Combining Weak and Strong Lensing in Galaxy Cluster Mass Reconstruction

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with:
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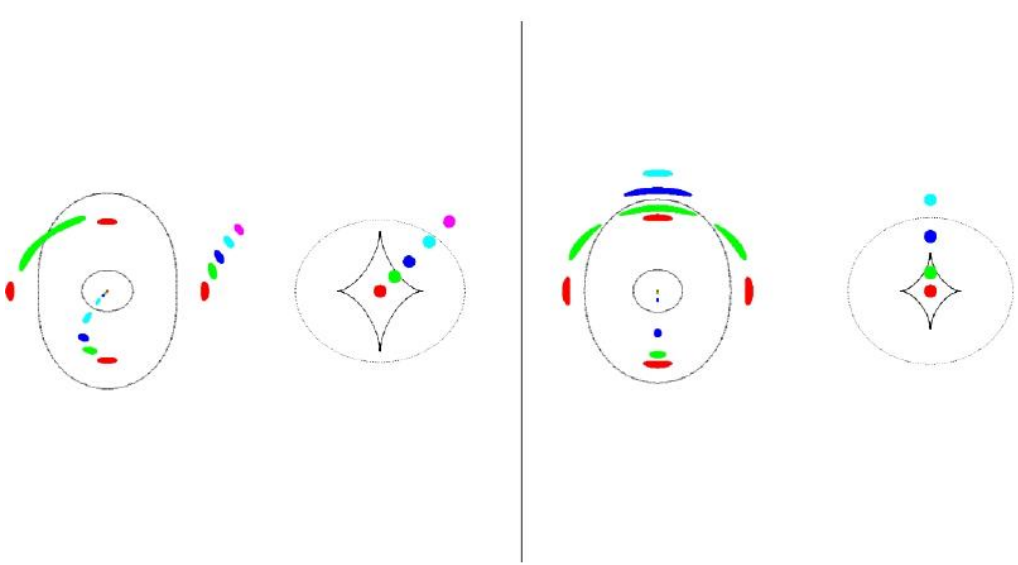
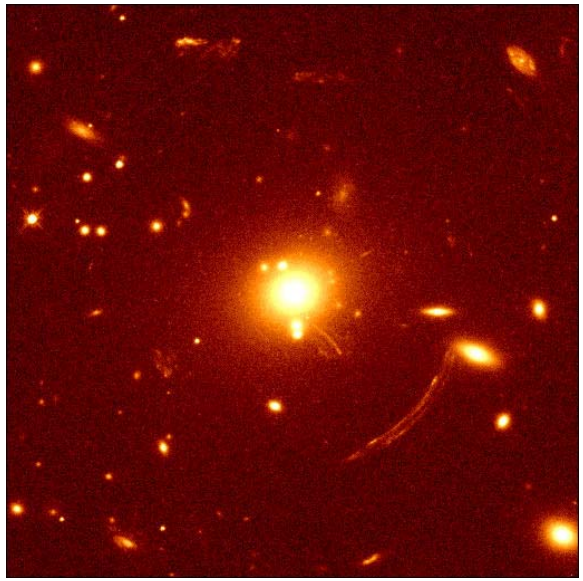
Gravitational lensing





Weak lensing

- Slight image distortions of background galaxies.
- Galaxies also carry intrinsic ellipticity.
  $\Rightarrow$ Weak lensing has to be treated statistically.

Strong lensing

- Strong distortions of background galaxies to giant arcs or even rings.
- Takes place only near the core.
  $\Rightarrow$ No reconstruction on full scale possible.

The Reconstruction Method (JM et al. 2009)

In our reconstruction method we try to combine the advantages of both lensing regimes into a joint method:

- Fully non-parametric, adaptive grid method (no initial model necessary).
- Reconstruction quantity is the lensing potential ψ.
- Maximum-likelihood method. We are searching for that lensing potential which is most likely to have caused the observations:

$$\chi^2(\psi) = \chi^2_w(\psi) + \chi^2_s(\psi)$$

- Input data are:
  1. Ellipticity catalogue
  2. Arc positions
  3. Flexion catalogue (given a reliable measurement, work in progress)
  4. Multiple image positions (Bradač et al. 2005-08)
- χ^2-function is the minimised with respect to the potential on every grid position.

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(Meneghetti et al. 2008)

- Use shapelet decomposition of real galaxies ($\sim$ 10000 from HUDF (b,v,i,z) and $\sim$ 3000 from GOODS (z).
- Use simulated clusters or analytic profiles to add lensing.
- Add sky background, instrumental noises and the PSF
- Produce a mock observation for different instruments.

ARI ITA LSW

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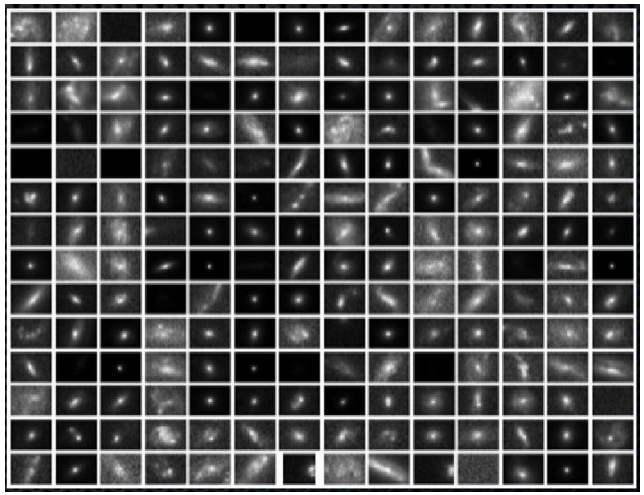

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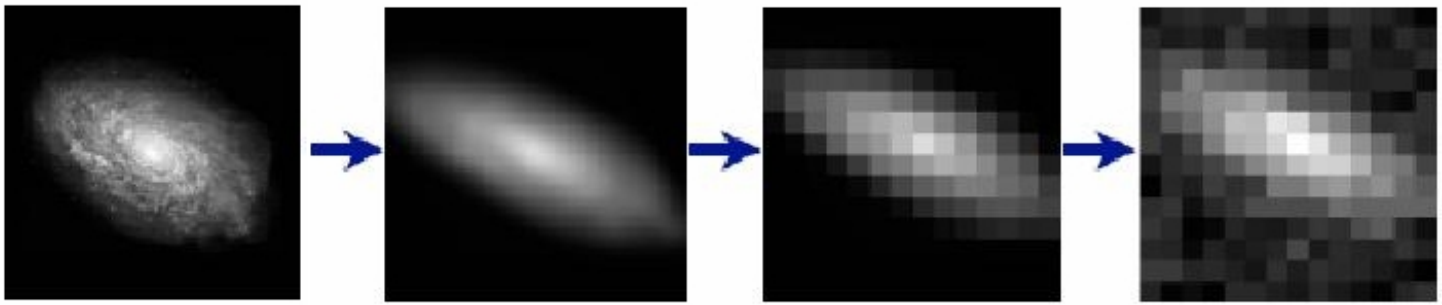

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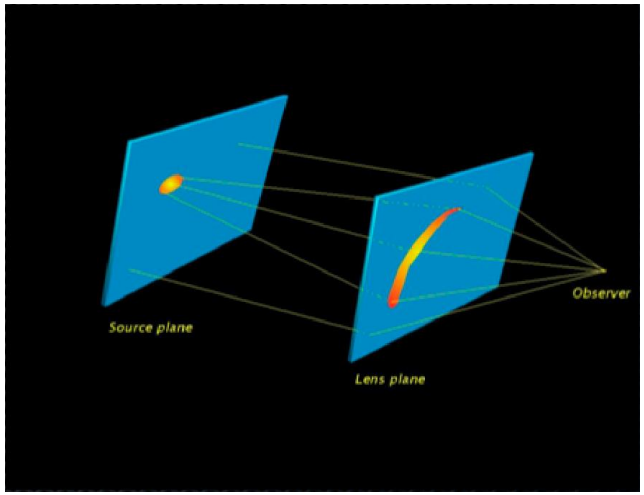

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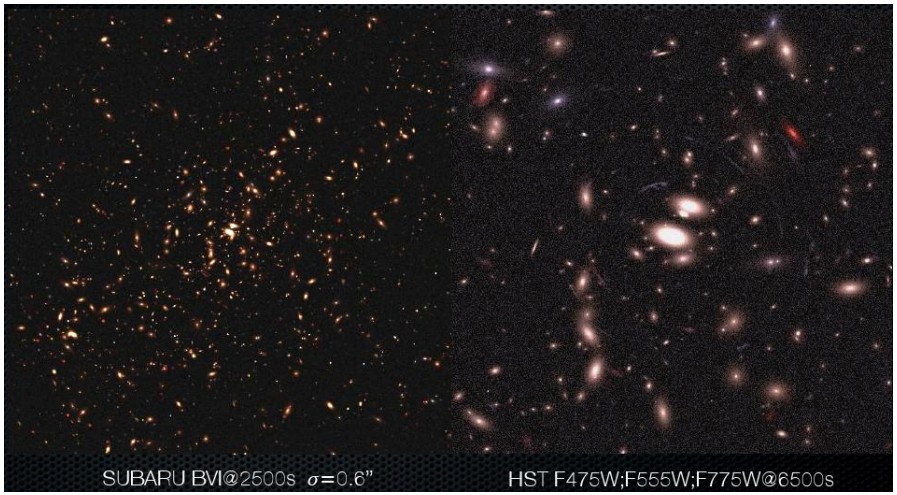

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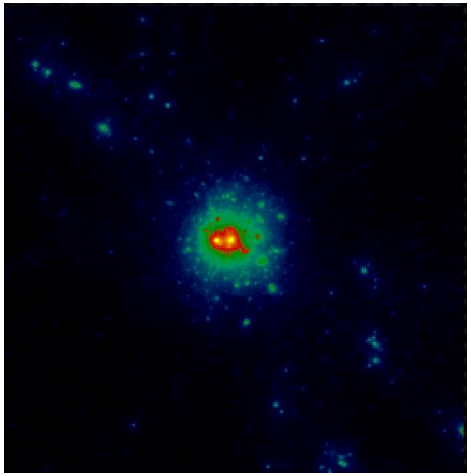
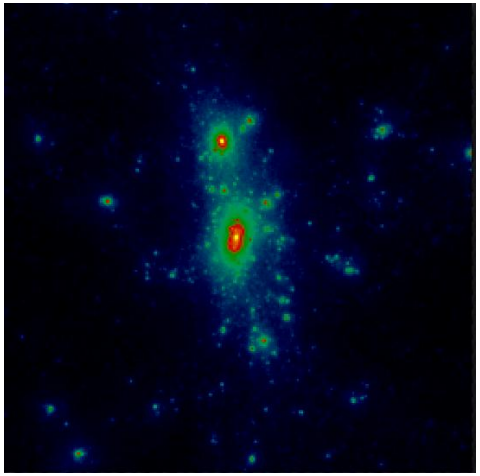
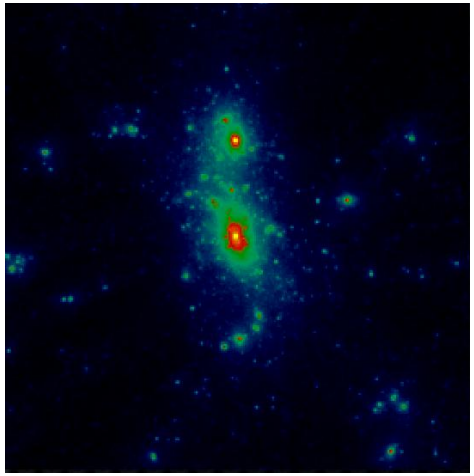
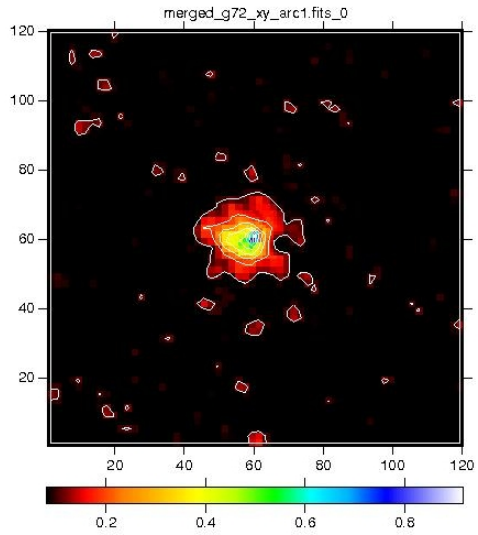
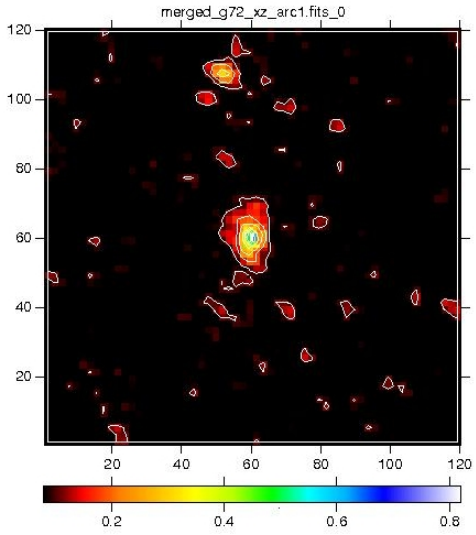
A Realistic Test: g72 (Meneghetti, Rasia, JM et al. 2009)

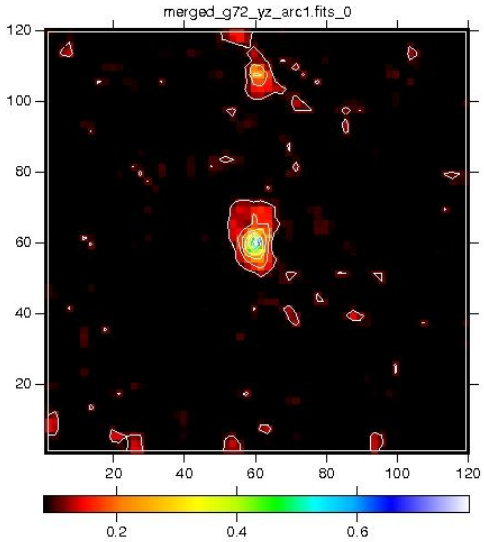












Quantitative Results (Meneghetti, Rasia, JM et al. 2009)