

# Simulations of Strong Lensing

UChicago, 09/05/2015

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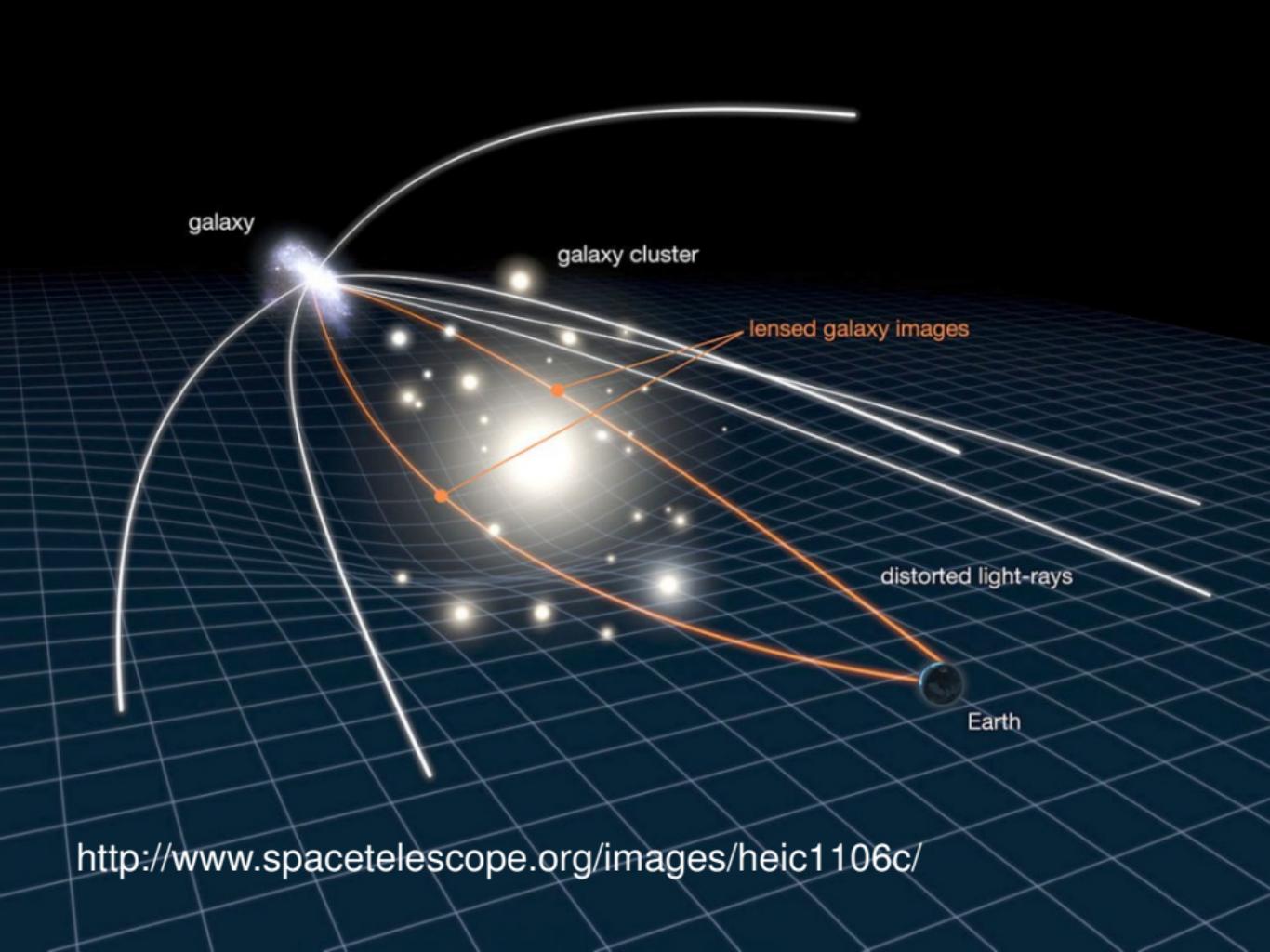
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In collaboration with:

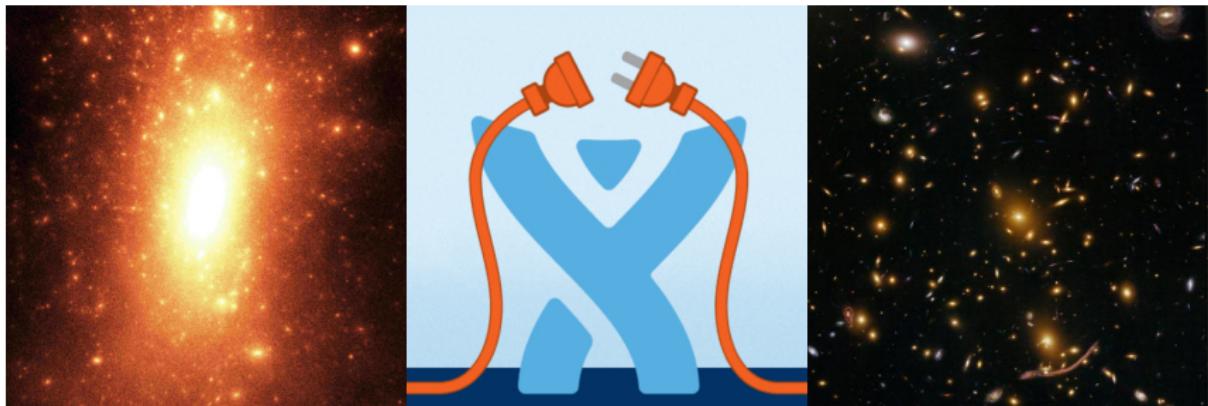
Mike Gladders, Salman Habib, Katrin Heitmann, Steve Rangel,  
Lindsey Bleem, Michael Florian, Hilary Child, Patricia Fasel.



<http://www.spacetelescope.org/images/heic1106c/>

# Simulations of Gravitational Lensing

What will happen?



Modified from figures on <https://www.atlassian.com>.

# Simulations of Gravitational Lensing

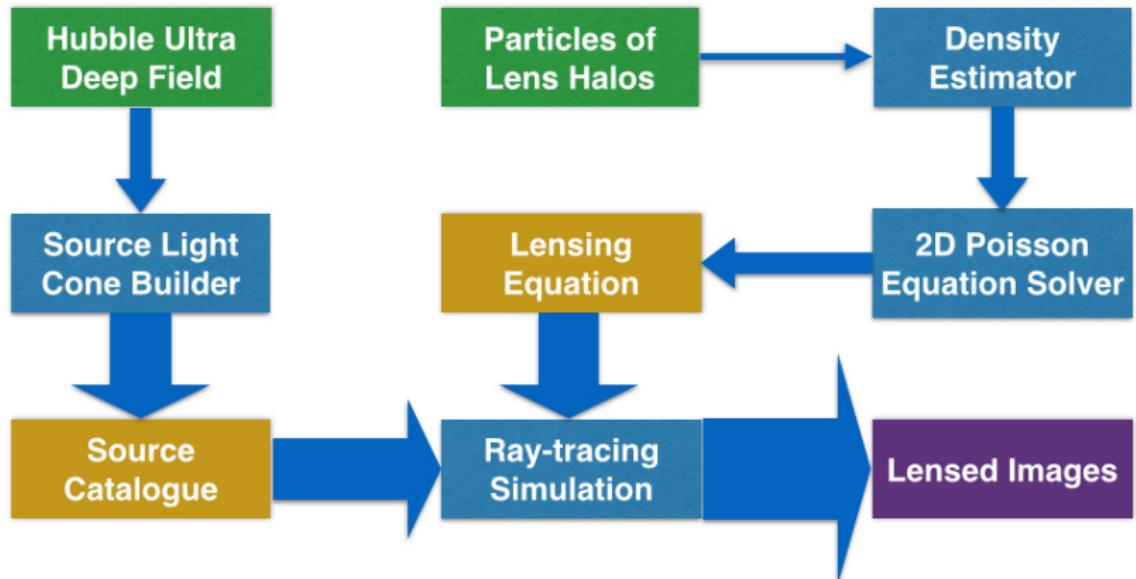
What will happen?



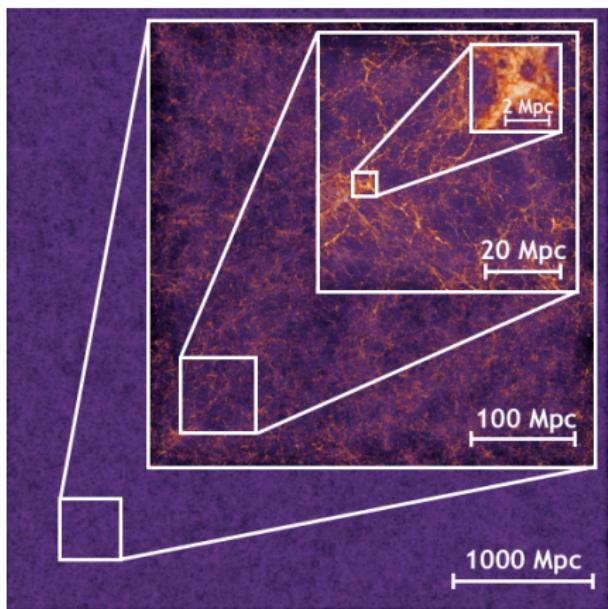
Modified from figures on <https://www.atlassian.com>.

# Producing Lensed Images

■ Data ■ Code ■ Output ■ Connector



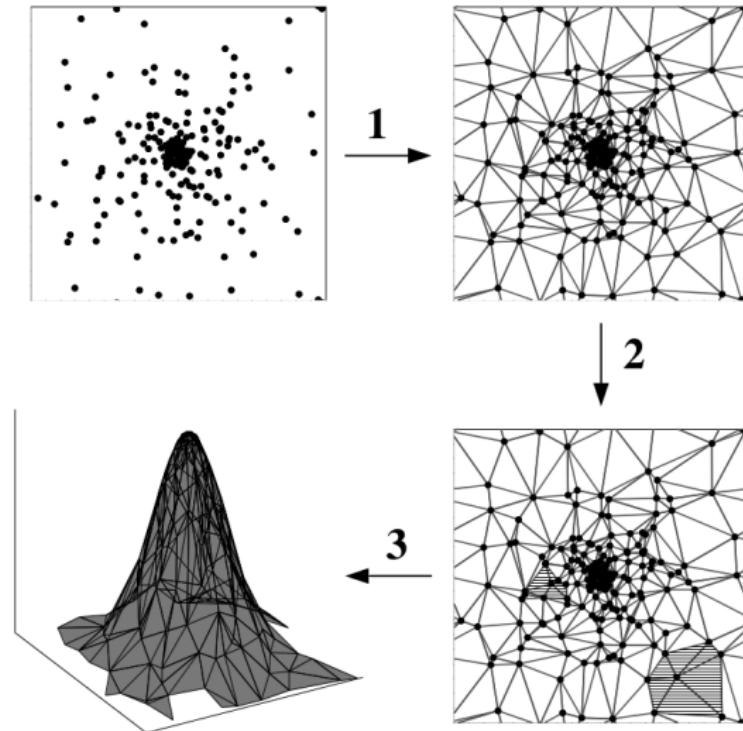
# The Outer Rim Simulation

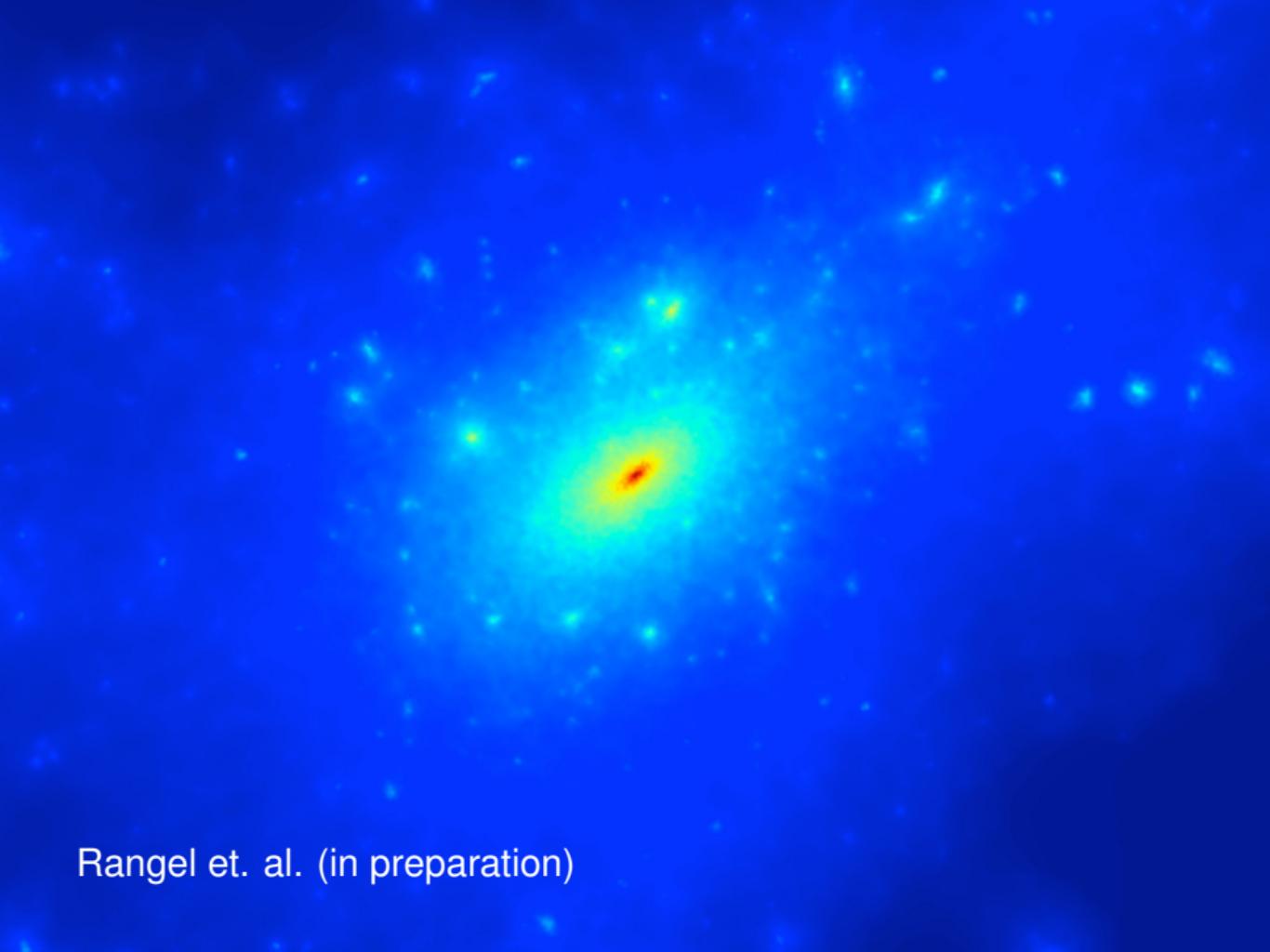


- $V_{\text{box}} = (3h^{-1}\text{Gpc})^3$ .
- $M_p = 1.85 \times 10^9 h^{-1} M_\odot$ .
- $N_p = 10240^3$ .
- 100 snapshots ( $z = [10, 0]$ ).

The Q Continuum Simulation is  
with higher mass resolution.  
Heitmann et.al. (2014)  
arXiv:1411.3396

# Density Estimation

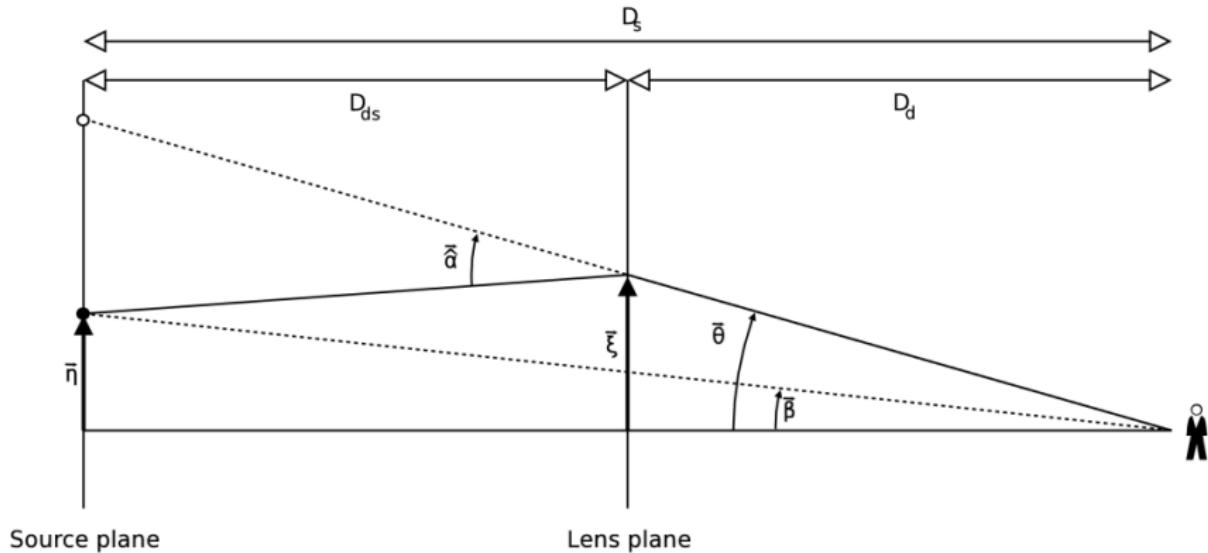




Rangel et. al. (in preparation)

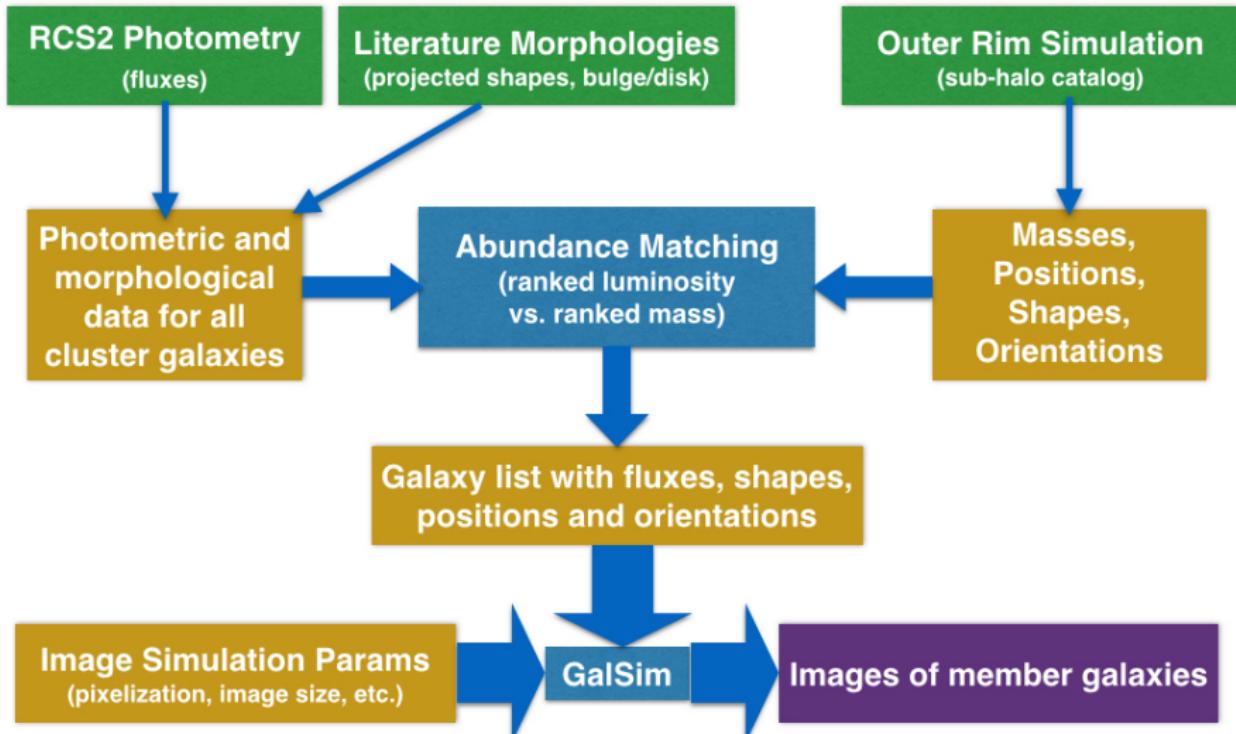
# Building Lensing Equation

- $\vec{\alpha}(\vec{\theta}) = \frac{1}{\pi} \int d^2\vec{\theta}' \kappa(\vec{\theta}') \frac{\vec{\theta} - \vec{\theta}'}{|\vec{\theta} - \vec{\theta}'|^2}.$
- $\beta = \theta - \alpha(\theta).$



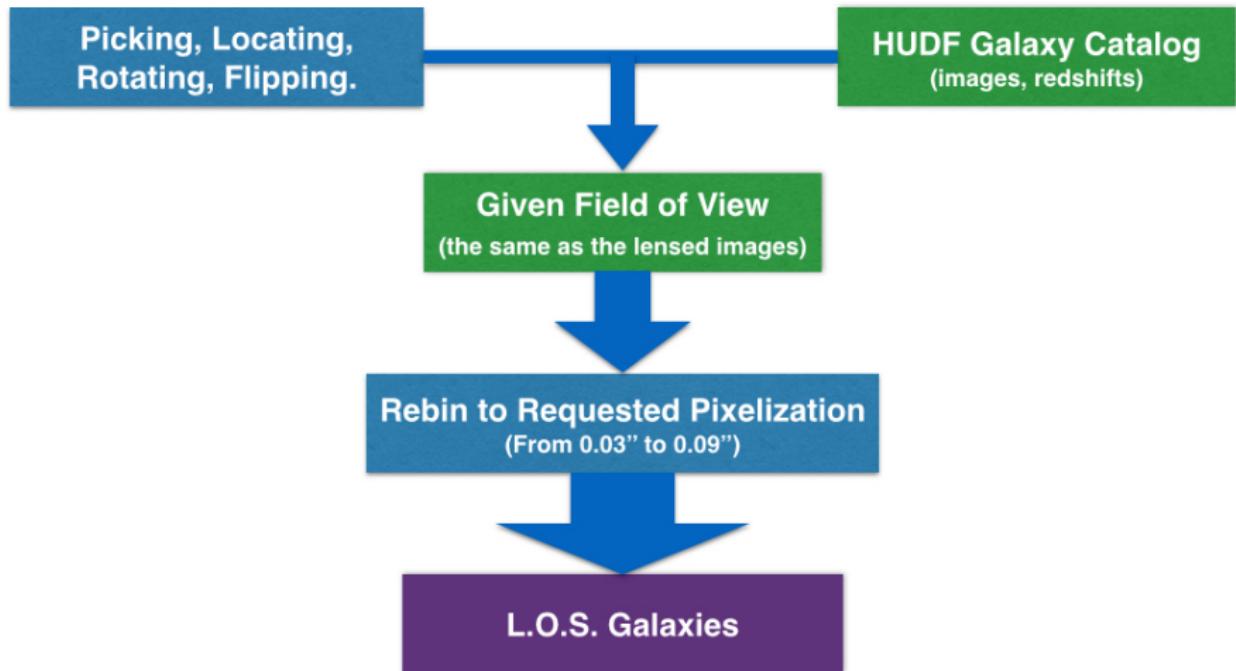


# Producing Images of Member Galaxies





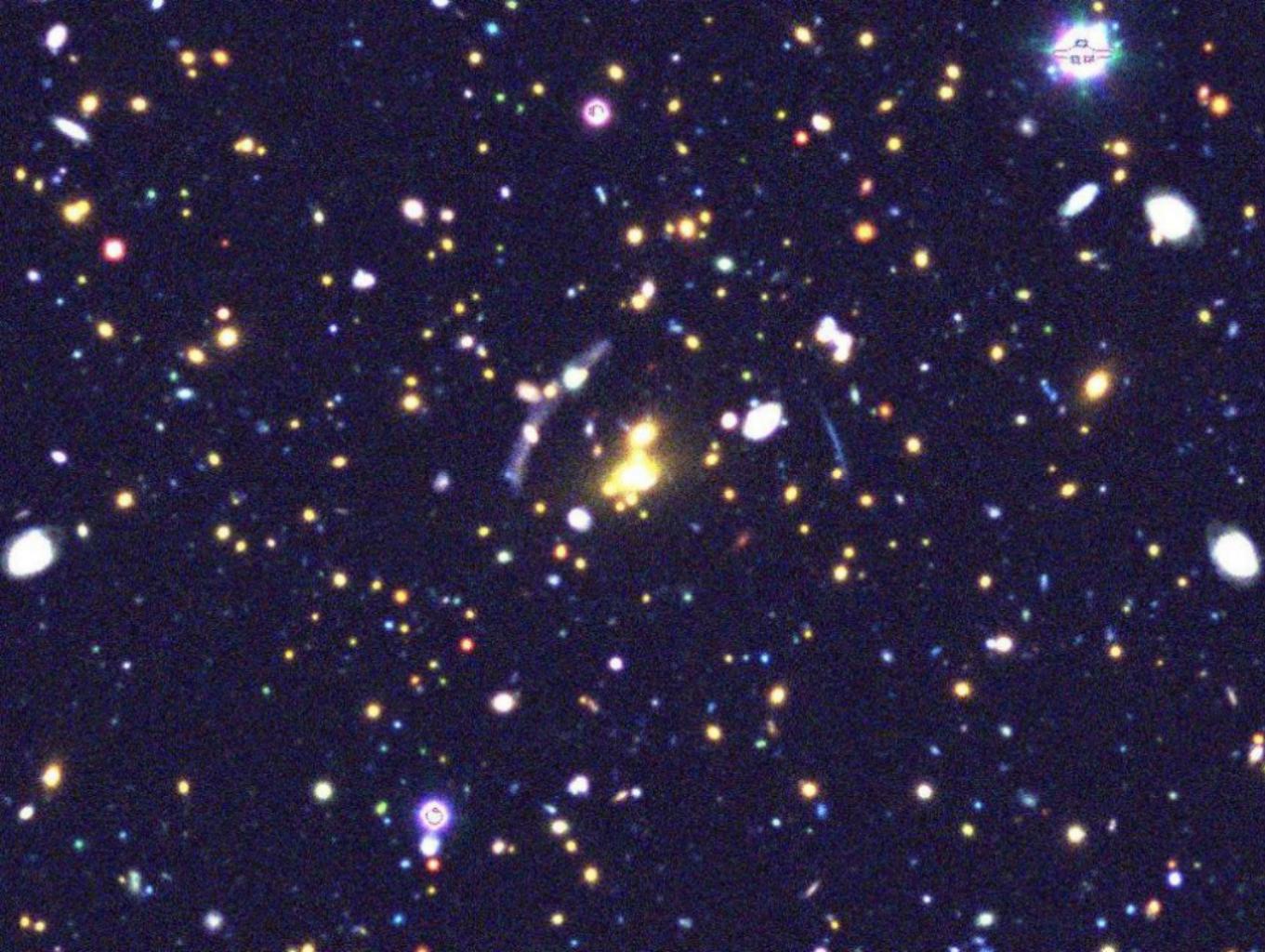
# Producing Images of L.O.S. Galaxies











## Current and Future Work

- 1 Lensing effects on the morphology distribution of the background source galaxies. (Florian+ in preparation)
- 2 Effects of KSZ, TSZ and LSS on cluster mass calibration using cluster CMB lensing. (Hou+ in progress)
- 3 Arc statistics : a comparison to strong lensing in the SPT cluster catalog. (Magellan+PISCO) (Bleem+ in progress)
- 4 Algorithm of automatically arc-finding in simulated images and future image surveys, e.g., LSST, WFIRST. (Li+ in progress)

