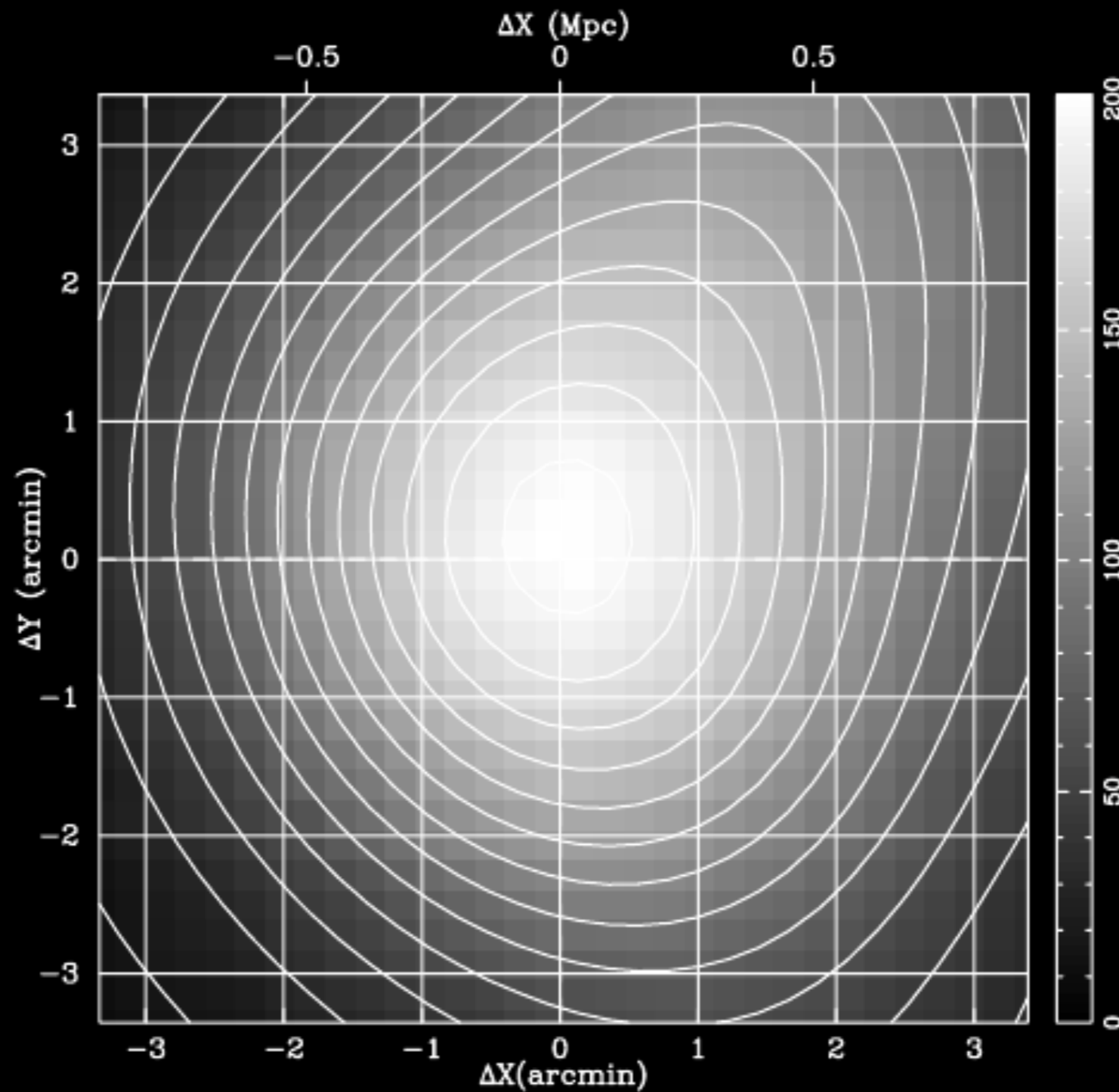
$z = 0.308$

extensive radio  
halo and relics

complicated X-ray  
morphology

at least bimodal  
galaxy velocity  
distribution

# Lensing not very conclusive



Cypriano+ 04

# So a team formed...

## Europe

J. Merten

R. Massey

F. Braglia

Y. Jimenez-Teja

N. Benitez

T. Broadhurst

M. Meneghetti

## South America

E. S. Cypriano

L. Sodre Jr.

## North America

D. Coe

R. Dupke

B. Frye

J. Rhodes

L. A. Moustakas

J. Krick

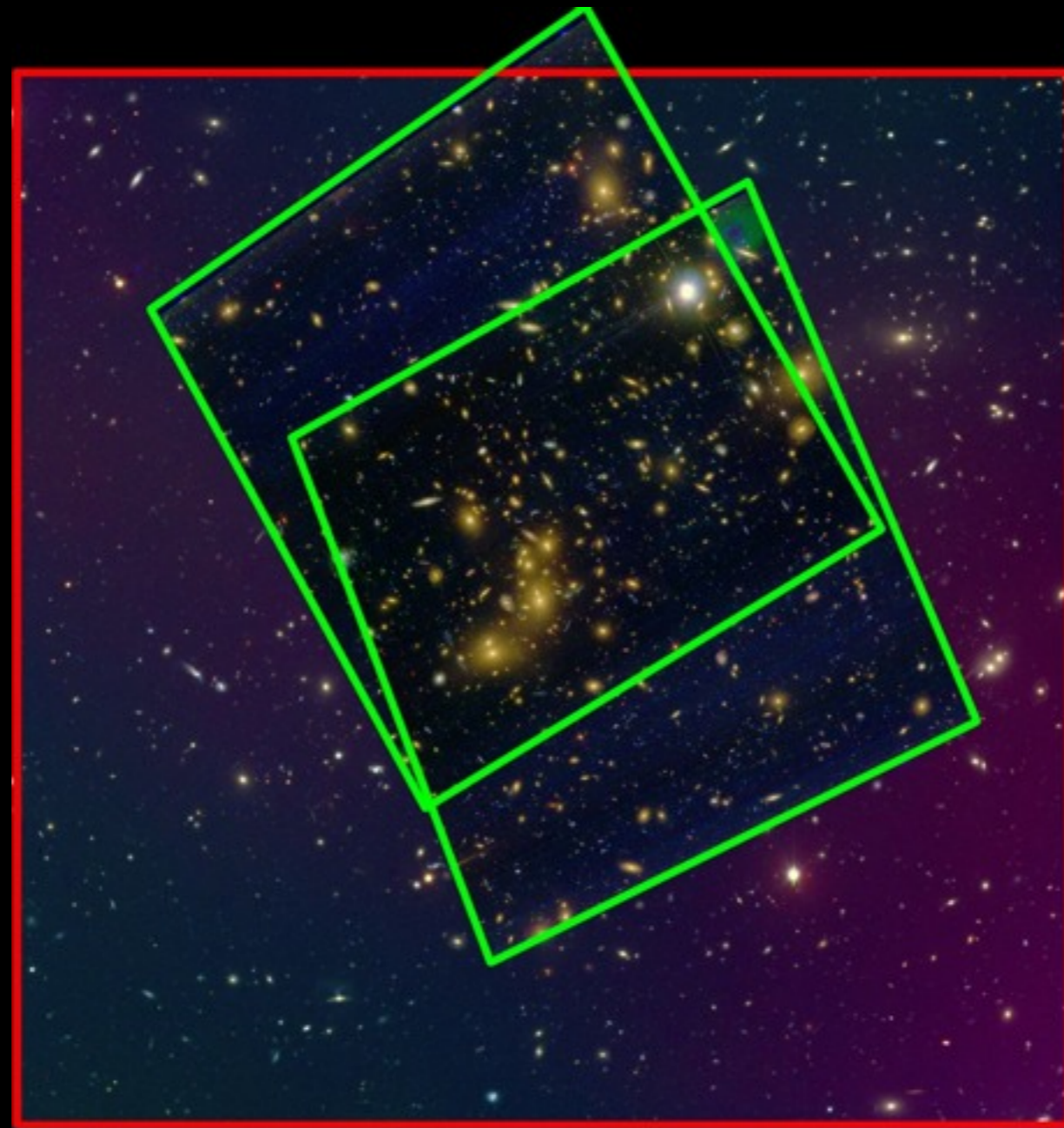
J. N. Bregman

## Rest of the World

A. Zitrin

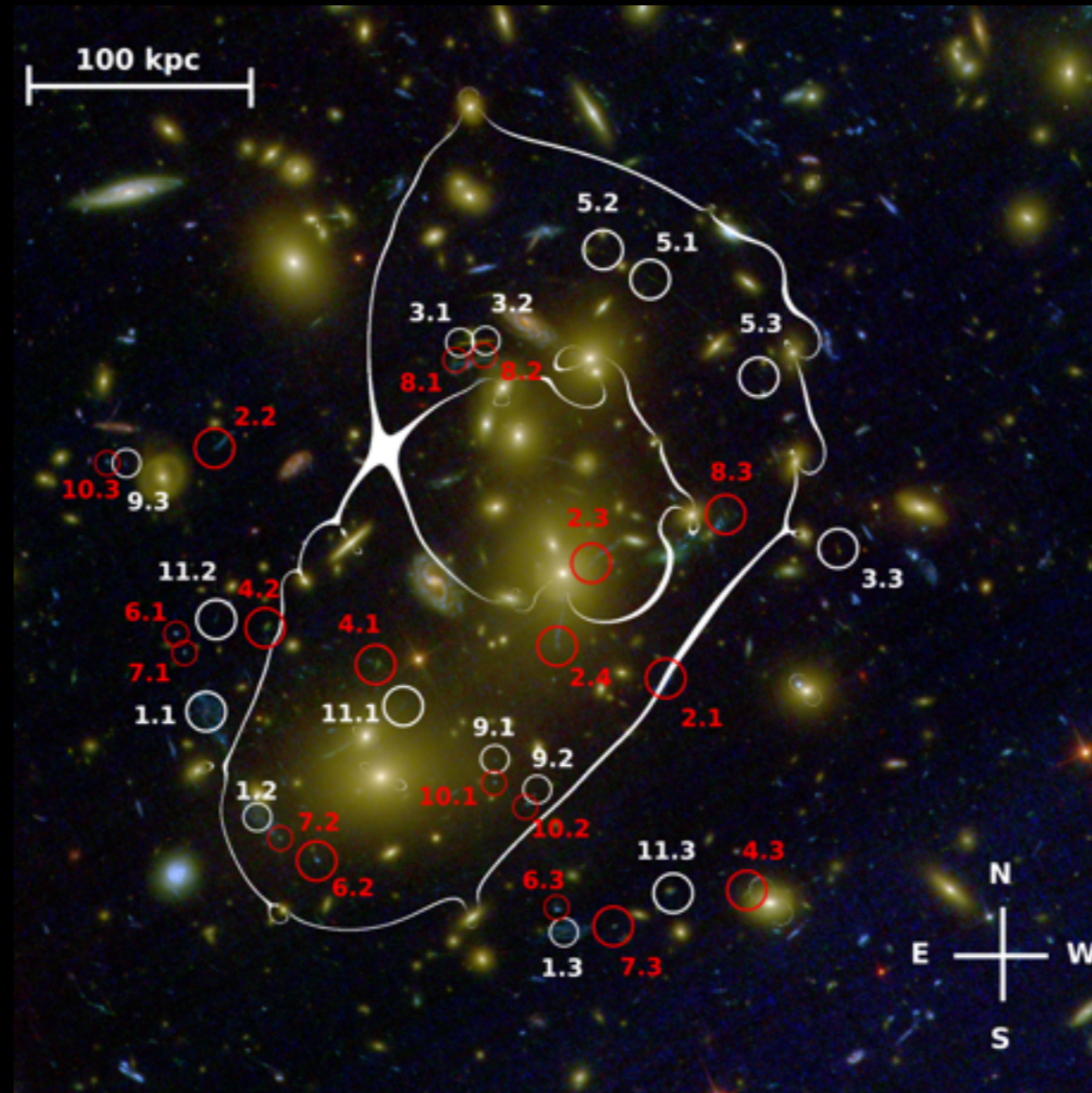
N. Okabe

**... and we looked in more  
detail**



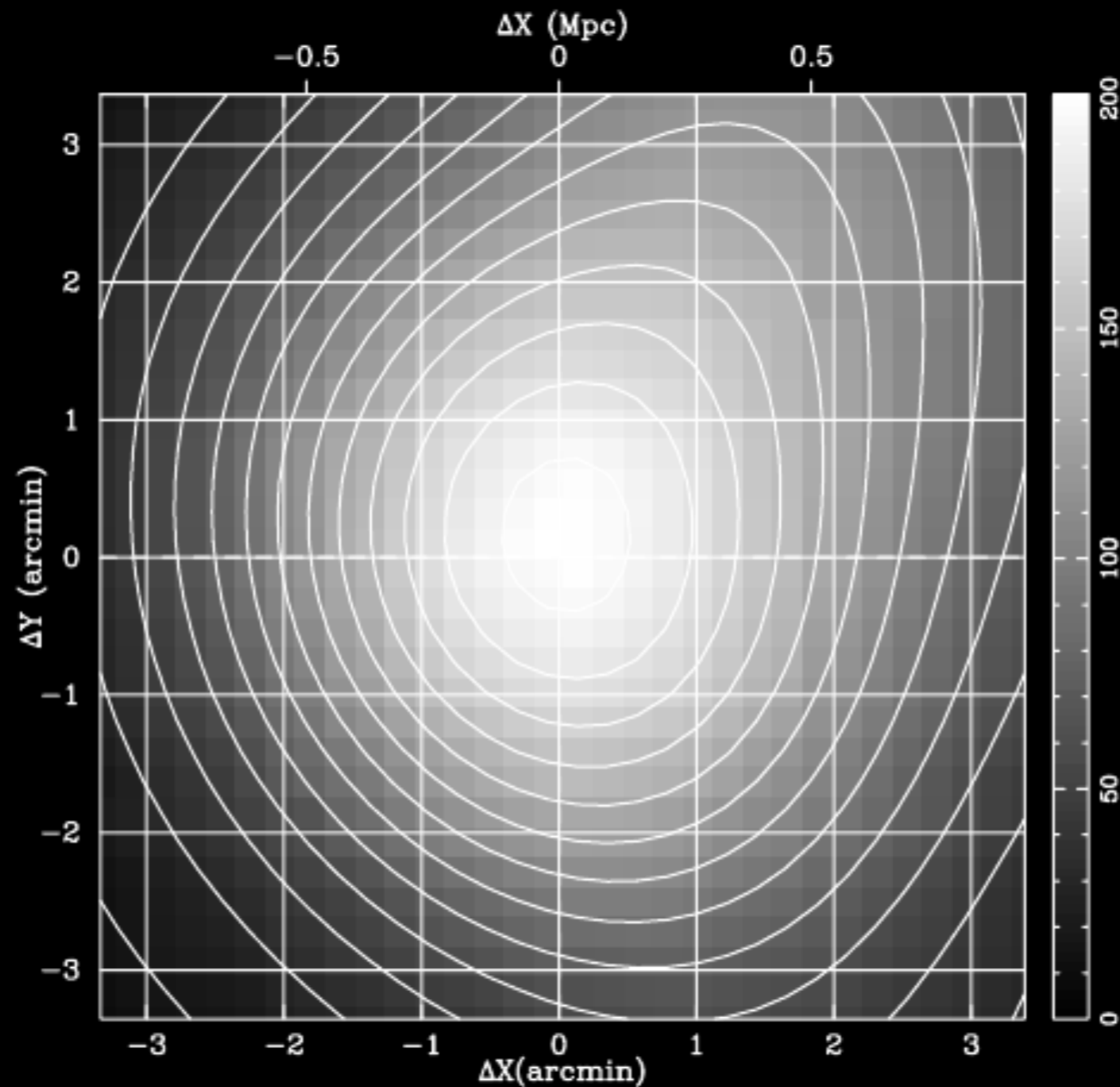
**8 Orbits in Hubble Cycle 17, PI: R. Dupke**

... and we looked in more detail



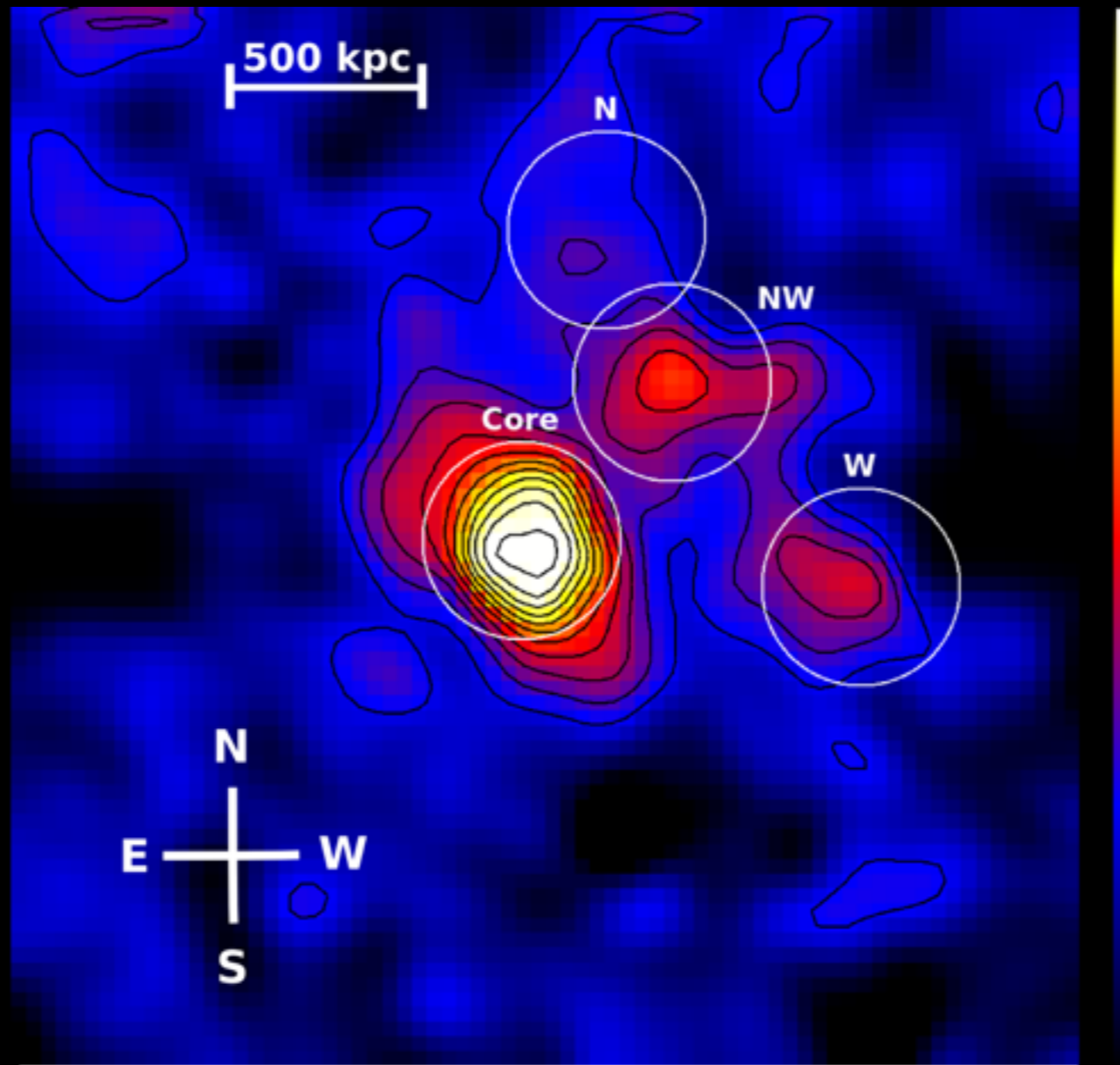
**JM+ 11**, we identified 34 multiple images

... and we looked in more detail



before

... and we looked in more detail



JM+11, MNRAS in press



**Wednesday, June 22, 2011**

Crash im All: Sternen... x Google News: Riesige ... x Kosmische Kollisionsr... x  
Crash im All: Sternen... x Google News: Astrono... x Astronomers unveil P... x  
content.usatoday.com/communities/sciencefair/post/2011/06/astronomers-unveil-pandoras-crash-1  
Facebook ITA LEO Deutsch-Engl... W Wikipedia eBay Amazon.de Tagesschau SAO/NASA ADS BB Bank Arxivsorter Other Bookmarks  
350 milyon yıl süren ... x Facebook  
www.hurriyet.com.tr/planet/18092019.asp?gid=381  
Facebook ITA LEO Deutsch-Engl... W Wikipedia eBay Amazon.de Tagesschau SAO/NASA ADS BB Bank Arxivsorter Other Bookmarks  
Ana Sayfa | Arşiv | English | Ekler | Alternatif Erişim Yolları | E-İş | Üye Girişi | Üye Ol | Benim Sayfam

# Hürriyet PLANET

PLANET EKONOMİ SPOR KELEBEK KÜLTÜR - SANAT YAZARLAR WEBTV SAĞLIK TEKNOLOJİ

DİĞER  
PLANET ANA SAYFA WIKILEAKS BELGELER - RAPORLAR

## 350 milyon yıl süren kozmik patlamaların oluşturduğu galaksi görüntülendi

Space.com 23 Haziran 2011



Gök bilimciler, dört ayrı galaksi kümesinin yüzyıllar süren patlamaları sonucunda oluşan dev bir galaksi kümesine ait görüntüleri elde etti.

Bilim insanları, farklı teleskoplardan elde edilen fotoğrafları bir araya getirerek, "Pandora'nın Kümesi" olarak da bilinen Abell 2744 galaksi kümesinin görüntüsünü oluşturdu. Gök bilimciler, Abell 2744'ün, oluşumları yaklaşık 350 milyon yıl süren dört ayrı galaksi kümesinden bir araya geldiğini belirtti.

- [ABELL 2744 GALAKSİSİ / Foto Galeri](#)

Michigan Üniversitesi'nden Renato Dupke, "Pandora'nın Kümesi adını vermeyi uygun gördük çünkü Abell 2744'te çok farklı ve garip olayların vasaadına dair bulularımız var" dedi.

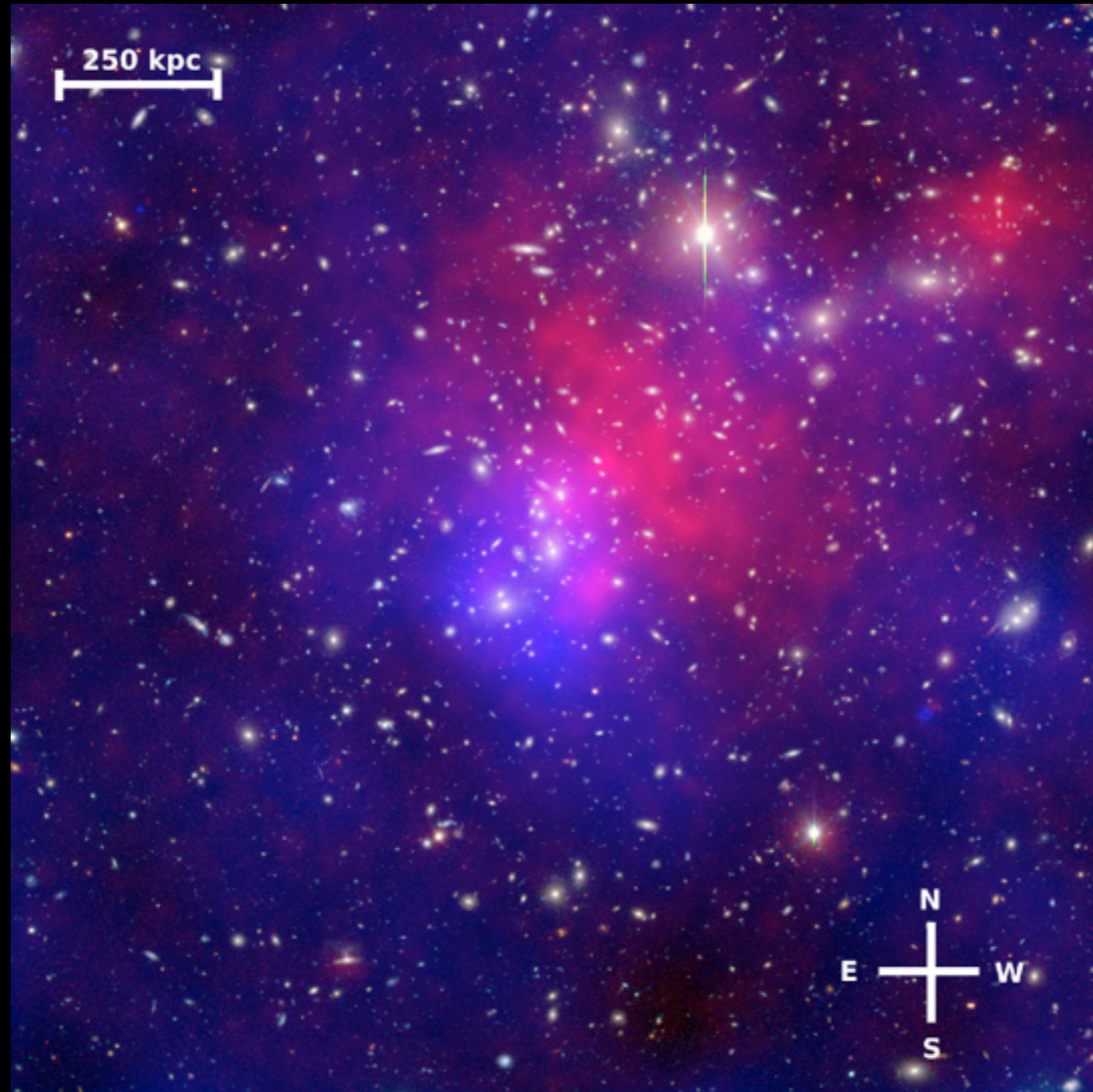
Like 51K Hürriyet'i Takip Et!

### DİĞER HABERLER

**Dostun yoksa 'sarı bana'**  
Japonya'da mucitler, şefkate muhtaç yalnızlara bir nebze derman olacak 'kucaklama makinesi' ica...

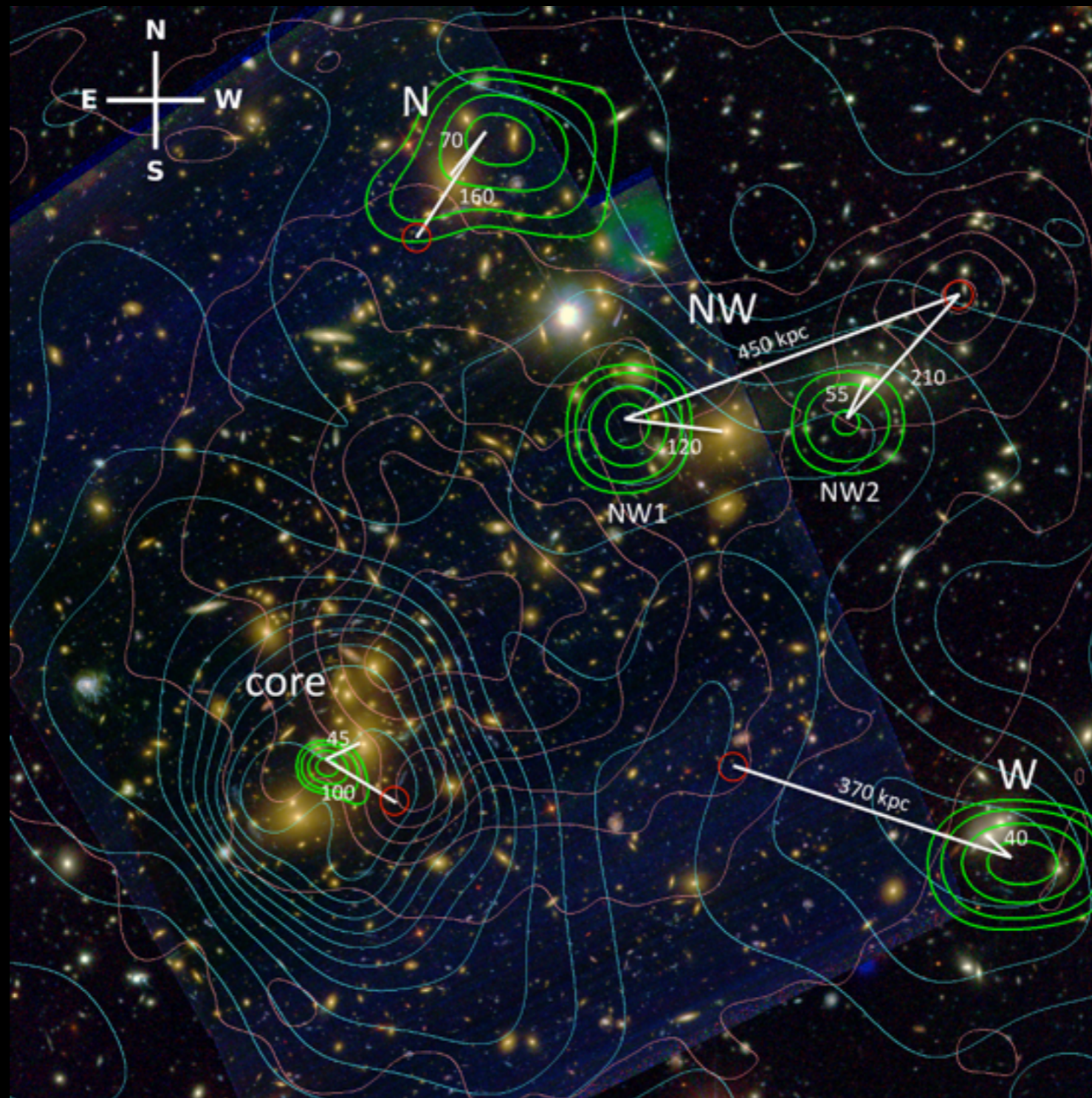
**Nato da pes etti**  
Tarihi boyunca sürekli işgale uğrayan, hiçbir süper gücün uzun süre elinde tutamadığı Afganista...

# Pandora's Cluster



**NASA, ESA, CXO, D. Coe & J. Merten**

# Pandora's Cluster



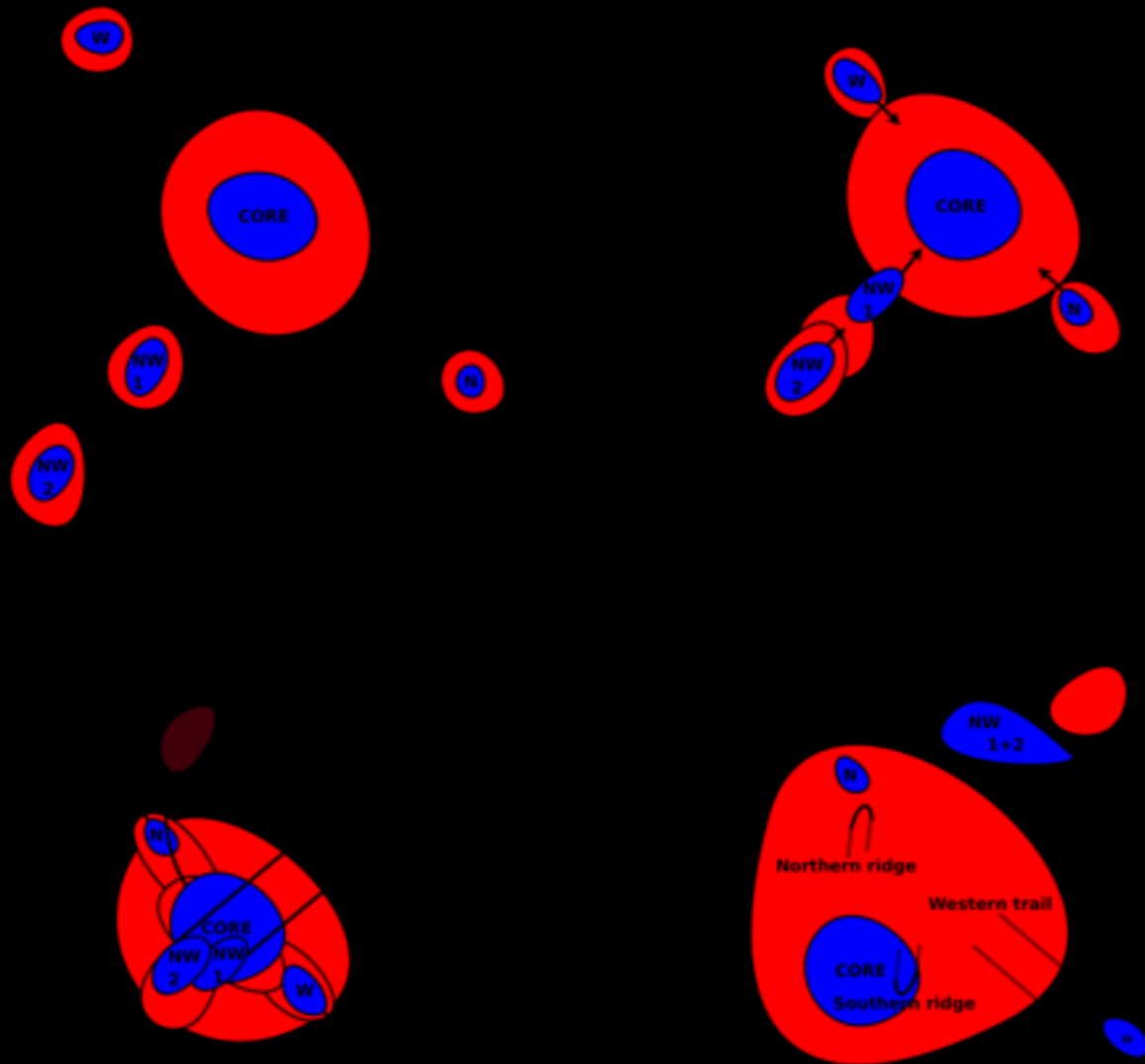
JM+ 11

# Pandora's Cluster

This will become  
a real challenge for  
simulations

Collaboration with  
D. Springels group  
in Heidelberg

A first search in  
MXXL was already  
successful



JM+ 11

# The CLASH

One of three HST/MCT programmes ~550 orbits

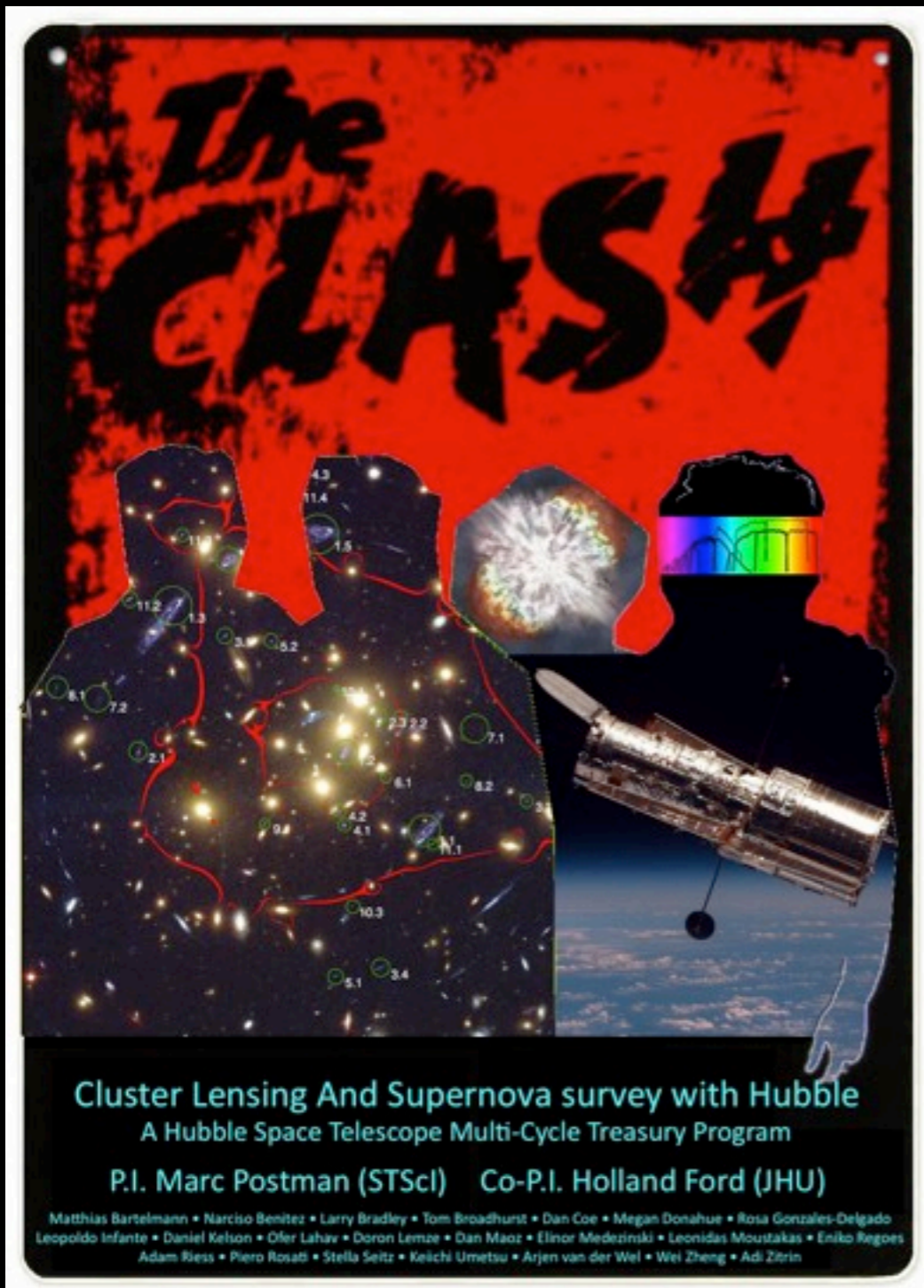
## Science Drivers

To map the DM profile and substructure to unprecedented precision

To detect SN Ia out to  $z \sim 2.5$

To detect and analyse galaxies out to  $z > 7$

To study the structure and evolution of galaxies in and behind the clusters

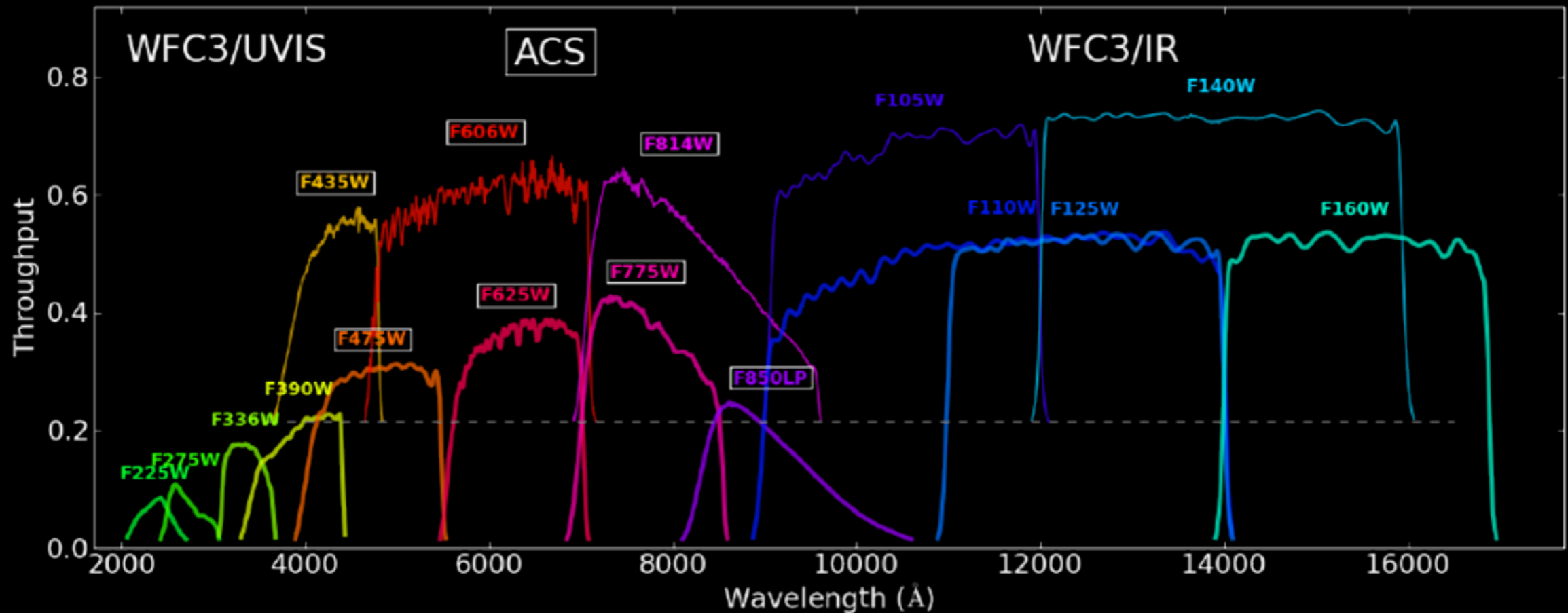


# The team



**Granada, autumn of 2010**

# The observing programme



**25 clusters**

**20 orbits and 16 filters / cluster**

**20 X-ray selected**

**ACS/WFC3 in parallel**

**5 spec. lenses**

**excellent photo z's**

**$0.18 < z < 0.9$**

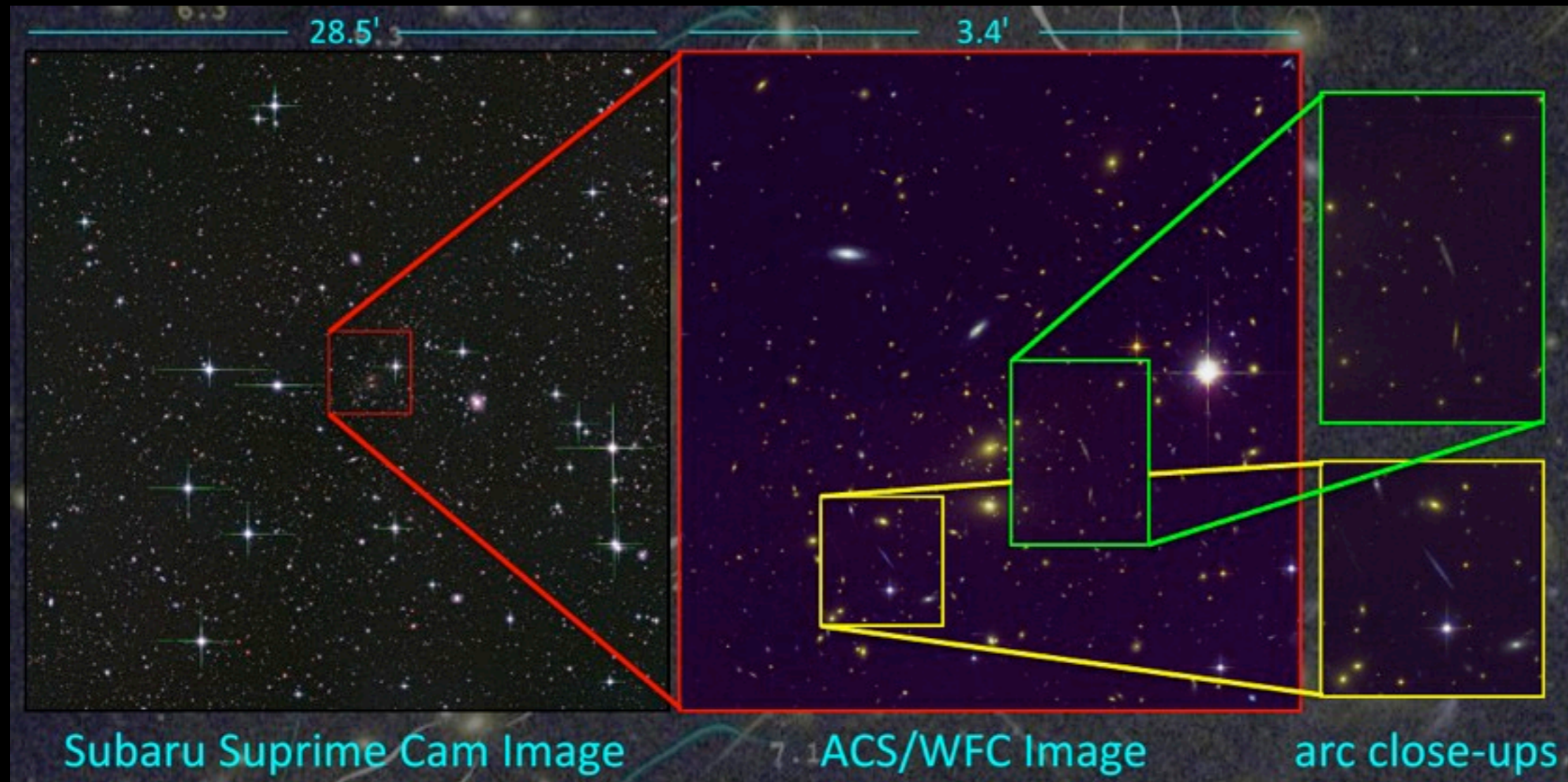
**BPZ / LePhare**

**use Hubbles full power**

**follow-up time > CLASH**

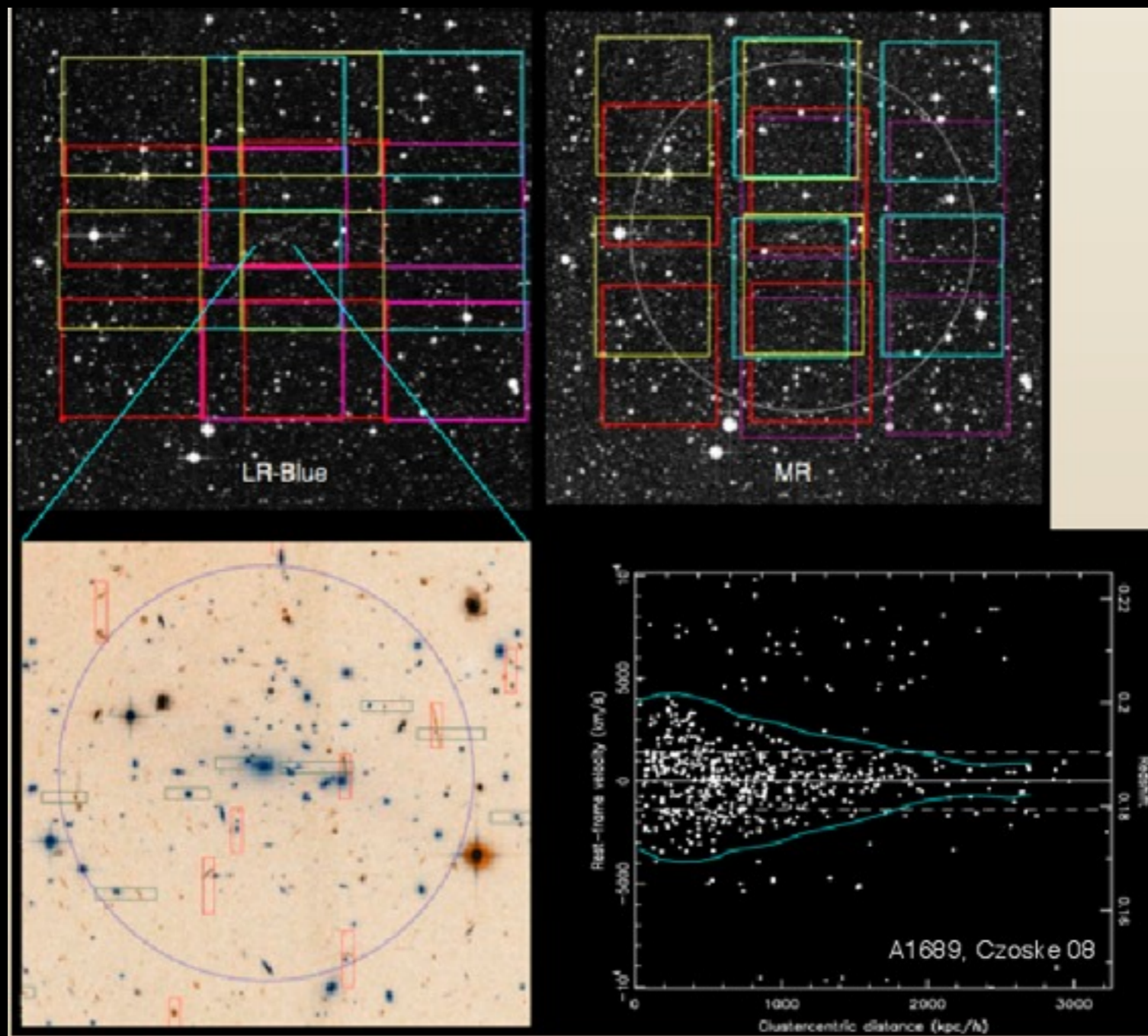


# That's not all



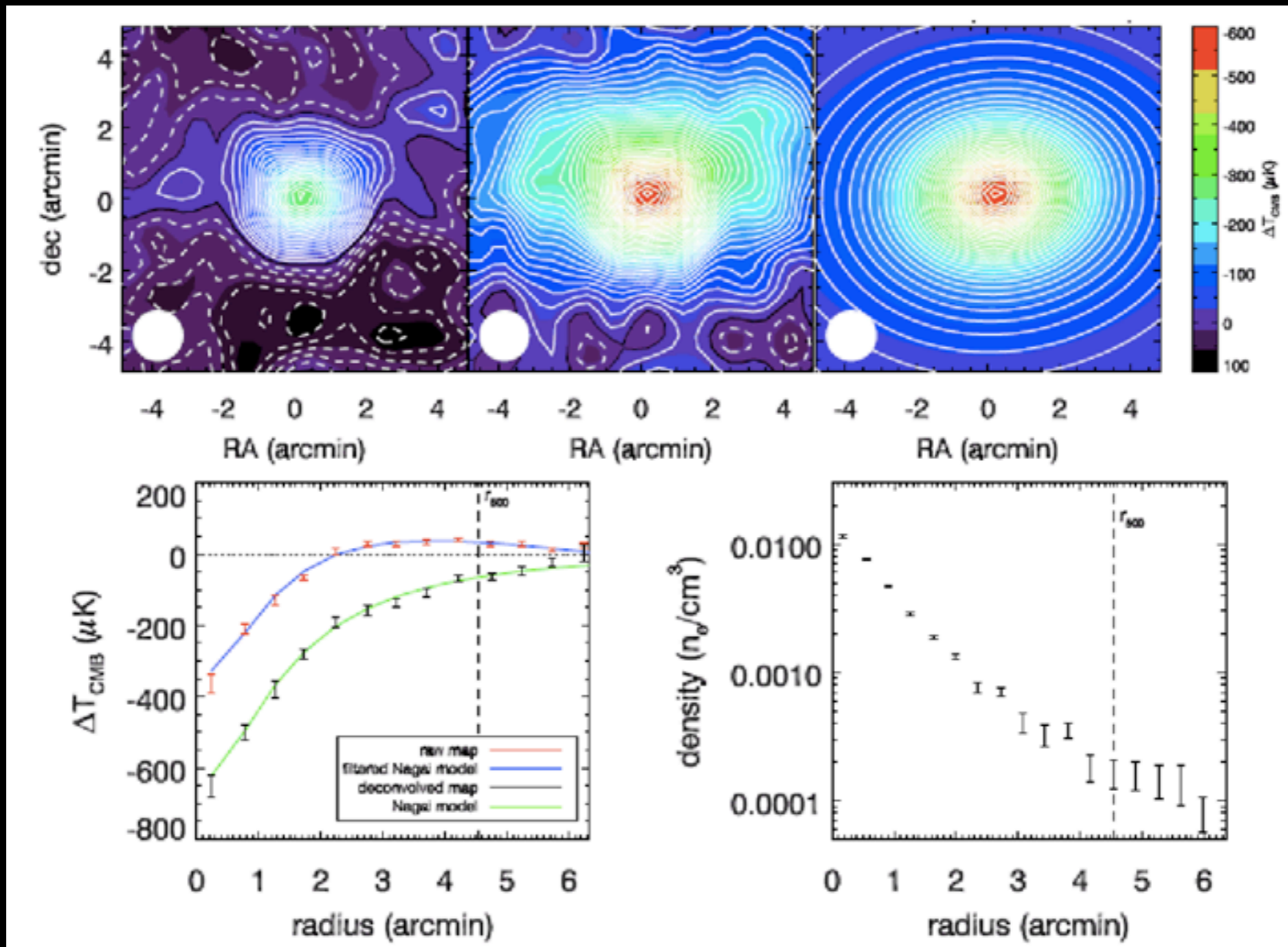
**BURIZ Subaru imaging for almost all  
CLASH clusters**

# That's not all



**ULT/Magellan specs for arcs and cluster members**

# That's not all



**Bolocam / AMiBA / Mustang SZE observations**

# First images



**A 383**



**M1149**



**Postman & CLASH 11**



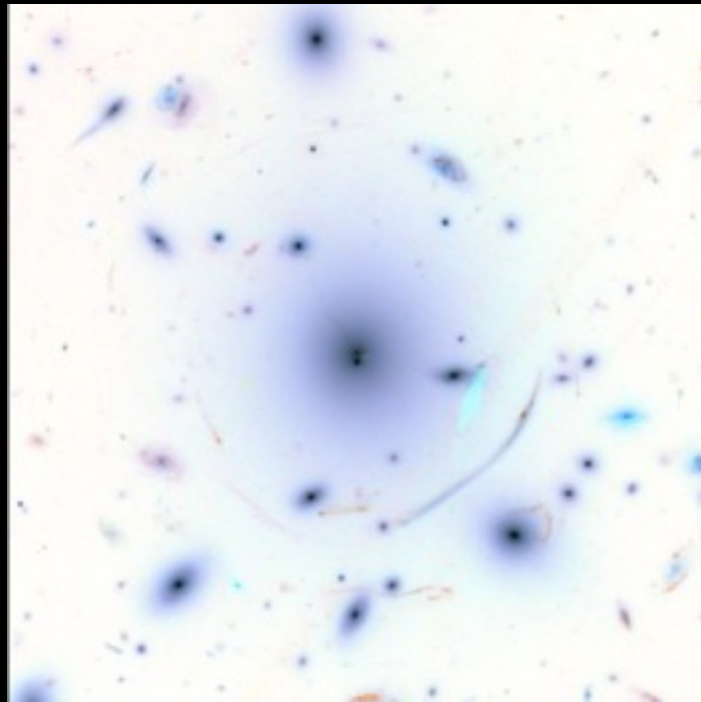
**A 2261**



**M1206**



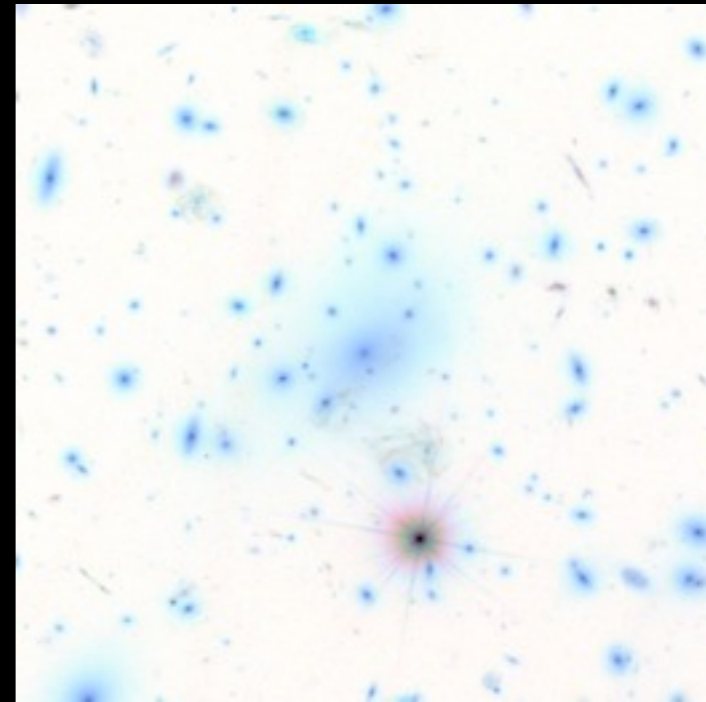
# First images



**A 383**



**M1149**



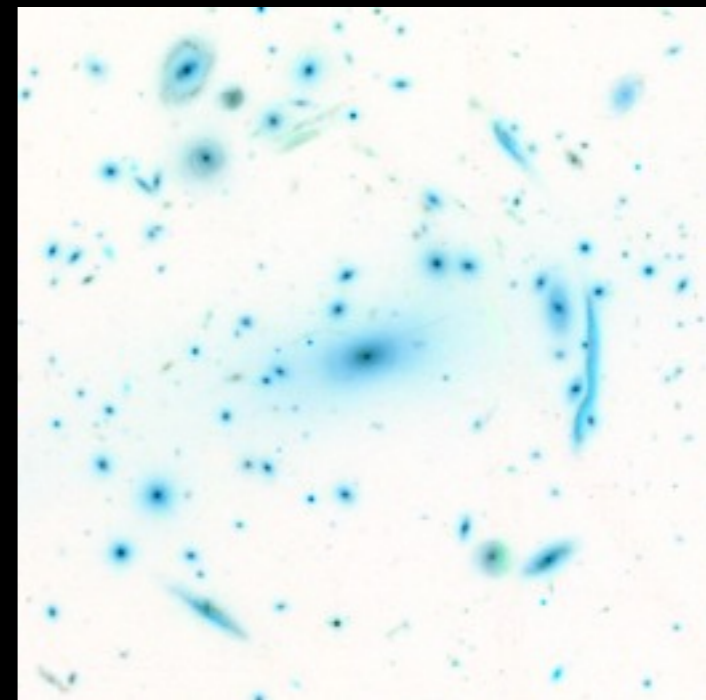
**Postman & CLASH 11**



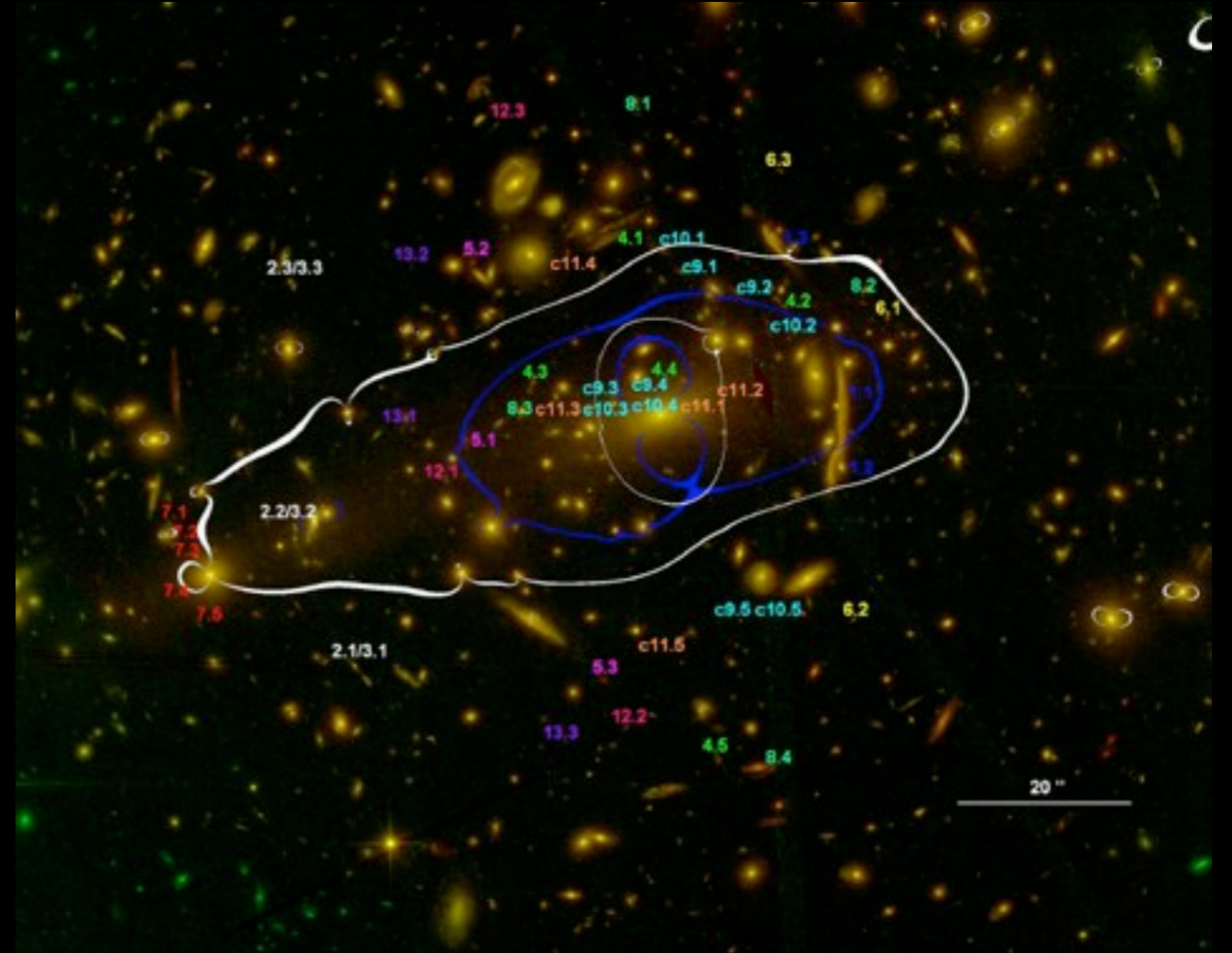
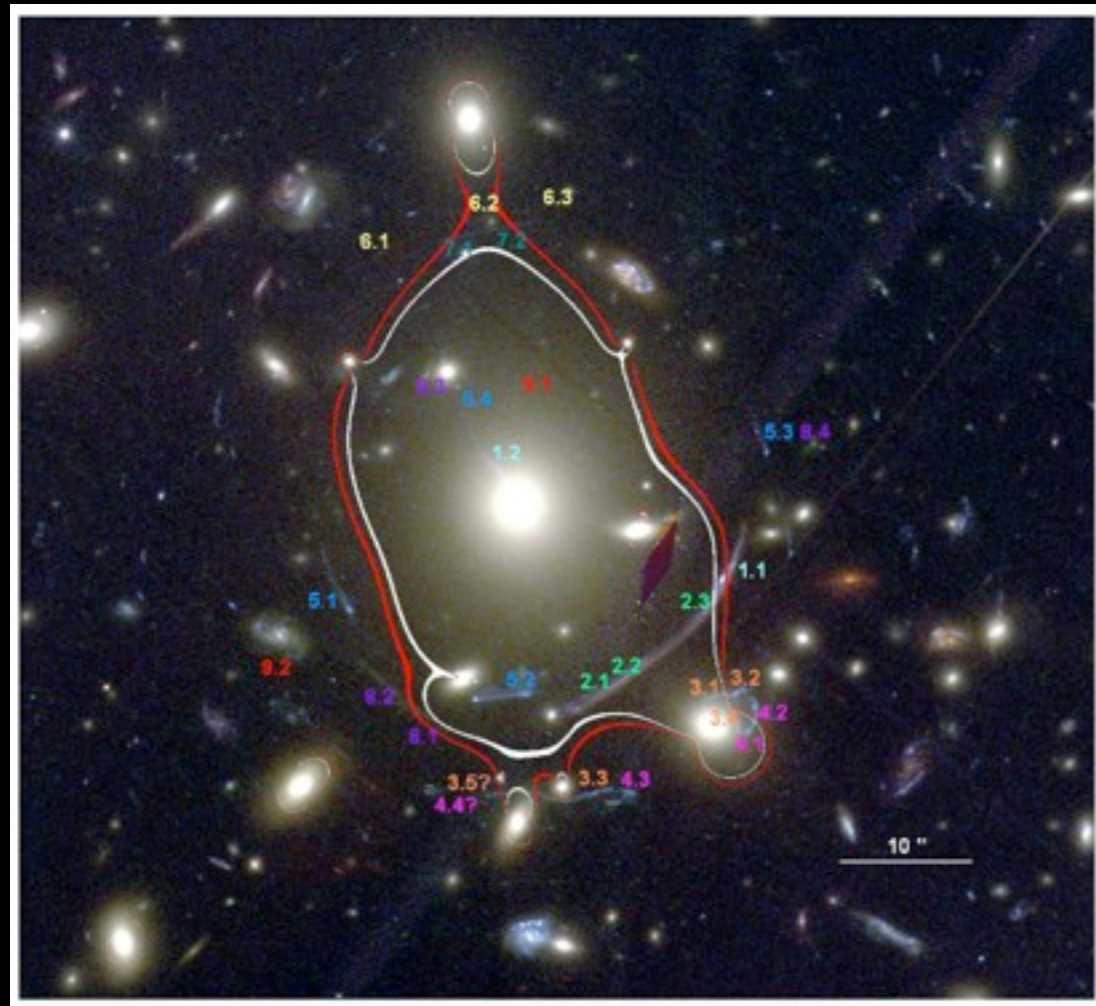
**A 2261**



**M1206**

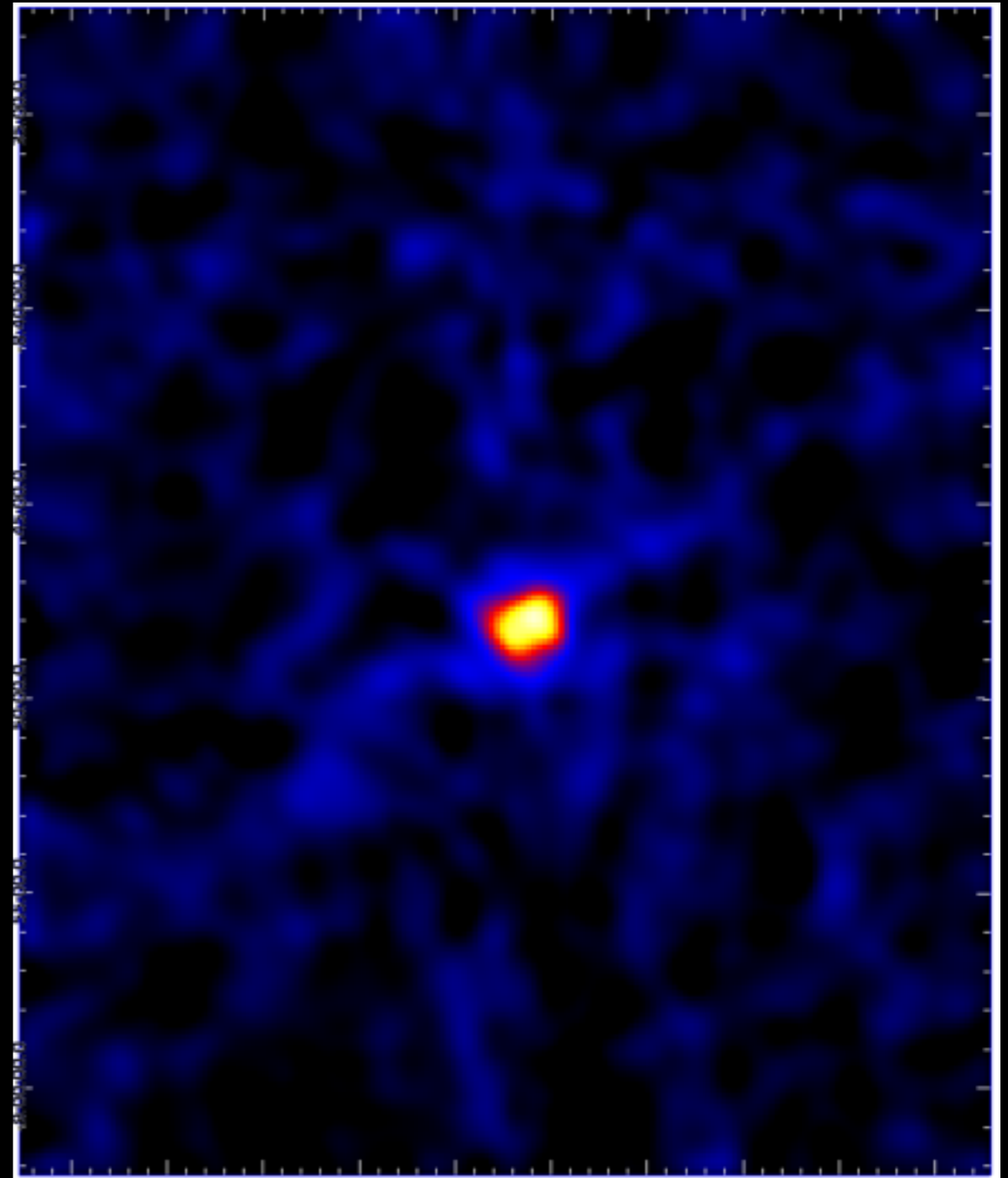
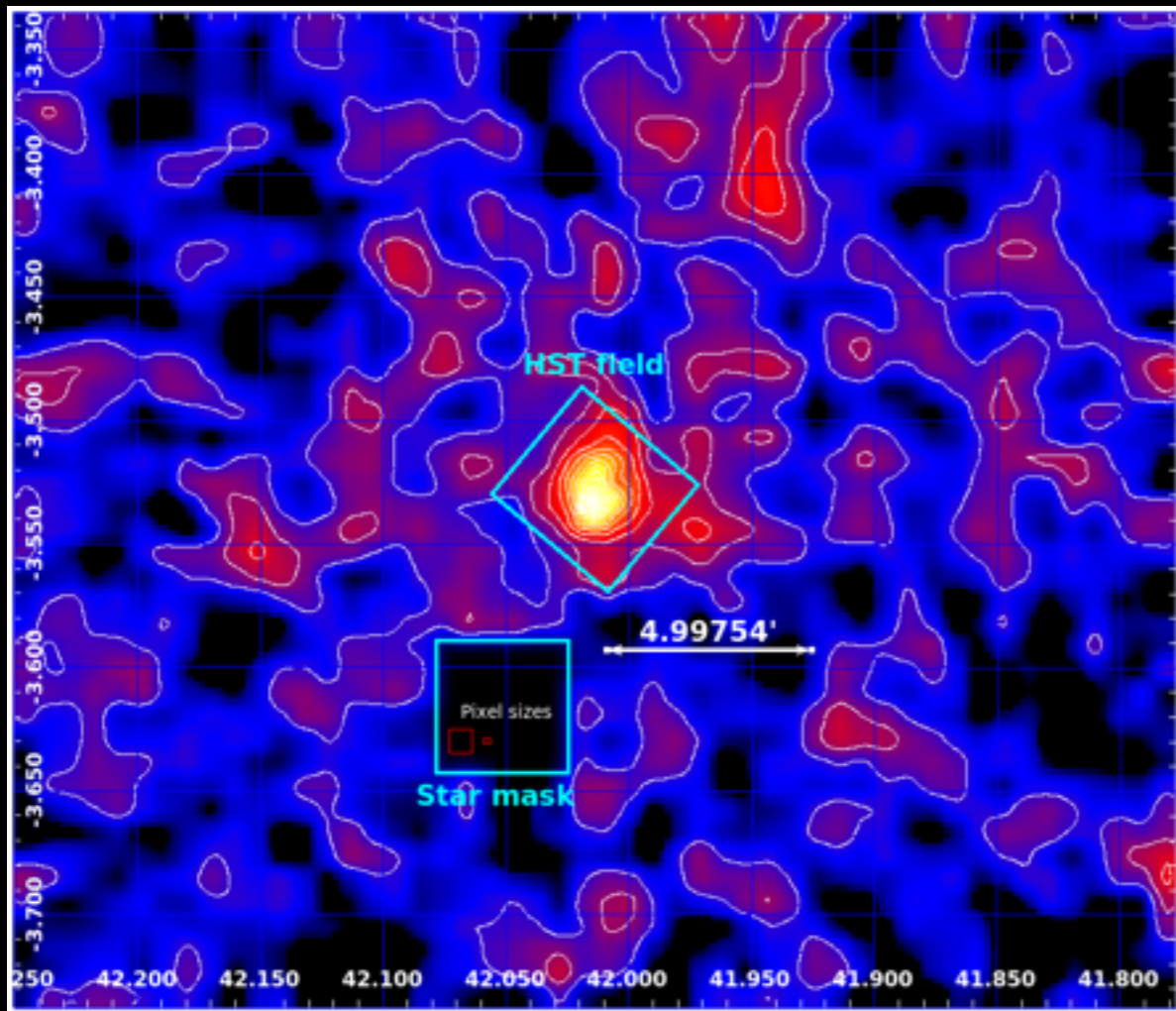


# First results



**A383 & MACS1206, Zitrin, Rosati & CLASH 11**

# First results



**A383 & MACS1206, Merten, Umetsu,  
Medezinski & CLASH 11**

# Conclusions

**Clusters of galaxies are powerful cosmological probes**

**In Pandora's Cluster formerly known as Abell 2744 one can observe the creation of cosmic structure almost directly**

**The CLASH programme will observe 25 clusters with unprecedented data quality and provide a true treasure trove**