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7衝突銀河団の質量・バリオン分布

Subaru Weak Lensing of Seven Merging Clusters: Distributions of Mass and Baryons

○岡部　信広（東北大学）　&　梅津　敬一（ASIAA）

○ Nobuhiro Okabe (Tohoku Univ.)

& Keiichi Umetsu (ASIAA)

すばるユーザーズミーティング

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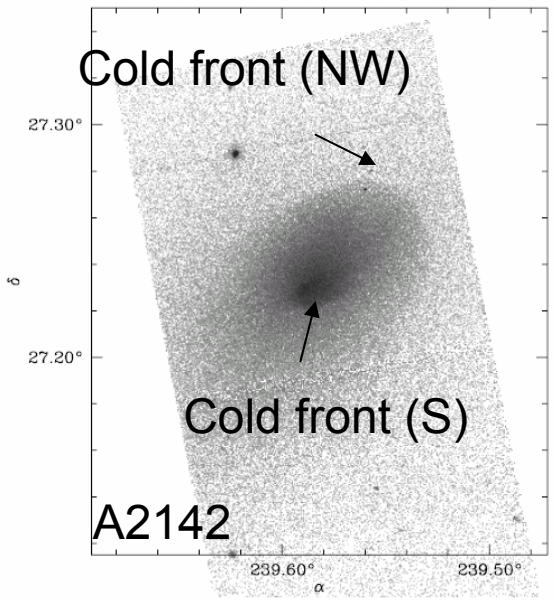
Okabe & Umetsu (2006), Okabe & Umetsu (2007), Umetsu & Okabe (2007)…

1: Motivation – X-ray Clusters

Chandra and XMM-Newton revealed complicated ICM structures which are expected to be associated with cluster mergers.



Density

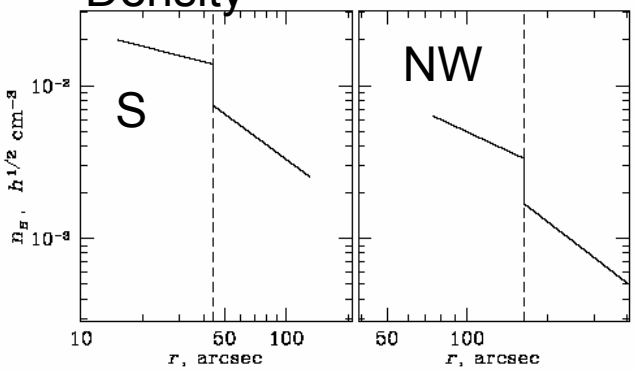


FIG. 4*d*

Temperature

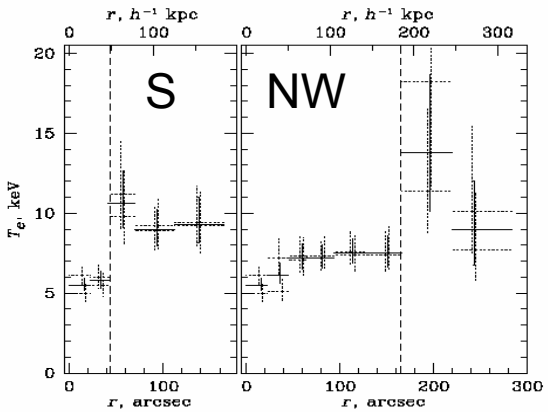
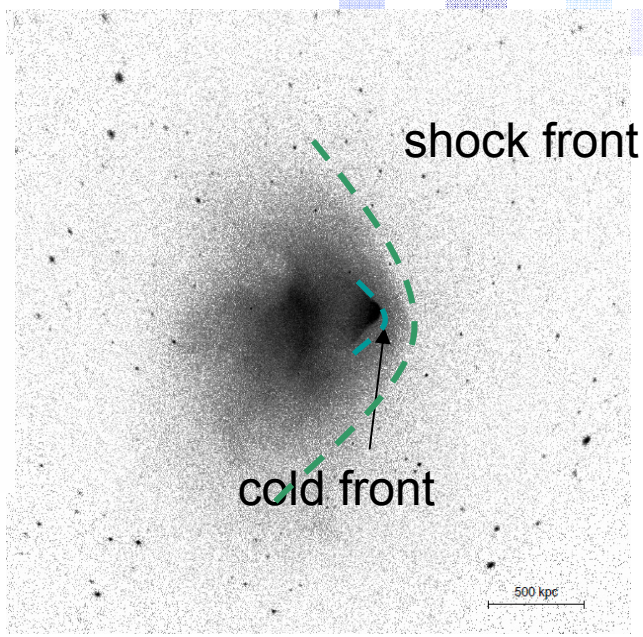


FIG. 4*b*



1E0657-56

(exposure time=500ksec)

Motivation

(1) ICM is dynamically controlled by dark matter.

(2) Understanding the ICM phenomena requires to know the dark matter (mass) distribution.

(3) Mass distributions deduced from X-ray results are ill constrained because the ICM is not in hydrostatic equilibrium.

$$\frac{1}{\mu m_p n_g(r)} \frac{dP_g}{dr} = -\frac{d\Phi}{dr}$$

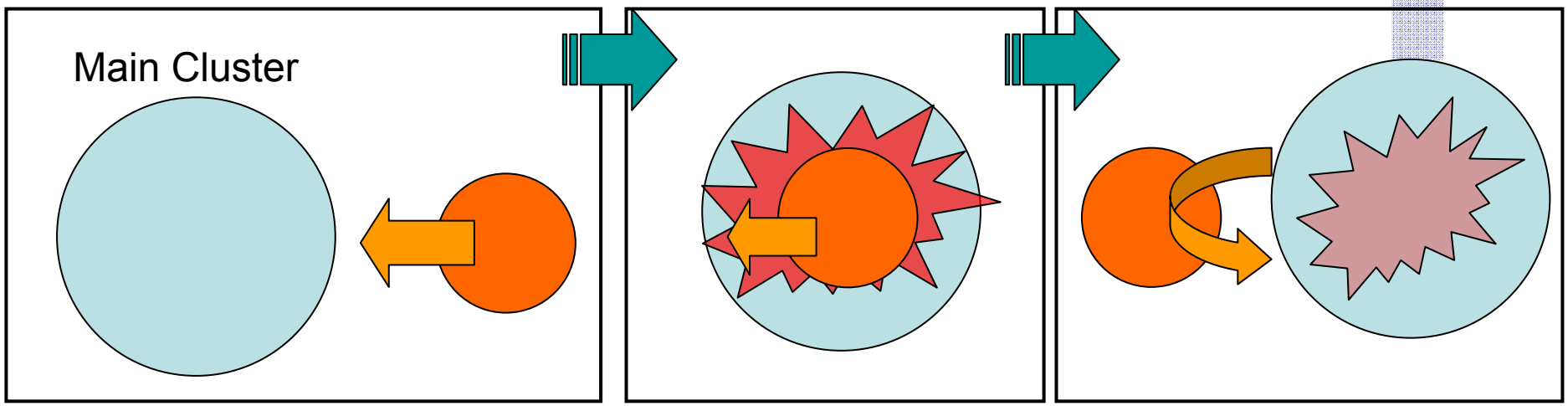
The only method to directly reveal mass distribution without the assumption of dynamical states and mass distributions

is to use a weak gravitational lensing effect.

2:Cluster Targets

1:We have not yet known mass distributions in almost all merging clusters!!!

*** Various Merging Stages**



2: We have not yet known the relationship between dark matter and baryons (ICM and member galaxies) during merger process.

Cluster Targets

Suprime-CAM

S05A-159, PI: Okabe

Archive (SMOKA)

Table 2. Cluster X-ray Features

Cluster	z	Type	1 arcmin (kpc/h_{70})	Components	T_{ave} (keV)
(1)	(2)	(3)	(4)	(5)	(6)
A754	0.0542	On-going	63.1		10.0 ± 0.3 [a]
A1750	0.0860	Binary	96.7	A1750C	3.87 ± 0.10 [b]
				A1750N	2.84 ± 0.12 [b]
A1758	0.2790	Binary	254.0	A1758N	8.2 ± 0.4 [c]
				A1758S	$6.4^{+0.3}_{-0.4}$ [c]
A1914	0.1712	On-going	174.9		10.9 ± 0.7 [a]
A2034	0.1130	Cold Front	123.2		7.9 ± 0.4 [d]
A2142	0.0909	Cold Front	101.7		8.1 ± 0.4 [e]
A520	0.1990	On-going	197.2		7.1 ± 0.9 [a]

This talk focuses on distributions of mass and baryons in Merging Clusters.

3: Summary

1 :

Weak Lensing analysis is a new observational method to understand galaxy clusters.

- **Complementary to X-ray / Optical Analyses.**

2 :

Subaru + Suprime-CAM is the most powerful instrument of weak lensing analysis.

- **Subaru/Suprime-CAM can carry out WL analysis on almost ALL X-ray clusters**

3 : Distributions of Mass, ICM, and member galaxies.

Initial Stage : Mass ~ Galaxies ~ ICM **A1750 & A1758**

On-Going/Cold front : Mass ~ Galaxies ≠ ICM

peak

Mass in front of X-ray core : **A1758N & 1E0657-56** (Clowe et al 2004)

Mass behind X-ray core : **A754**

No significant offset within smoothing scale : **A520, A1914 & A1758S**

Mass in front of Cold front : **A2034, A2142 & 1E0657-56** (Clowe et al. 2004)

4 : Combined Study (Subaru UM 2005)

Lx-T relation, M-T relation, f_{gas} & M/L…

Compare with Temperature, Pressure and Entropy Maps of ICM

Constrain merger geometry & energy input into ICM…

Locuss
(Local Cluster Substructure Survey)

Flux limited Sample: Lx> 5 x 10^{44} erg/s

Redshift : 0.15< z <0.30

Subaru/Suprime-CAM : Goal ~40 clusters

Currently ~15 clusters (S05B & S06A , PI: Futamase)

Reduction finished!. and observation (S07A)

(Okabe, Takada, Umetsu & Futamase, PASJ, in prep)

HST/ACS: 143 Targets (100 clusters) Simith & Kneib

NOW OBSERVING (until the end of 2007)

Chandra/XMM-Newton/Suzaku: Mazzotta, Ponman, Finogenov & Okabe

Archival DATA (Chandra/XMM)+ Suzaku (Low X-ray background)

SZE: SZA Carlstrom & Church

Combined Studies : WL+ SL, WL+X-ray, WL+SZE