Probing the density profile in the lens galaxy group SL2SJ02140-0532

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Limousin, M.   *Laboratoire d'Astrophysique de Marseille*

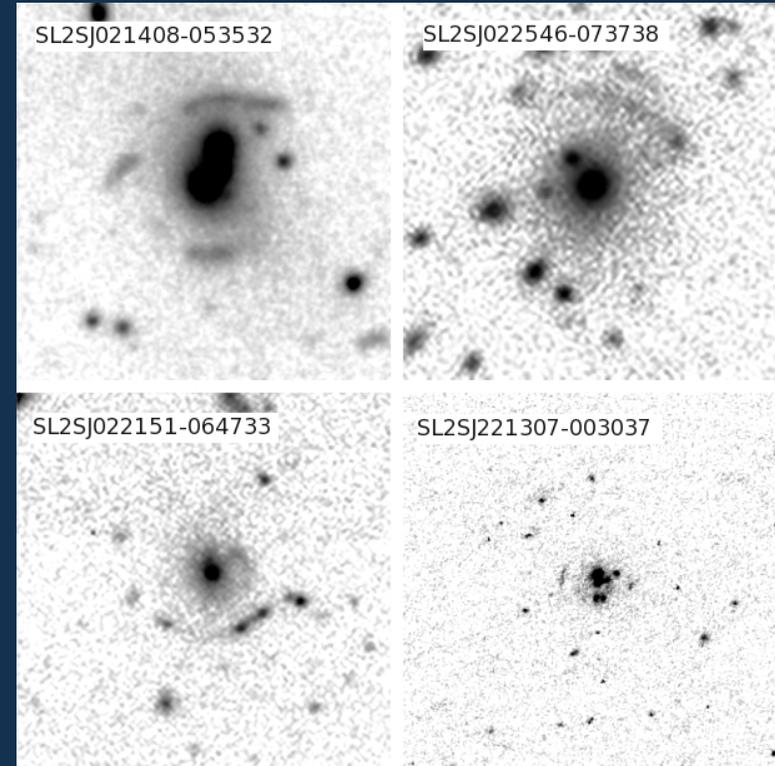Cabanac, R.   *Laboratoire d'Astrophysique de Tolouse-Tarbes*

Outline

- Introduction

    - We explain briefly the aim of this work

    - Our sample of groups

- SL2SJ02140 group

- Results

- Future work

- Summary

Why galaxy groups?

- The slope problem: The DM follows a Universal NFW profile

  $\alpha = 1$ (Navarro et al. 1997)

  $\alpha < 1$ (e.g. Sand et al. 2002)

- Looking the answer at the intermediate regime of the mass spectrum

  ✔   Less complex than clusters

  ✖   Less constraints than in clusters

- Our sample

  20 groups from CFHTLS-SL2S

  0.35 < z < 0.88

  8 with spectroscopic data (VLT-FORS2)

  See the poster of Verónica Motta

- The goal: *Join Dynamics, SL and WL*

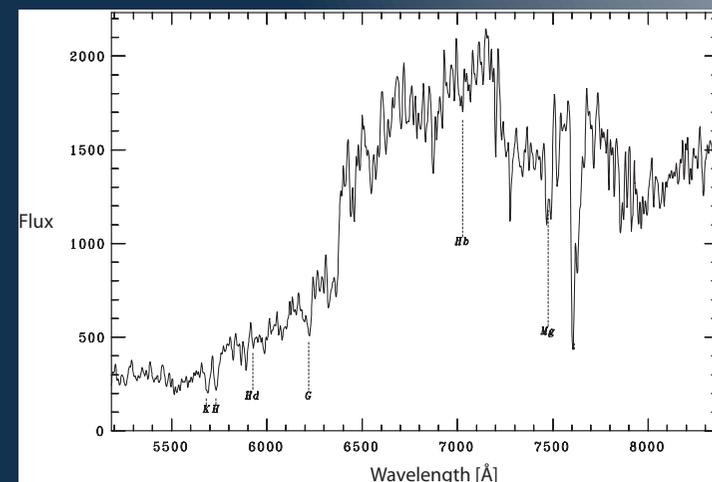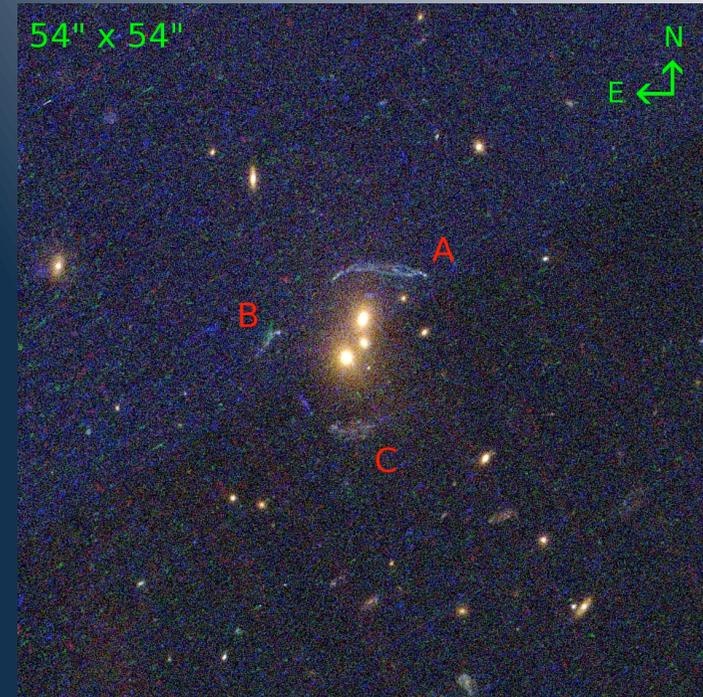SL2SJ021408-053532 SL2SJ022546-073738

SL2SJ022151-064733 SL2SJ221307-003037

SL2SJ02140-0532

$z_G = 0.444 \pm 0.001$

$z_{A-B} = 1.7$ (photometric), $z_c = 1.0$

$\sigma_* = 216$ km/s

$\sigma_{Group} = 680 \pm 175$ km/s, with 14 secure members

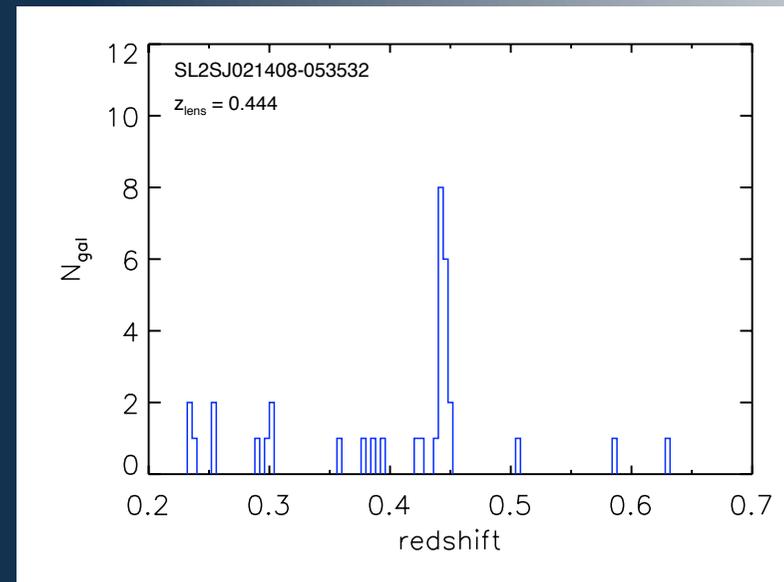$\sigma_{WL} = 612\ ^{+180}_{-264}$ km/s (Limousin et al.,2009)

SL2SJO2140-0532

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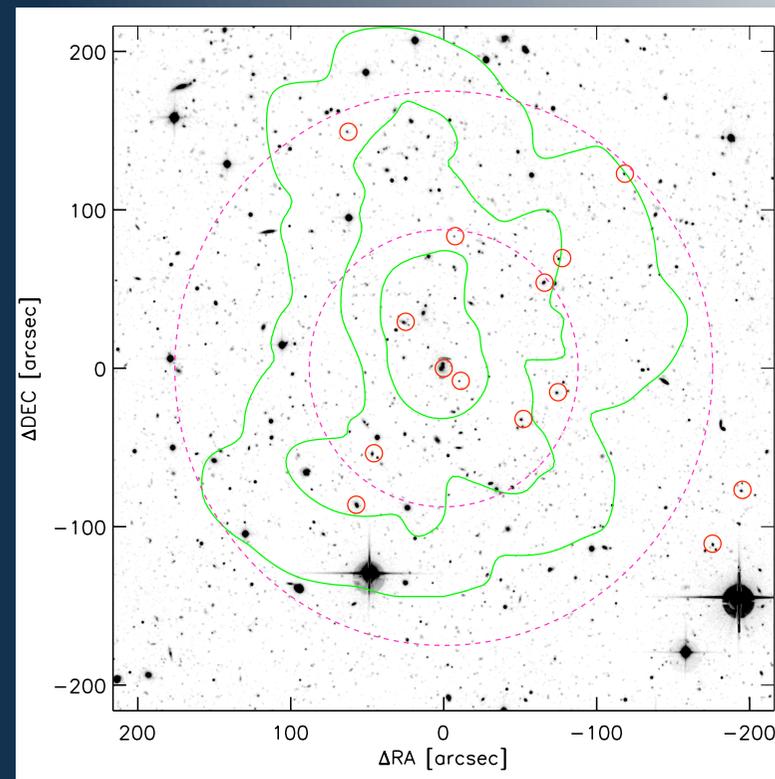$\sigma_{Group} = 680 \pm 175$ km/s, with 14 secure members

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The luminosity maps are in agreement with the spatial distribution of the 14 members

Strong lensing model

Our models

- Substructure ➜ Four systems

- Generalized NFW

$$\rho(r) = \frac{\rho_s}{(r/r_s)^\alpha (1 + r/r_s)^{3-\alpha}}$$

- Two models
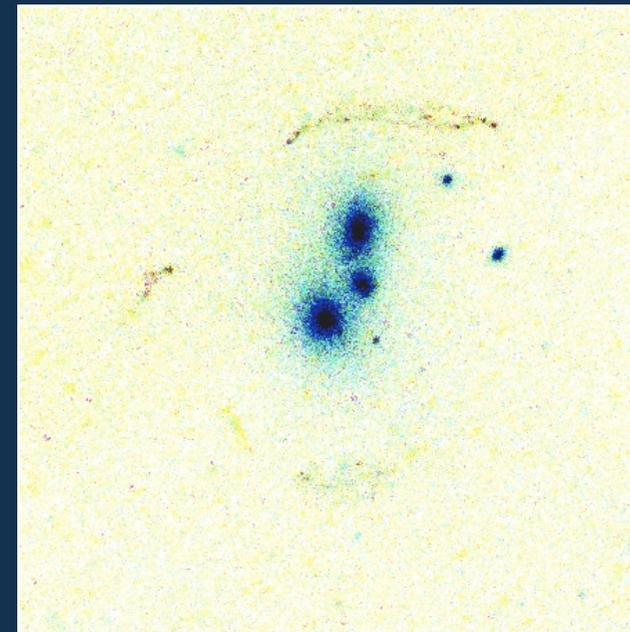
  I .- One single halo

  II .- One halo + 3 Galaxies

     - Scaling relations

- Alard 2009

  - One source

  - Bimodal mass distribution

  - Matter don't follow light

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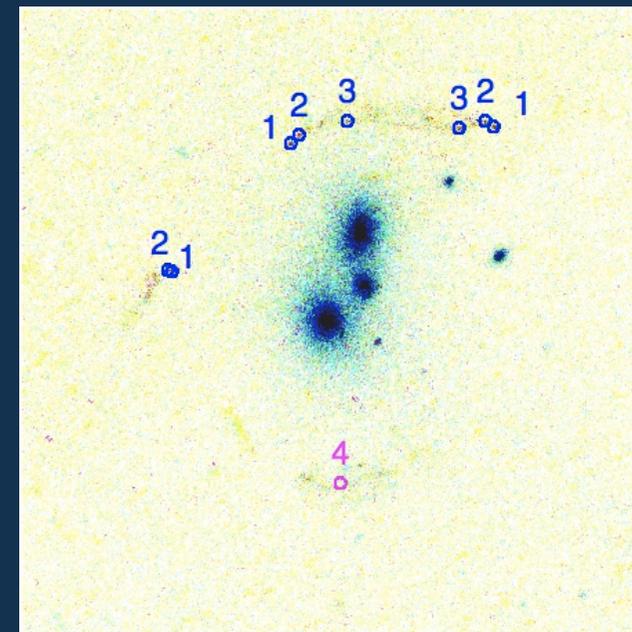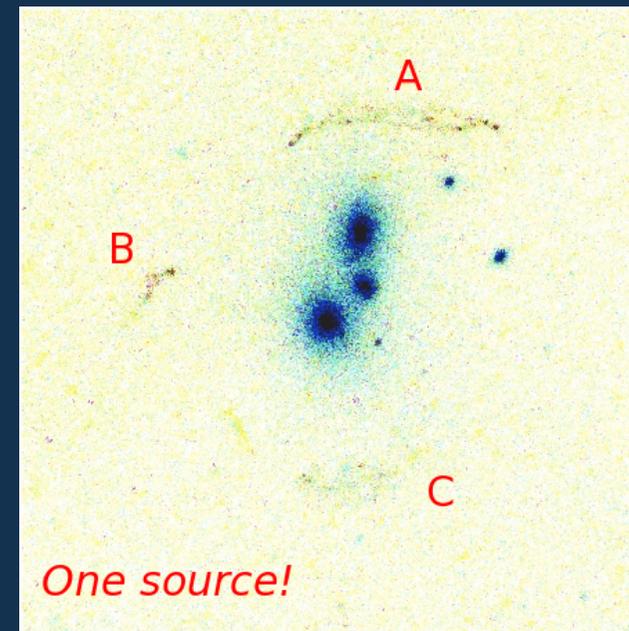
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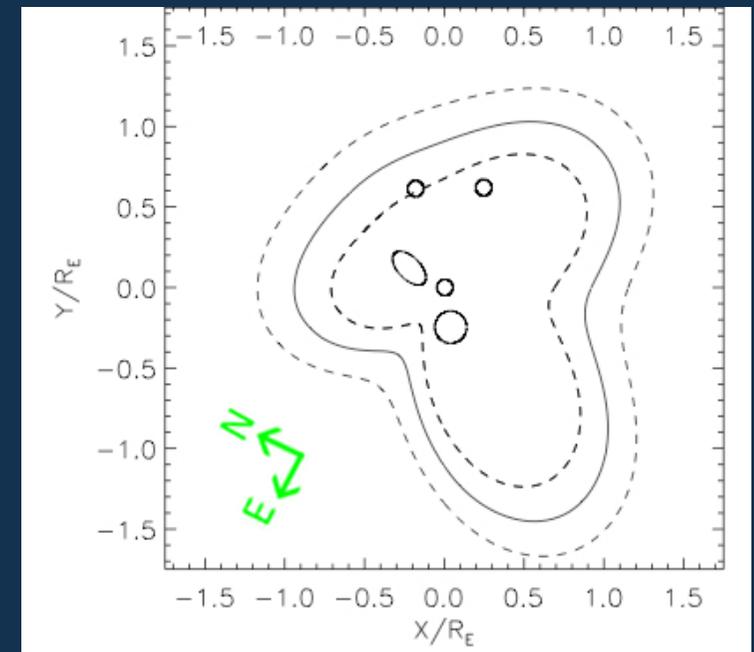
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No evidence of a central image

Results

Model I

$\chi^2 = 0.62$

r_s = 129 ± 40 kpc

θ = 111 ± 1 ➡ *In agreement with LC*

α = 1.0 ± 0.2

Model II

$\chi^2 = 0.4$

r_s = 227 ± 51 kpc

θ = 114 ± 1

α = 0.4 ± 0.2 ➡ *Shallow slope!*

*It is possible to reproduce the features
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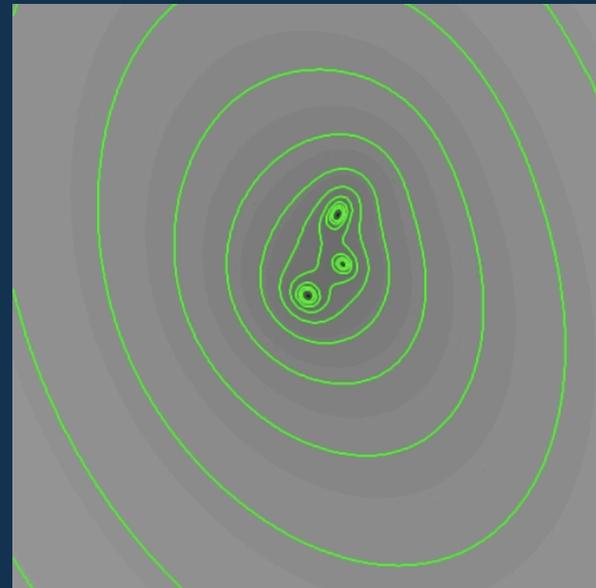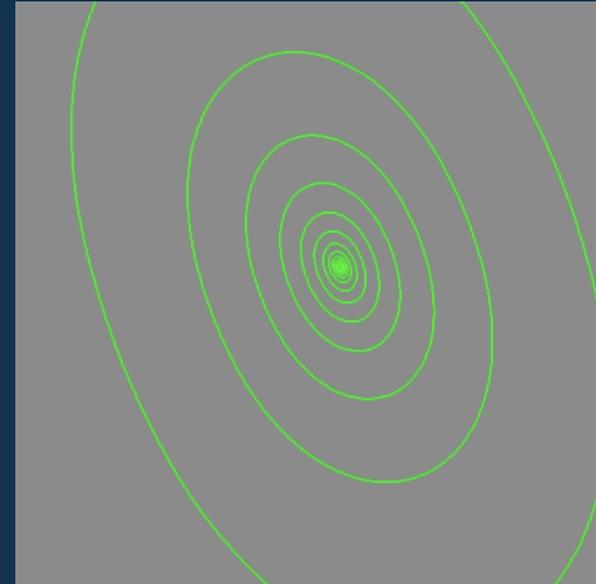
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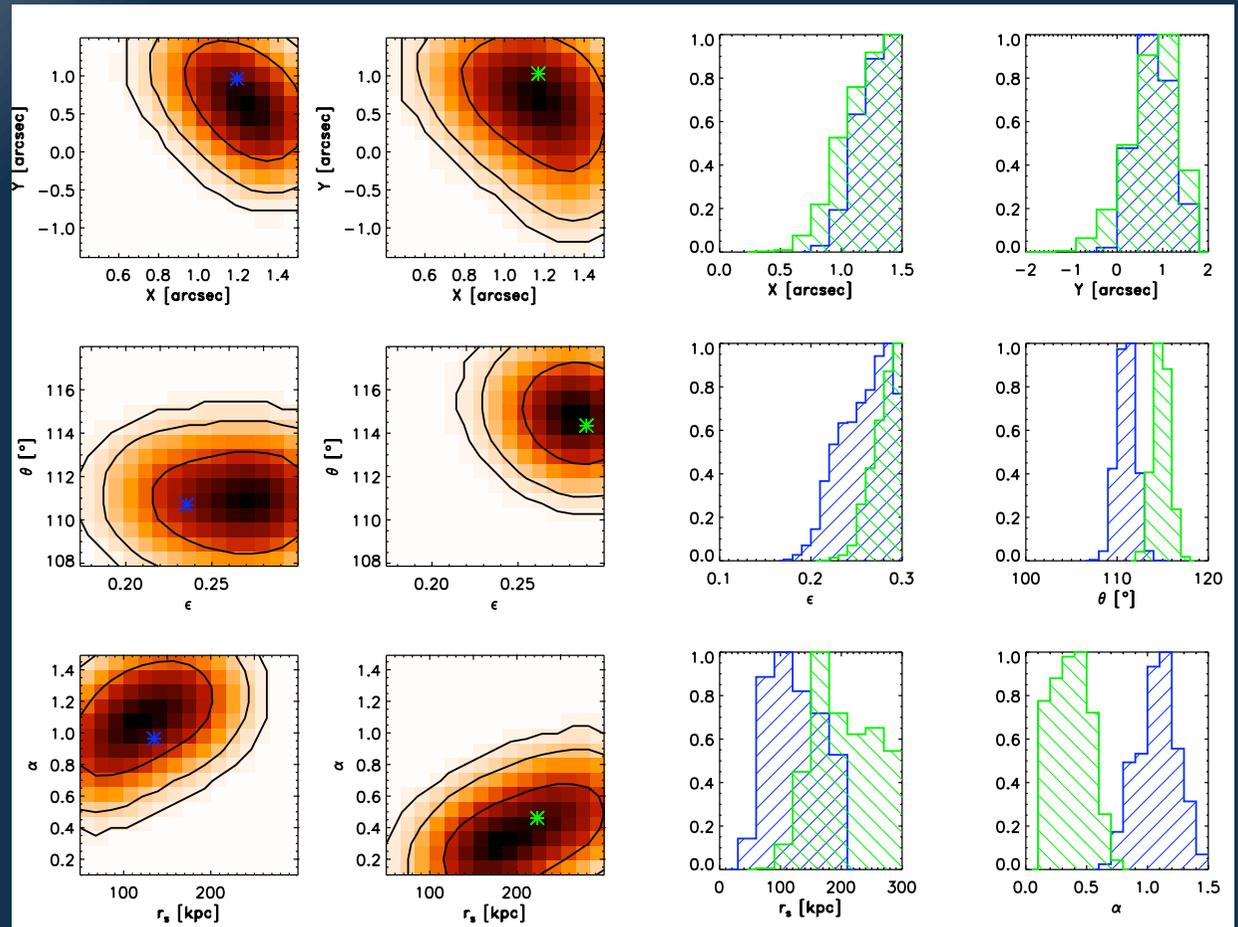
In the same range

$\alpha > 1$ ➜ $r_s > 300$ kpc
Degeneracy in $\alpha - r_s$

Model I   Model II

How we can brake the degeneracy?
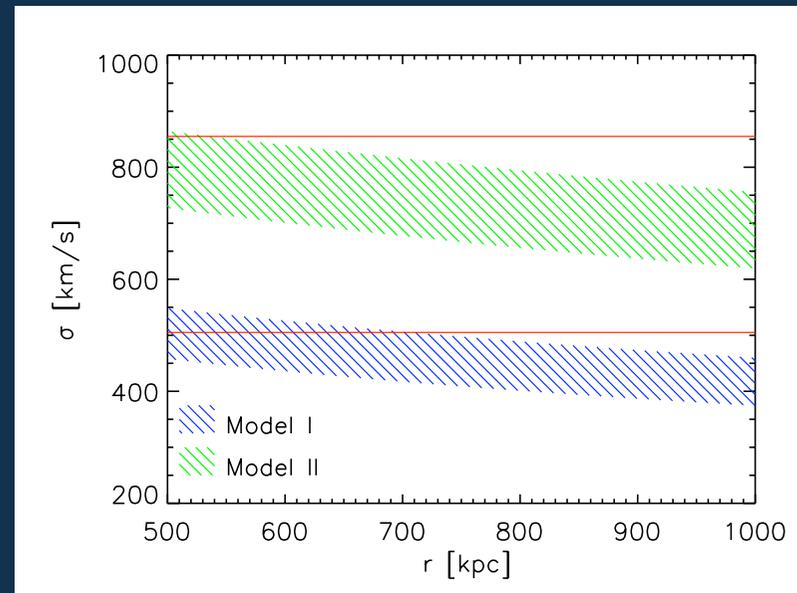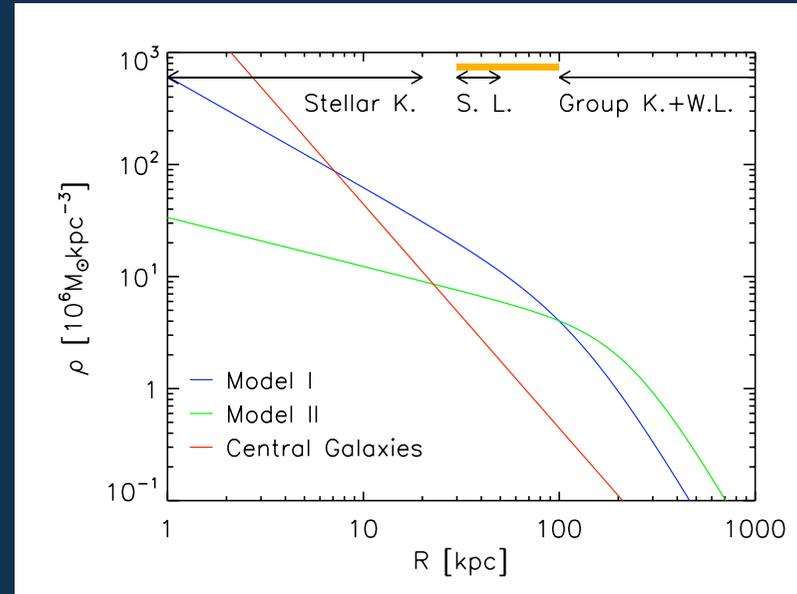
Results

Some limitations:

Given the mass in groups we don't expect to get a weak lensing signal enough that could allow us to fully probe a NFW profile

The constrained region by SL is smaller than in Clusters

A possible solution:

Use the velocity dispersion of the group as a new constraint in the model

Power law $\rho/\sigma^3 \propto r^{-\alpha}$, $\alpha = 1.8$
(Taylor & Navarro, 2001)

Future Work

- Implement the dynamic information of the group in the modeling, as well as the WL constraints

- Model those groups for which we have and we can obtain spectroscopic data

- Study a significant sample of lens galaxy group in order to characterize their dark matter profiles

As an additional work we are studying the dynamics and evolution in our groups (see Veronica Motta poster)
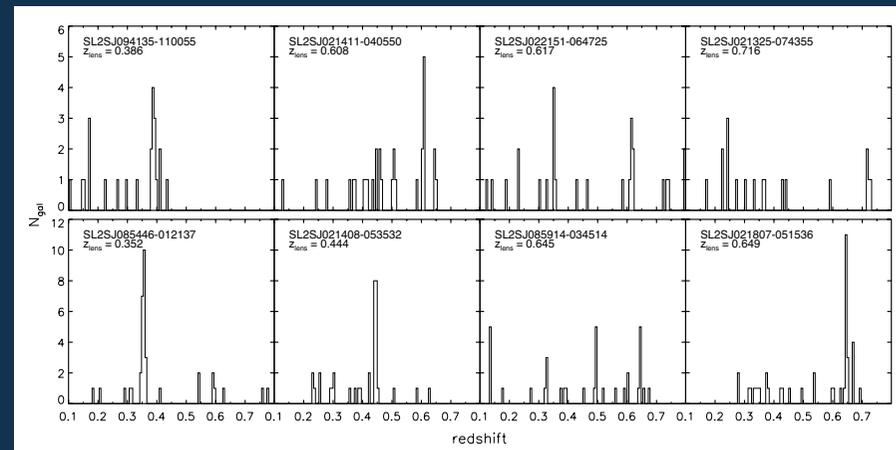
Summary

- ✓ Our models predicts an image configuration that is in good agreement with observations
- ✓ The results stand out the importance of spectroscopic data in order to avoid complex mass distributions models
- ✓ When we include the galaxies in the models, we found a shallower slope (α < 1). A strong degeneracy is still present in the models
- ✓ A possible solution to break the degeneracy is the combination of the cluster dynamics as well as WL information