

Strong lensing by a galaxy member of the distant cluster Cl J0152.7-1357

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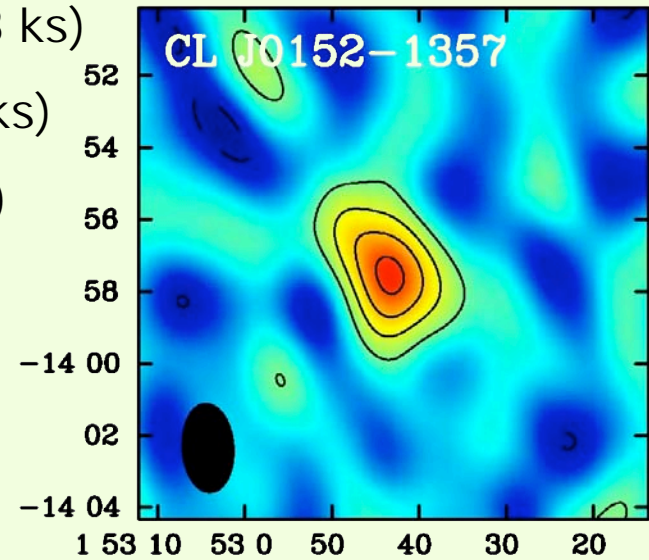


KI TP, September 28th 2006

CL J0152.7-1357 I

One of the richest and most X-ray luminous irregular distant cluster with apparent substructures

- Observations:
- ACS/HST → $r_{625}, i_{775}, z_{850}$ (4.8 ks)
 - LRI S/Keck → B, V, R, I (23.6 ks)
 - GMOS-N → r', i', z' (21.7 ks)
 - Chandra → 36.5 ks
 - BeppoSAX → 19.9 ks
 - XMM-Newton
 - BI MA → 28.5 GHz



Studies:

■ spectroscopic → $z = 0.84$

■ virial → $\sigma_v = 1110 \pm 163 \text{ km s}^{-1}$
 (I. Jorgensen *et al.*, 2005, AJ, 129, 1249)

■ X → $\begin{cases} T_{gas} = 6.5^{+1.7}_{-1.3} \text{ keV} \\ Z_{gas} = 0.14^{+0.27}_{-0.14} \end{cases}$
 (Z.-Y. Huo *et al.*, 2004, AJ, 127, 1263)

■ weak lensing → $\begin{cases} \sigma_v^{SIS} = 903^{+54}_{-57} \text{ km s}^{-1} \\ \sigma_v^{SIE} = 940^{+46}_{-48} \text{ km s}^{-1} \end{cases}$
 (M. J. Jee *et al.*, 2005, ApJ, 618, 46)

■ SZE → $T_{gas} = 8.7^{+4.1}_{-1.8} \text{ keV}$
 (M. Joy *et al.*, 2001, ApJ, 551, L1)

CI J0152.7-1357 II

Color-composite image of the cluster obtained by combining the three F625W (r), F775W (i), and F850LP (z) *HST/ACS* filters.

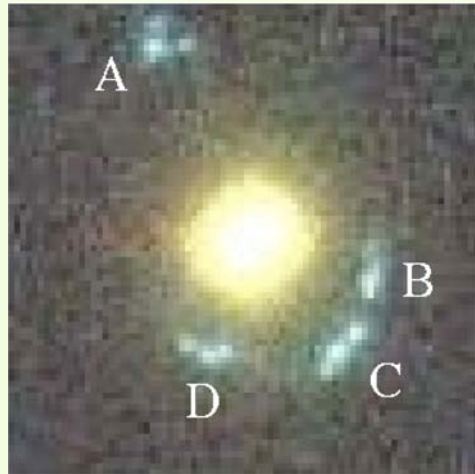


Zoom-in view of a $4'' \times 4''$ field around a lens galaxy at $z_l = 0.82$. $1''$ corresponds to 7.57 kpc at the lens plane.

Four images

The galaxy:

R.A. (J2000)	Dec. (J2000)	z_l	e ($1 - b/a$)	P.A. ($^\circ$)	r_{AB} (mag)
01:52:42.426	-13:56:17.96	0.82	0.047	45.1	22.85



Photometry of the four images:

Object	x_1^a ($''$)	x_2^a ($''$)	Flux ratio	Distance ^a ($''$)	r_{AB} (mag)
A	-0.76	1.69	0.54	1.86	25.51
B	1.04	-0.28	0.60	1.07	25.49
C	0.79	-0.89	1.00	1.19	25.05
D	-0.31	-0.92	0.92	0.97	25.19

^a With respect to the galaxy center.

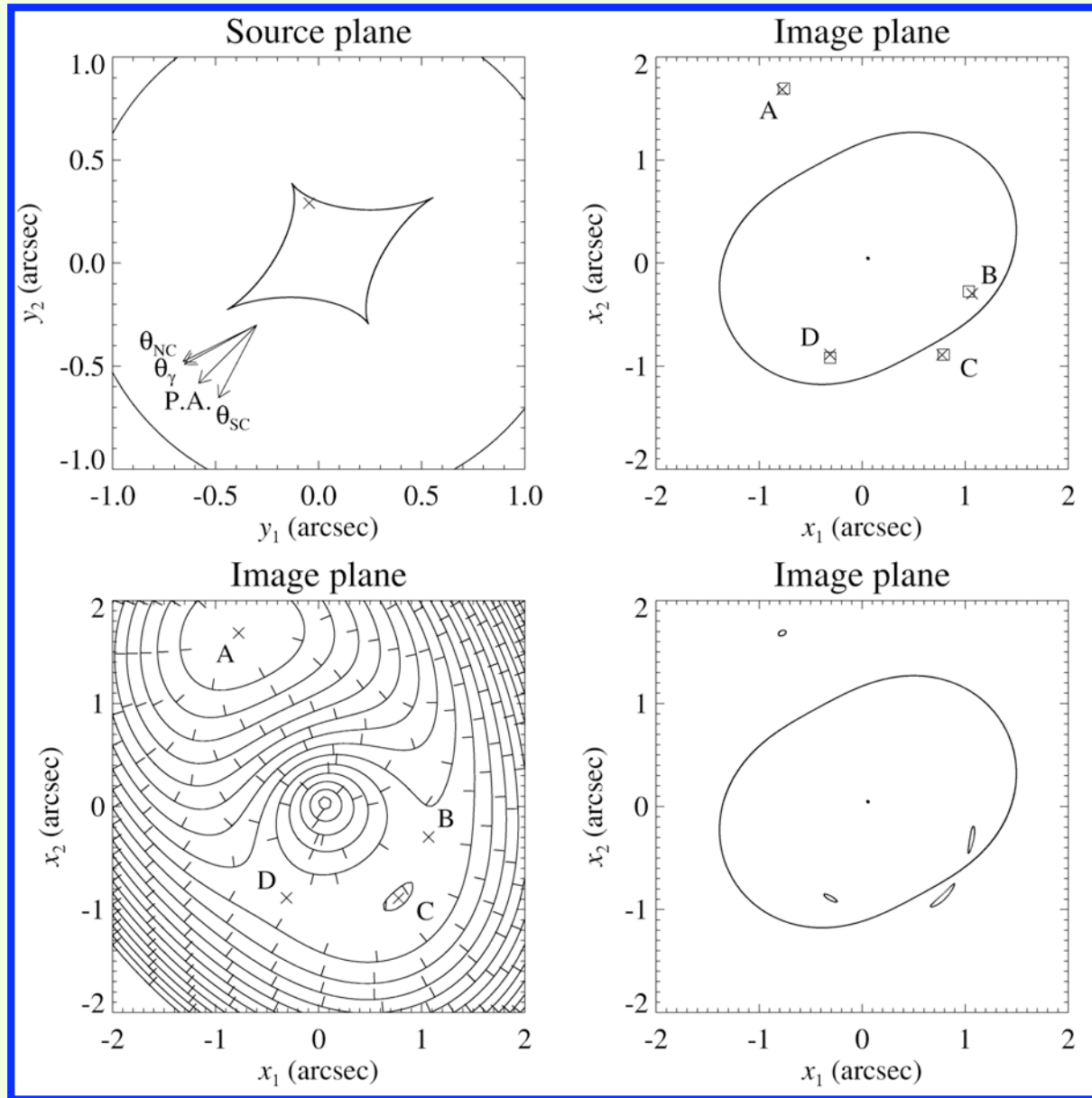
Model	θ_E ($''$)	x_{1l} ($''$)	x_{2l} ($''$)	e/γ^a	θ_{e/γ^a} ($^\circ$)	χ^2	dof
SIS ^b	1.34						
SIS	1.42	-0.09	0.42				
SIE ^b	1.91			0.486	28.3	14.3	3
SIE	2.55	0.15	-0.17	0.699	28.1	1.77	1
SIS+ES ^b	1.22			0.199	29.1	6.98	3
SIS+ES	1.23	0.06	0.05	0.188	28.6	1.29	1

Best-fit parameters for several models.

^a Ellipticity or external shear values, depending on the model.

^b The lens center is fixed to the galaxy center.

SI S+ES model



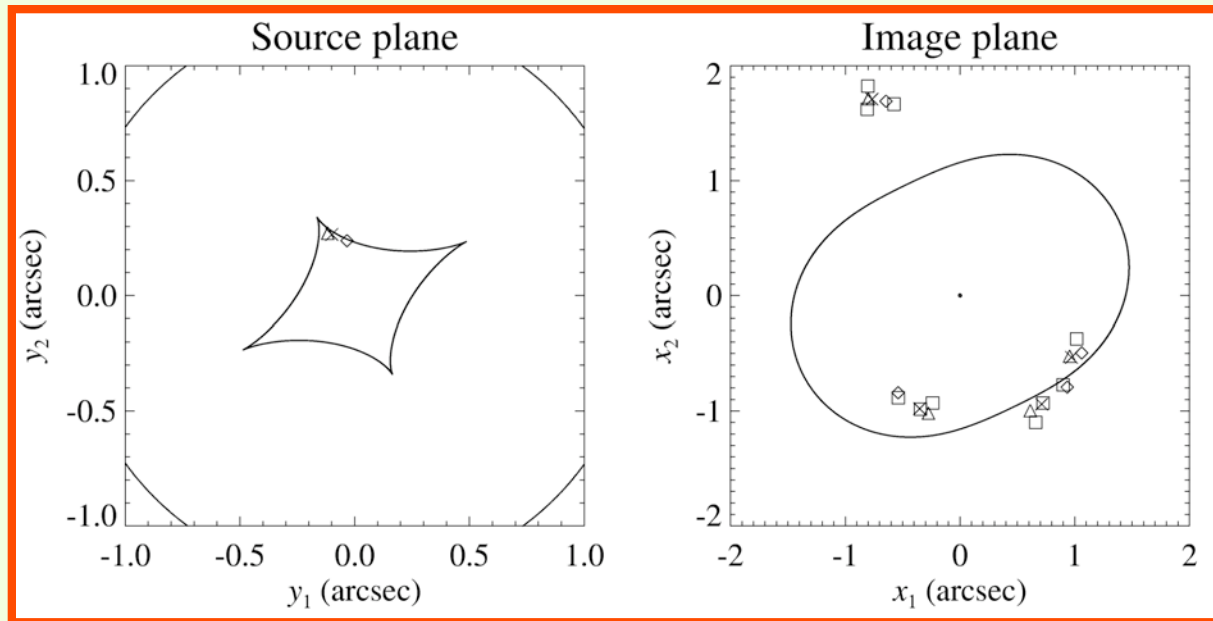
Twelve images

Best-fit parameters for several models.

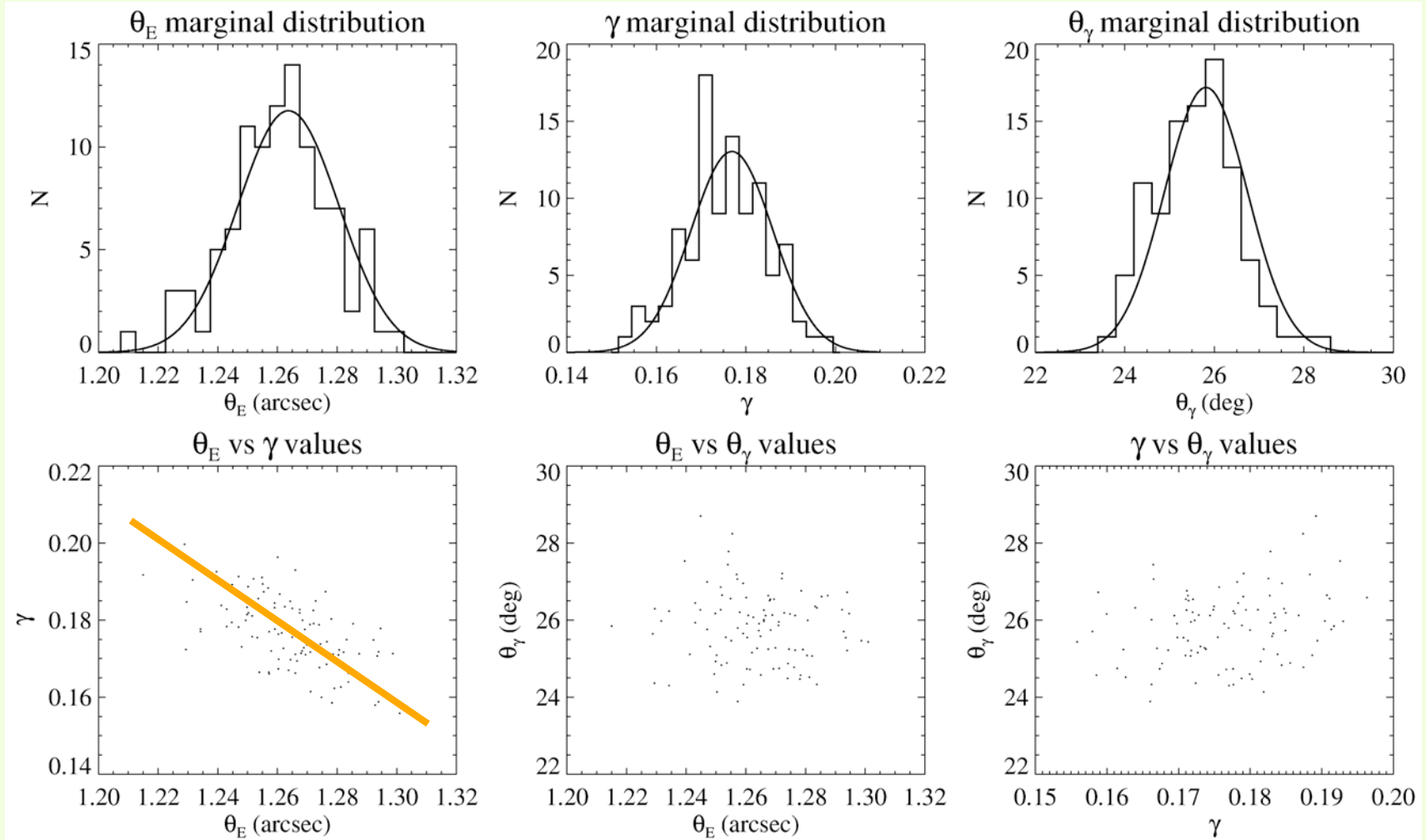
^a Ellipticity or external shear values, depending on the model.

^b The lens center is fixed to the galaxy center.

Model	θ_E (")	x_{1l} (")	x_{2l} (")	e/γ ^a	$\theta_{e/\gamma}$ ^a (°)	χ^2	dof
SIE ^b	1.87			0.441	25.1	37.5	15
SIE	2.19	0.10	-0.10	0.588	26.6	23.9	13
SIS+ES ^b	1.26			0.176	25.7	21.5	15
SIS+ES	1.22	0.01	-0.07	0.209	25.3	20.4	13



Model parameter uncertainties



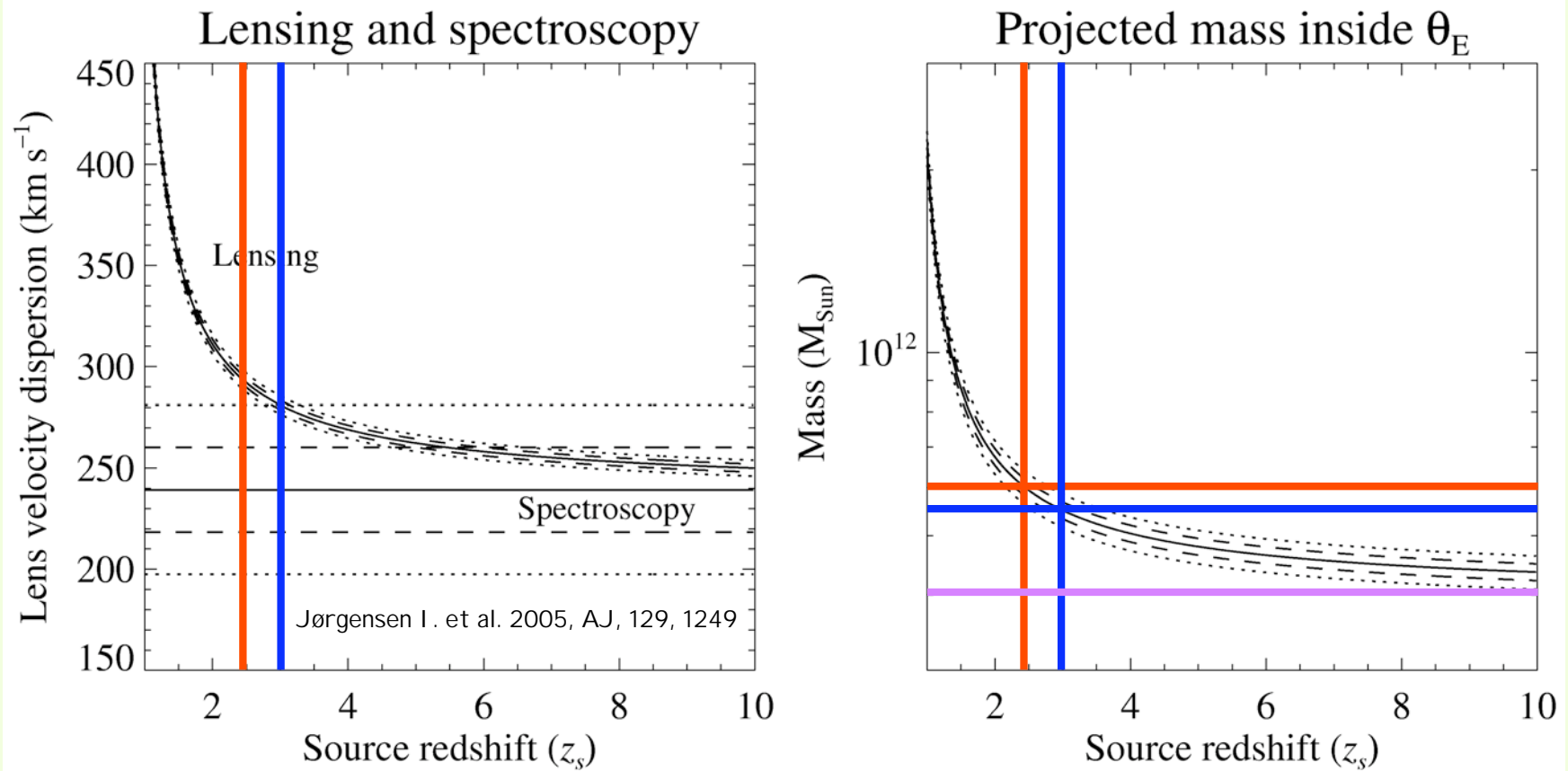
Statistical parameter uncertainties
from Monte Carlo simulations:

θ_E (")	γ	θ_γ (°)
1.26 ± 0.02	0.176 ± 0.009	25.7 ± 0.9

The source redshift and the projected mass

At $z_l = 0.82$, $R_E = 9.54 \pm 0.15$ kpc.

$$\theta_E = 4\pi \left(\frac{\sigma_v}{c} \right)^2 \frac{D_{ls}}{D_{os}}$$

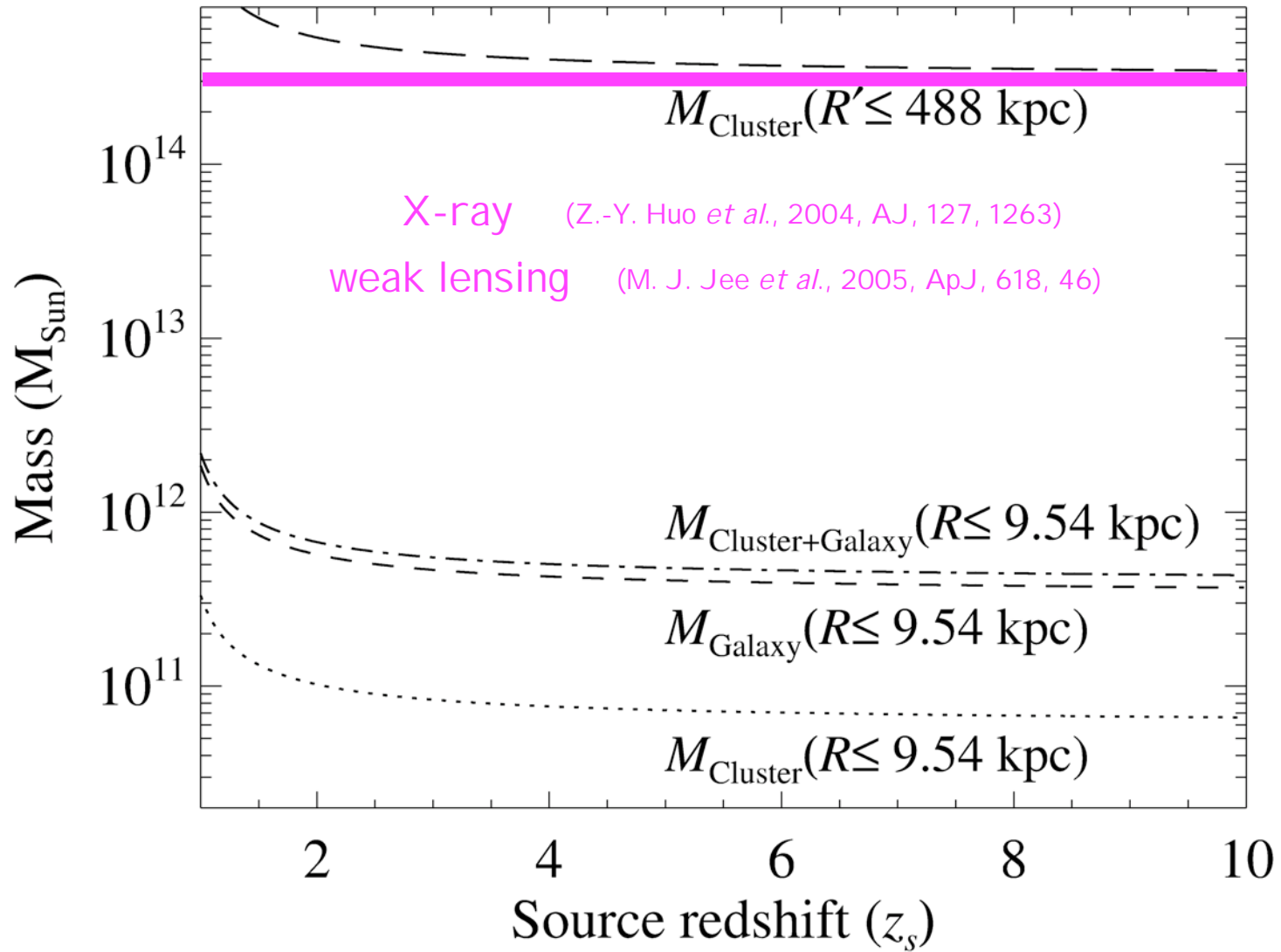


$z_s > 3.0$ at 95% CL $z_s > 2.4$ at 99% CL

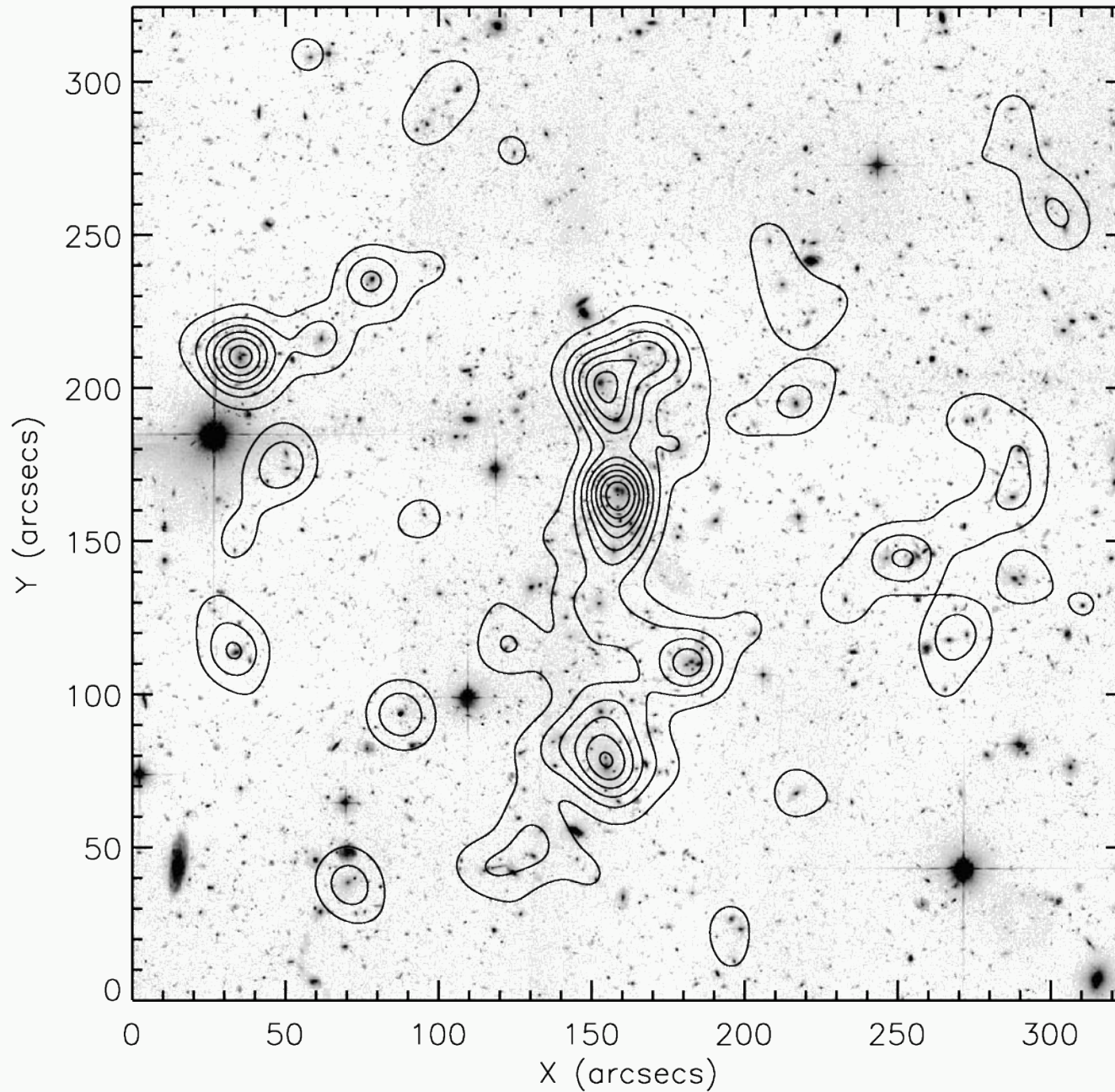
$M(R < 9.54 \text{ kpc}) = 4 - 6 \times 10^{11} M_{\text{Sun}}$

The galaxy in the cluster

Mass estimates

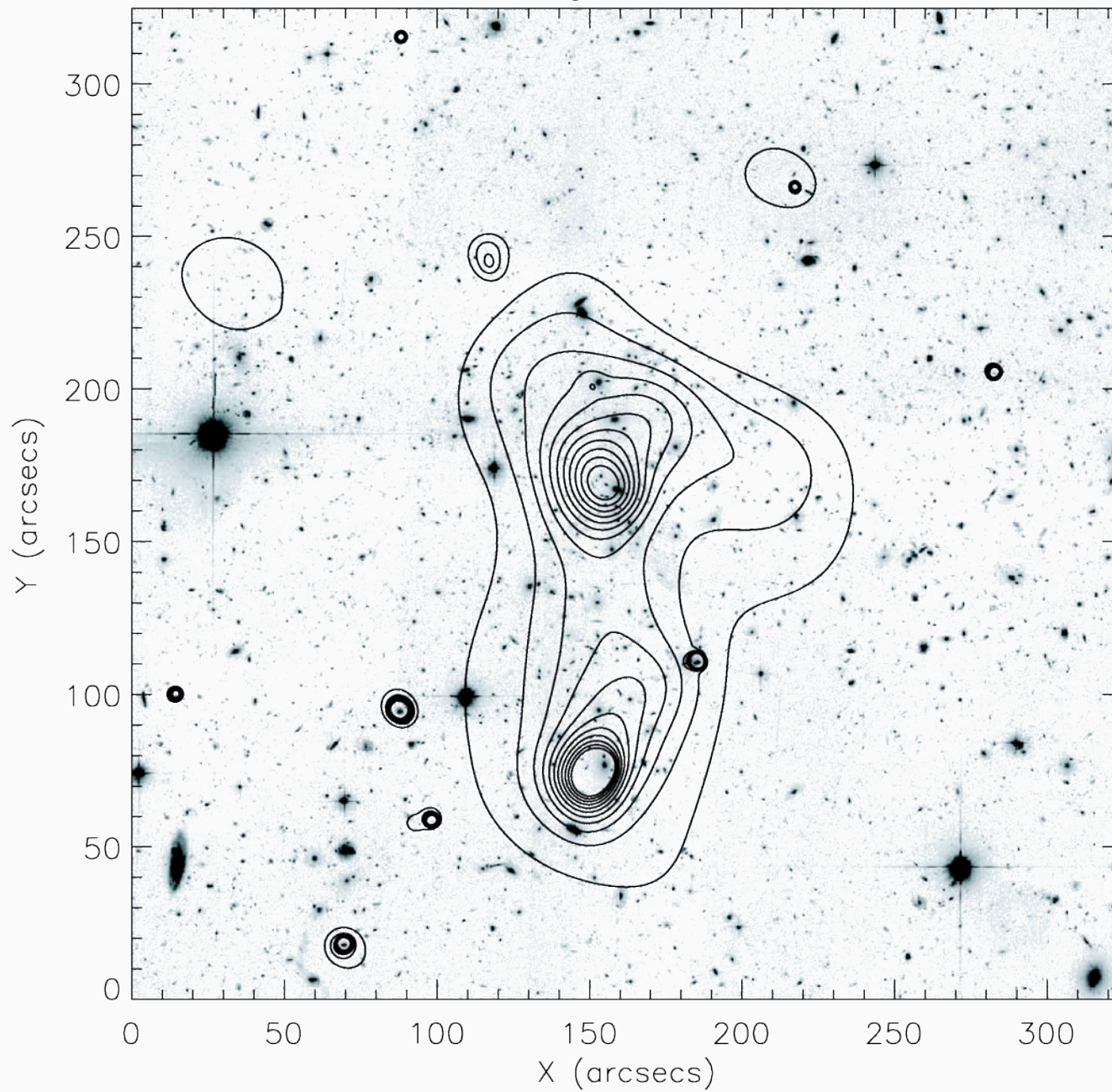


Luminosity map



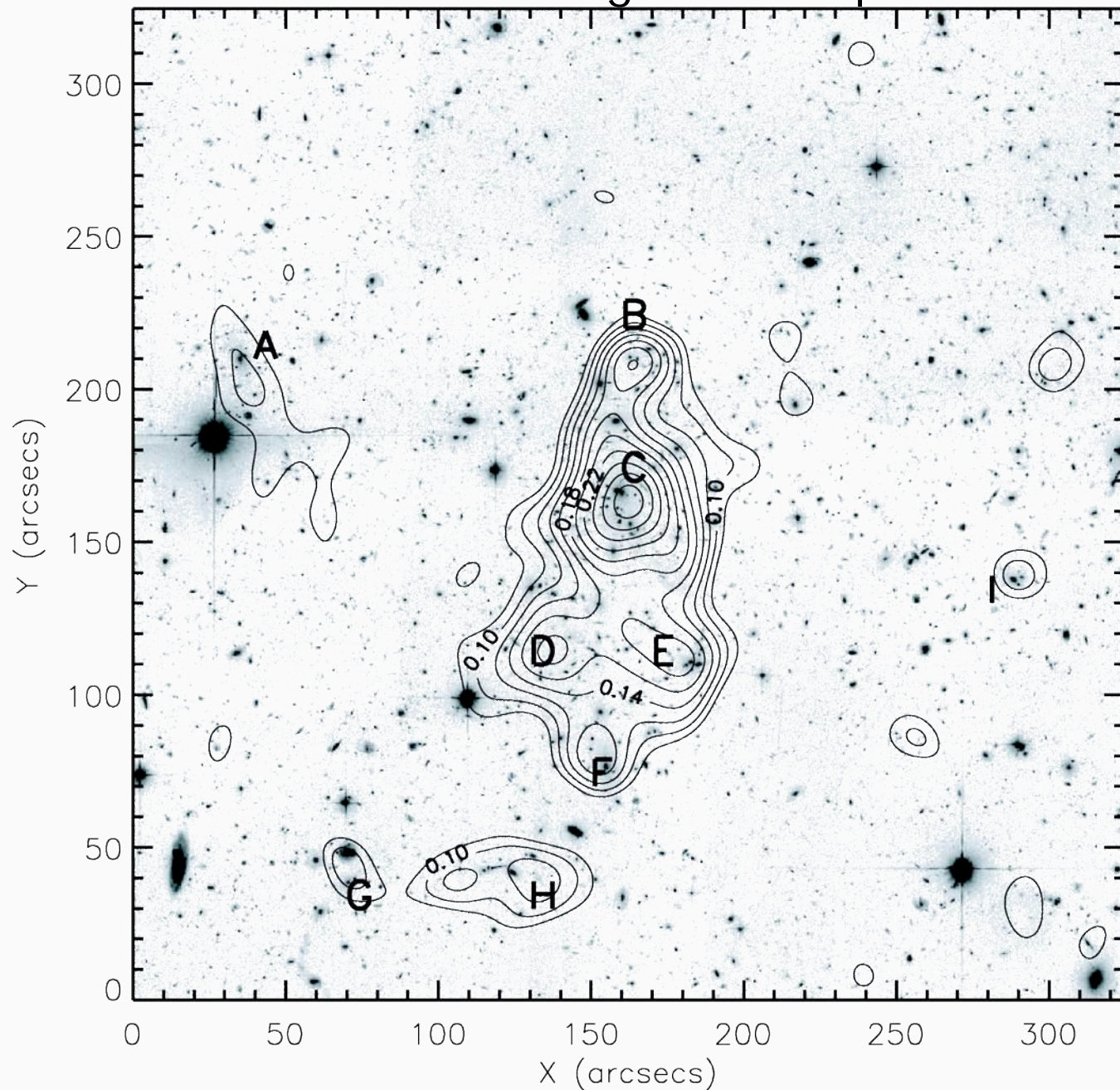
(M. J. Jee *et al.*, 2005, *ApJ*, 618, 46)

X-ray map



(M. J. Jee *et al.*, 2005, *ApJ*, 618, 46)

Weak lensing mass map



(M. J. Jee *et al.*, 2005, *ApJ*, 618, 46)

Strong lensing mass map



A deep-field astronomical image showing a vast field of galaxies. The galaxies are scattered across a dark, black background. Many galaxies are yellow or orange, while others are blue or red. Some galaxies are bright and prominent, while others are faint and small. The overall appearance is a rich, multi-colored population of galaxies. In the center of the image, the text "- THE END -" is overlaid in a bright orange color.

- THE END -