# Strong Lensing Analysis of the Cluster RCS0224-0002 at z=0.77

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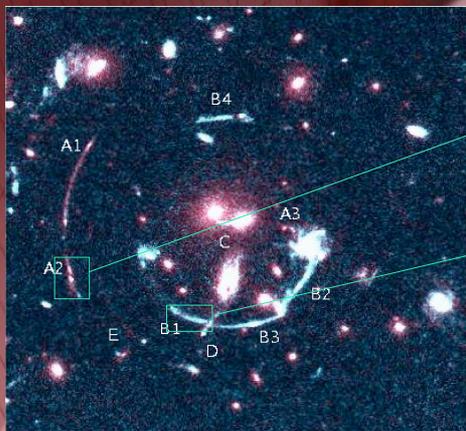
F606W/F814W HST picture of the Cluster RCS0224 with labelled arcs

The Method:
1) Source size minimization
2) Image plane minimization using Modified Hausdorff Distance
3) MCMC for fine tuning and error estimates

Arcs reproduced by the best fit model consisting of two isothermal non-singular ellipsoids to reproduce global cluster properties (NIE1, NIE2); eight isothermal non-singular spheres fixed at the position of cluster members (NIS1..8) - refereed to as the substructure; one non-singular ellipsoid, corresponding to the elongated object marked D in Fig.~1 (NIE3).

z=4.87

z=2.65*
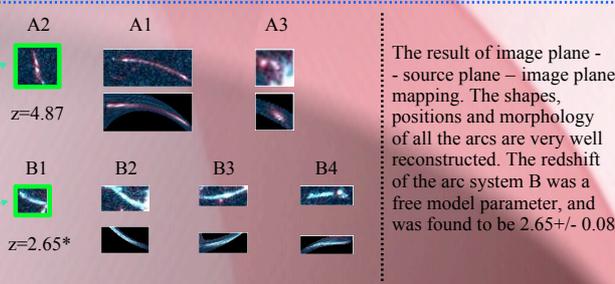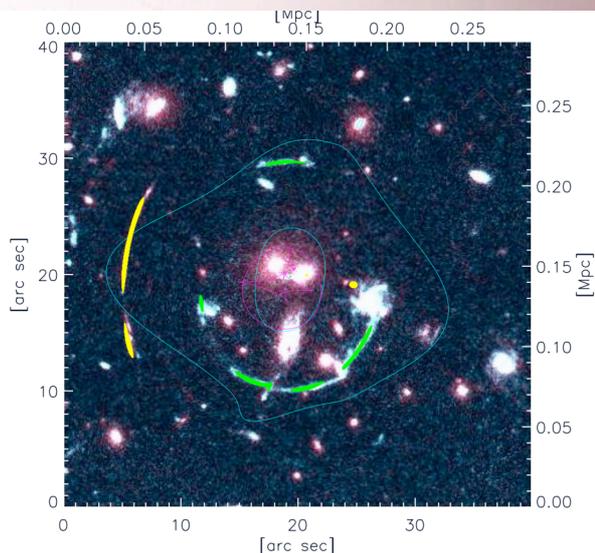
The result of image plane - - source plane – image plane mapping. The shapes, positions and morphology of all the arcs are very well reconstructed. The redshift of the arc system B was a free model parameter, and was found to be 2.65+/- 0.08.
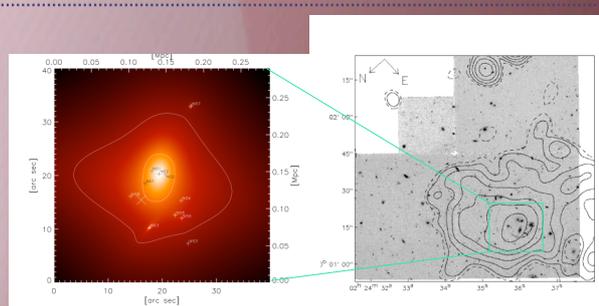
The reconstructed mass profile compared with X-ray emission. There is a ~5 arcsec shift between the centre of the mass density and highest X-ray emission. The figure to the left shows the mass profile with "+" marking the subcomponents positions and "X" marking the centre of the X-ray emission. The figure to the right shows X-ray emission contours.
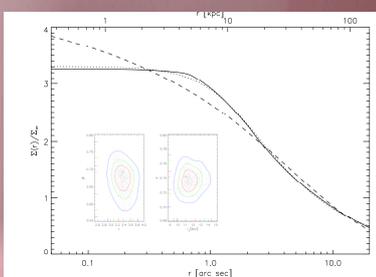
Radial average profile of the surface mass density of our best fit model (solid line) versus power law profile with $\gamma = 0.74$ (dotted line) and NFW-like profile with $\beta = 0.69$ (dashed line). Note that the radial profile has a very flat core, constrained by the central radial feature "C".
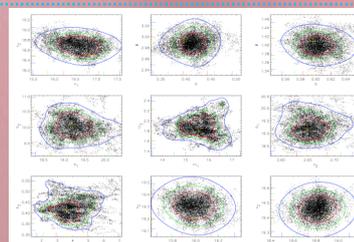
The Markov Chain Monte Carlo estimation of the model parameter errors. Most parameters are well constrained, however the M/L for the substructure has large error bars.

CONCLUSIONS:
* Using Modified Hausdorff Distance proved to be a good method for reconstructing the mass profile based on shapes of the arcs
* The three stage minimization is very efficient
* The reconstructed mass is $R_{200} = 1.9 \cdot 10^{14} M_{\odot}$ and is in a very good agreement with the X-ray mass ($1.7 \cdot 10^{14} M_{\odot}$)
* The slope of the mass profile is very flat
* There is a significant shift between mass and X-ray emission