

The Reionization Lensing Clusters Survey: Strong Lensing Analysis



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University of Michigan
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RELICS: Reionization Lensing Cluster Survey

Observations

190 orbits + 77 parallel (incl. 20 for SN follow-up)
46 fields lensed by 41 clusters
- 3 orbits ACS (minus archival)
- 2 orbits WFC3/IR Frontier Fields filters

Science

high-redshift galaxies
cluster mass scaling relations
merger physics + DM constraints
supernovae

Delivery

no proprietary period HST images
reduced images + catalogs
2-3 months after completion of each field
final high-z candidates + lens models
Nov. 2017 (JWST GO call for proposals)



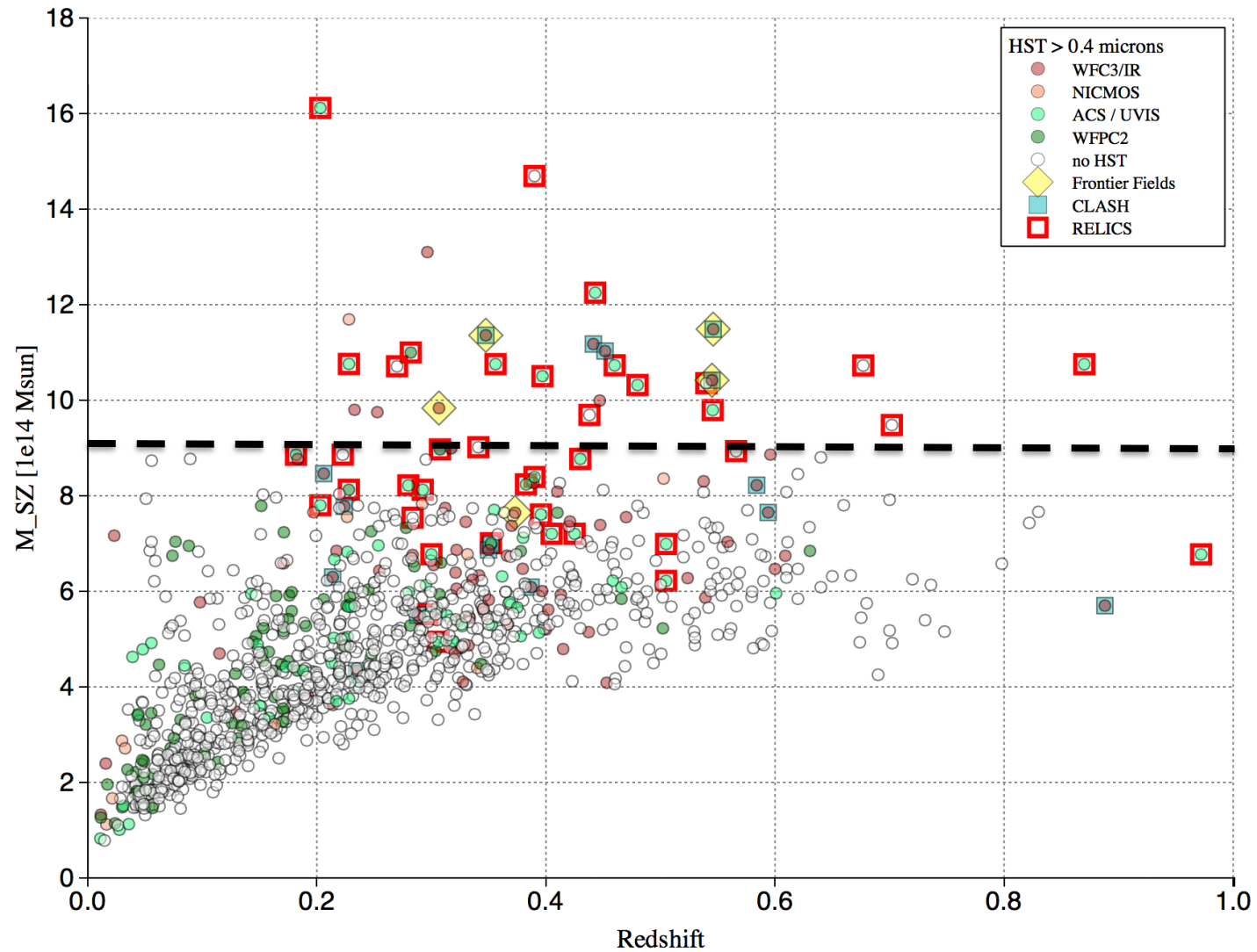
Abell 2537

(Slide courtesy D. Coe)

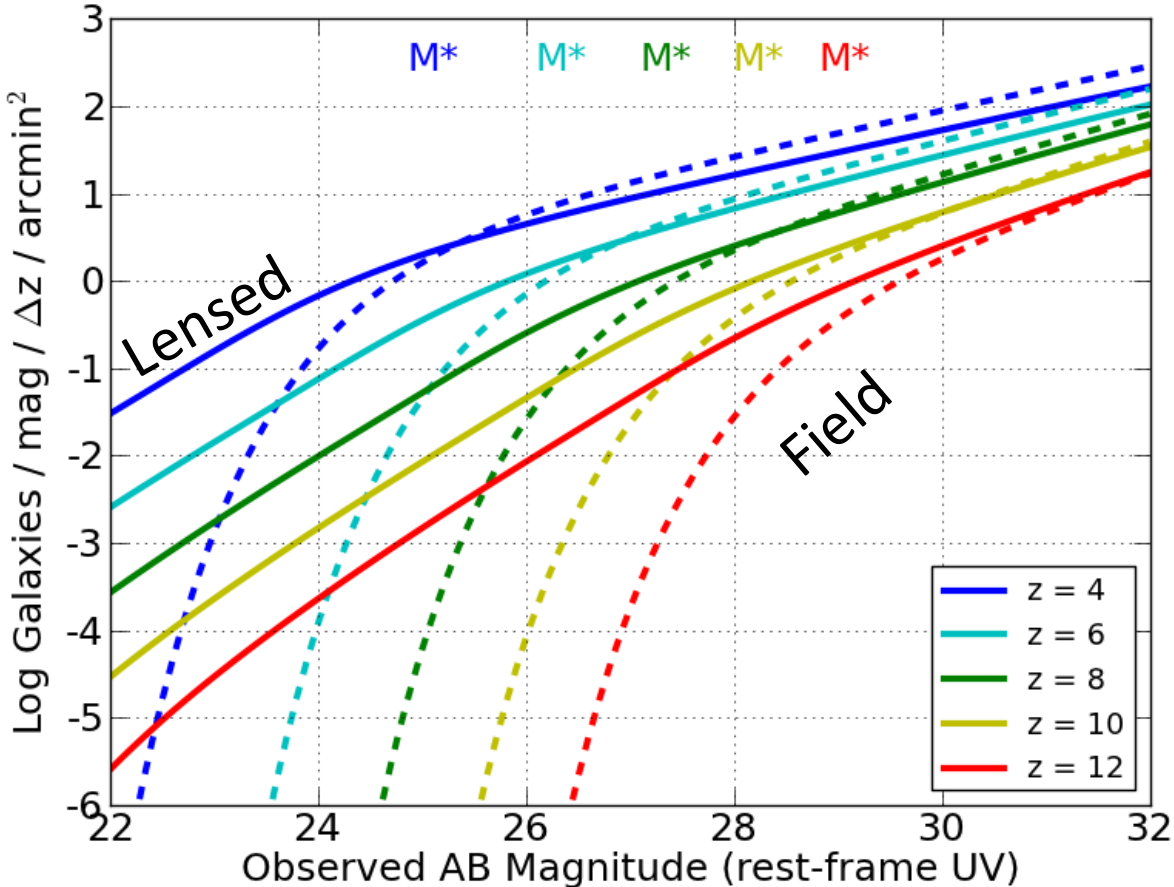
Observations

- Hubble: 190 Orbits (PI: Coe)
- Spitzer: 100 Hours (PI: Bradac); 290 Hours DDT (PI: Soifer)
- Magellan Megacam: 1 Night (PI: Jones)
- Archival X-ray
- Contributions from existing programs:
 - Magellan LDSS3 (Sharon)
 - Keck DEIMOS (Bradac)
 - Subaru HSC (Dawson, MC3PO)

Cluster Selection



Cluster Lensing Enables Efficient Discovery of Distant Galaxies



Bouwens12a luminosity function evolving all 3 parameters

(Slide Courtesy D. Coe)

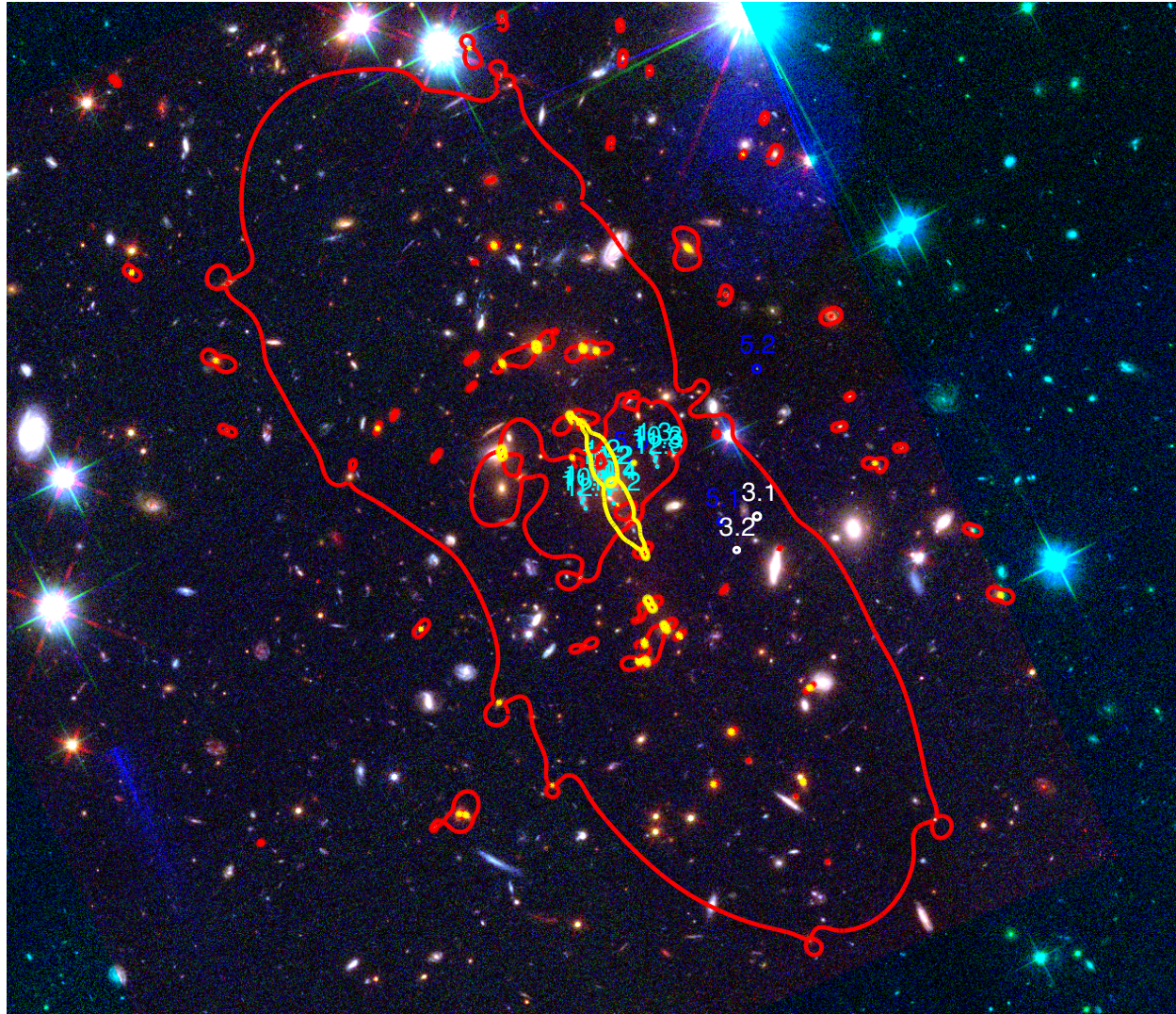
Lens Modeling

- Whenever possible, at least one spectroscopic redshift (see Johnson & Sharon 2016)
- Models computed with Lenstool, which is a parametric lens modeling code
- Each halo modeled as a PIEMD
- Proceed iteratively until the model converges

Arc Selection



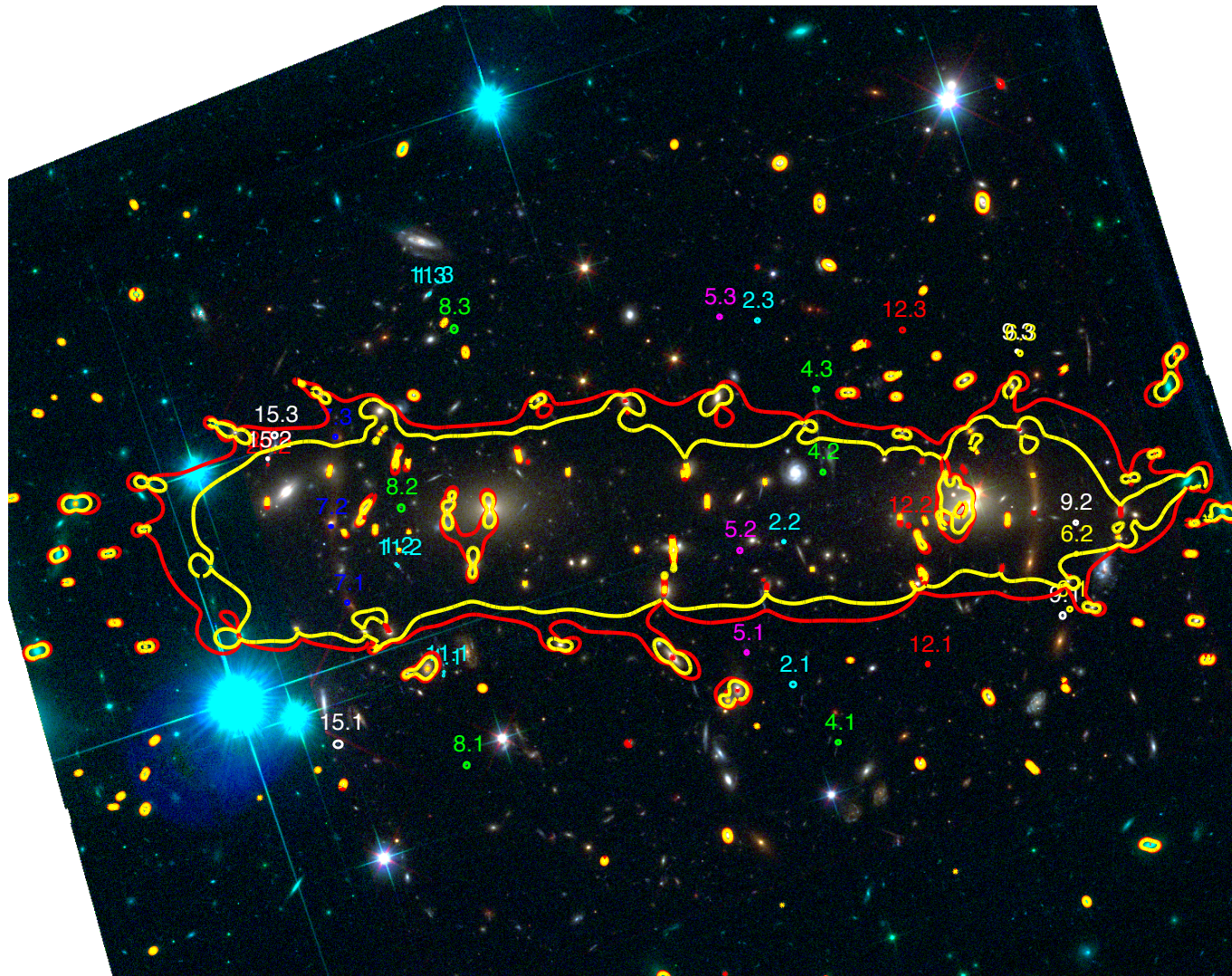
SPT0615-57



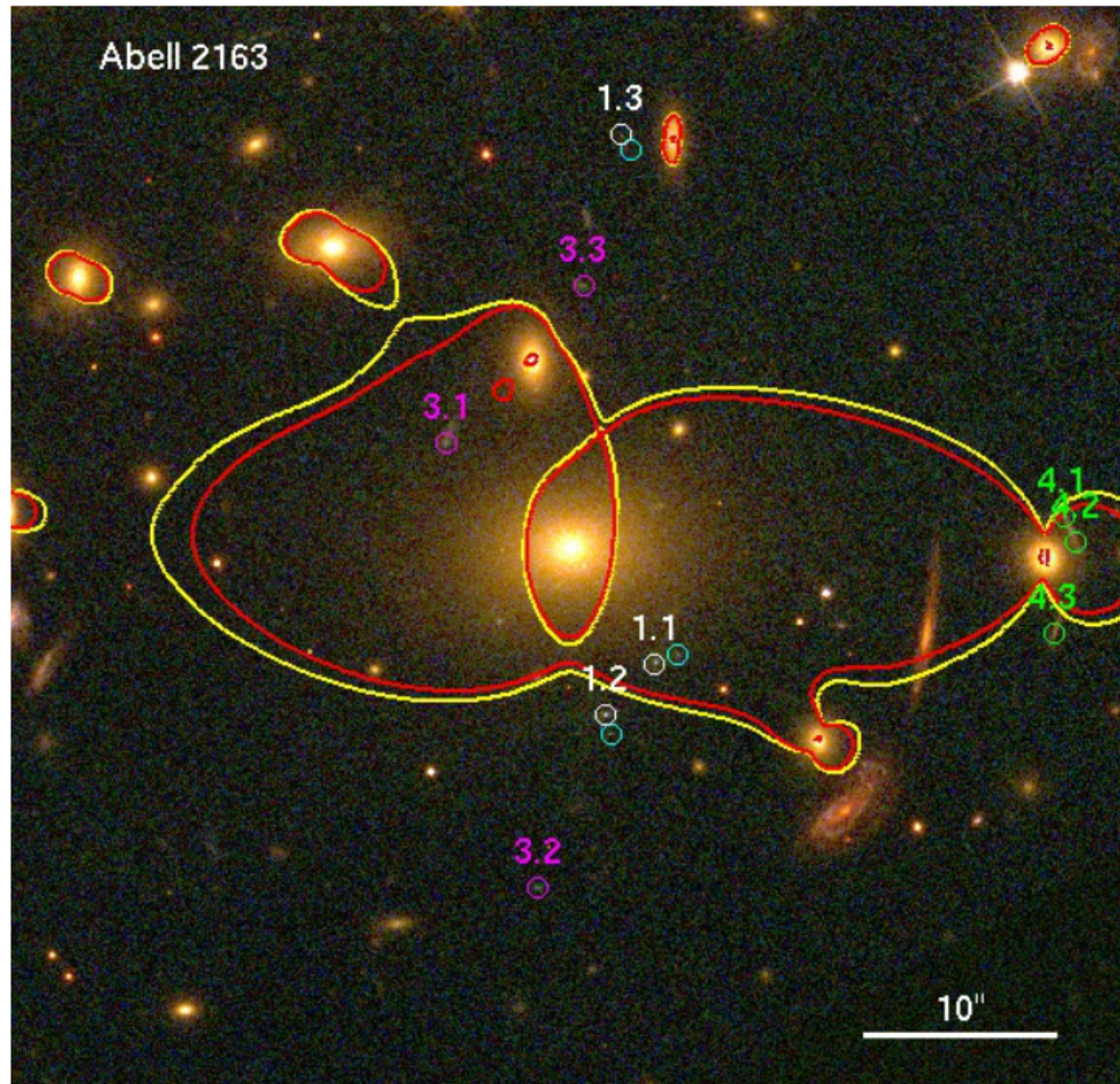
SPT0615 Zoom



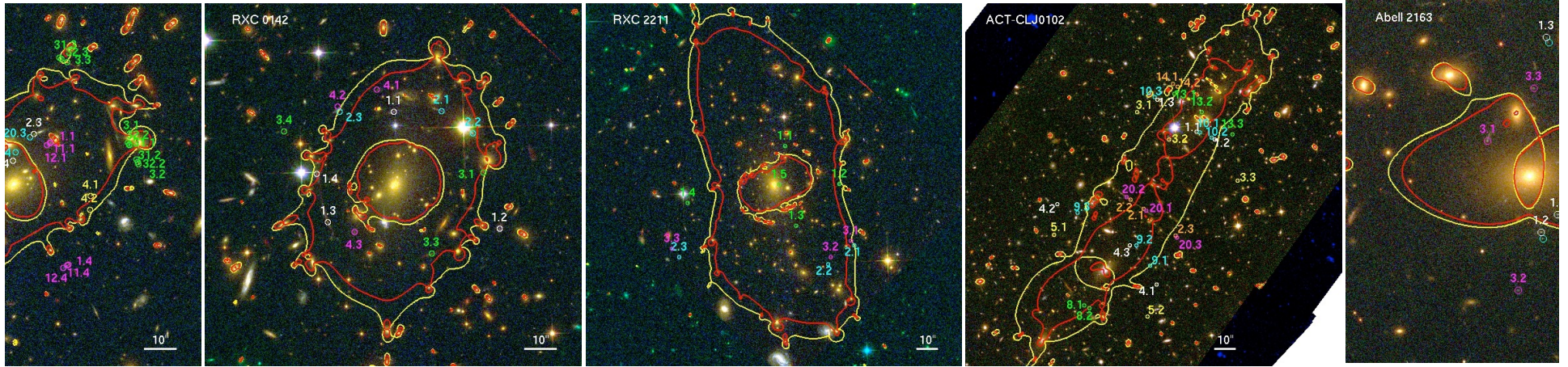
MACS0556



Abell 2163



Cerny et al., In Prep



RELICS: STRONG LENS MODELS FOR FIVE GALAXY CLUSTERS FROM THE REIONIZATION LENSING CLUSTER SURVEY

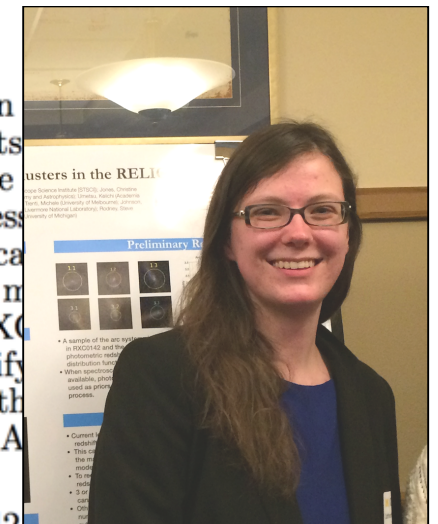
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Draft version June 15, 2017

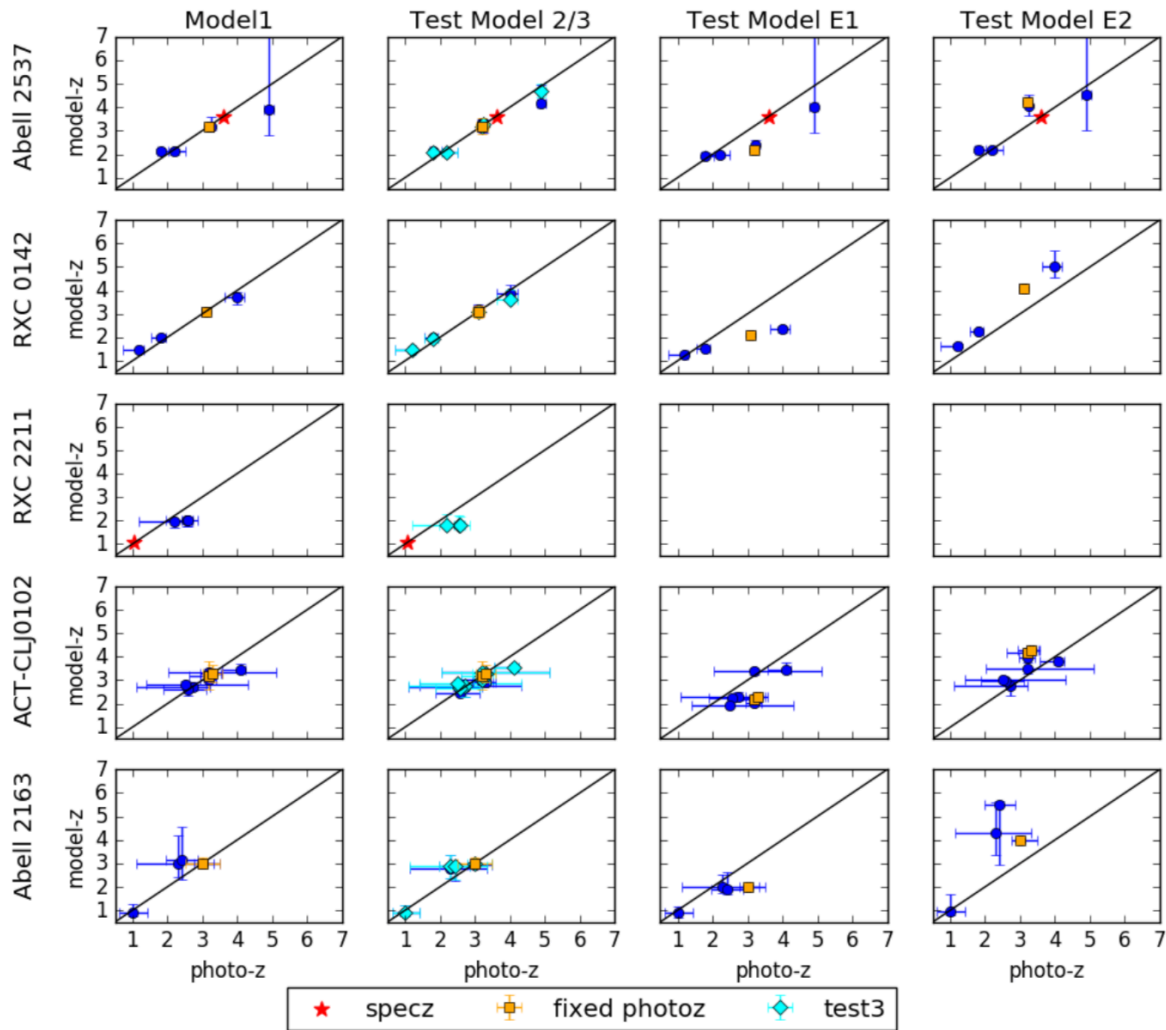
ABSTRACT

We present strong lensing models for five galaxy clusters from the Reionization Survey (RELICS) Hubble Treasury Program. The strong gravitational lensing effects significantly magnify background galaxies, which enhances our ability to discover the high redshift galaxies at $z \sim 9 - 12$ needed for a statistically significant sample necessary to calculate the galaxy luminosity function. The intrinsic properties of high-redshift galaxies are calculated by accounting for the lensing effect. Here, we present the first five lensing models from the RELICS program, based on new *HST* WFC3 and ACS imaging of the clusters RXC J0142.9+4438, Abell 2537, Abell 2163, RXC J2211.7-0349, and ACT-CLJ0102-49151. We quantify the lensing magnification due to statistical and systematic errors related to the lensing process. The models are made available to the community through the Mikulski Archive for Space Telescopes.

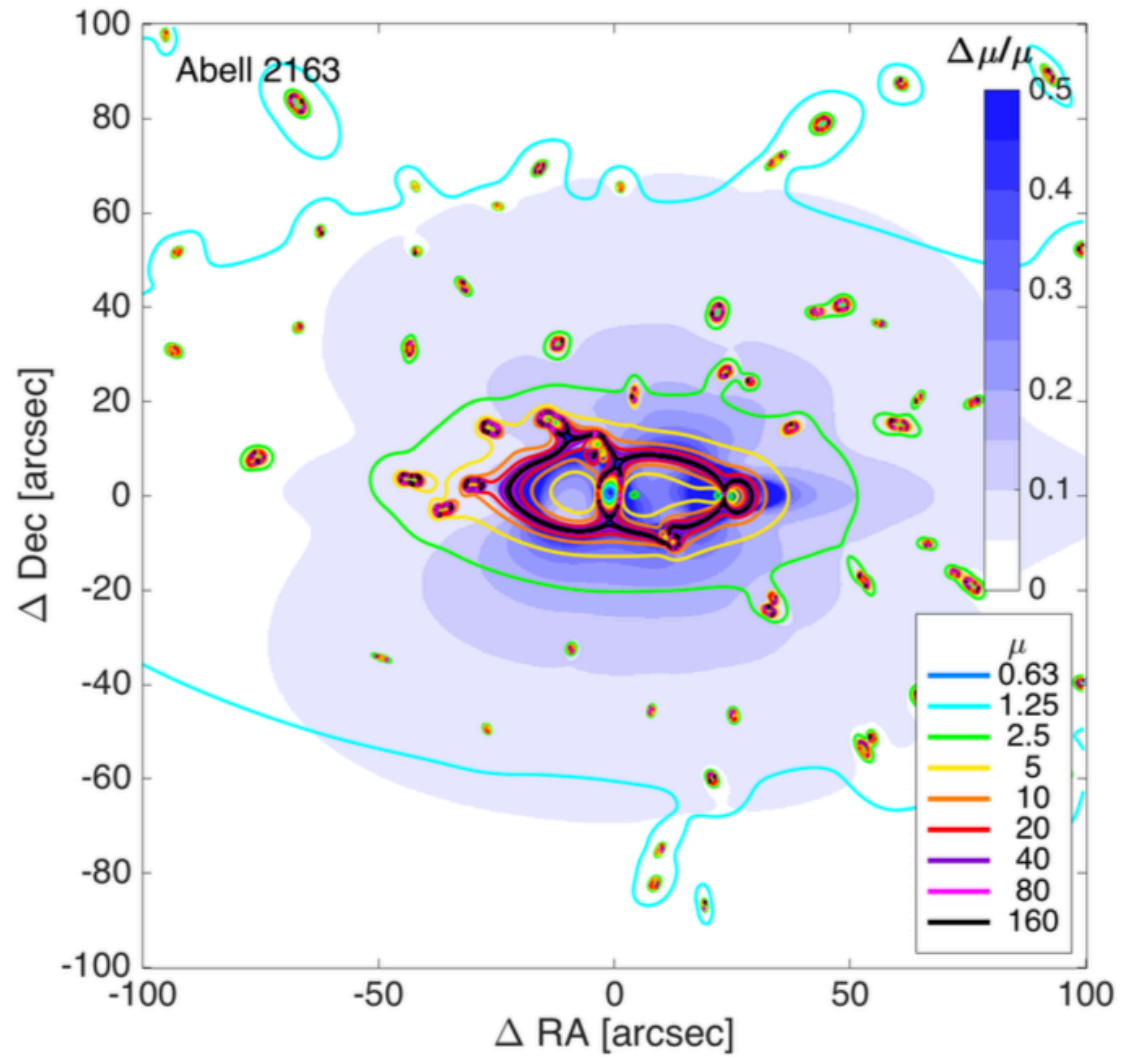
Subject headings: galaxies: clusters: individual (RXC J0142.9+4438, Abell2537, Abell2163, RXCJ2211.7-0349, ACT-CLJ0102-49151) — gravitational lensing: strong



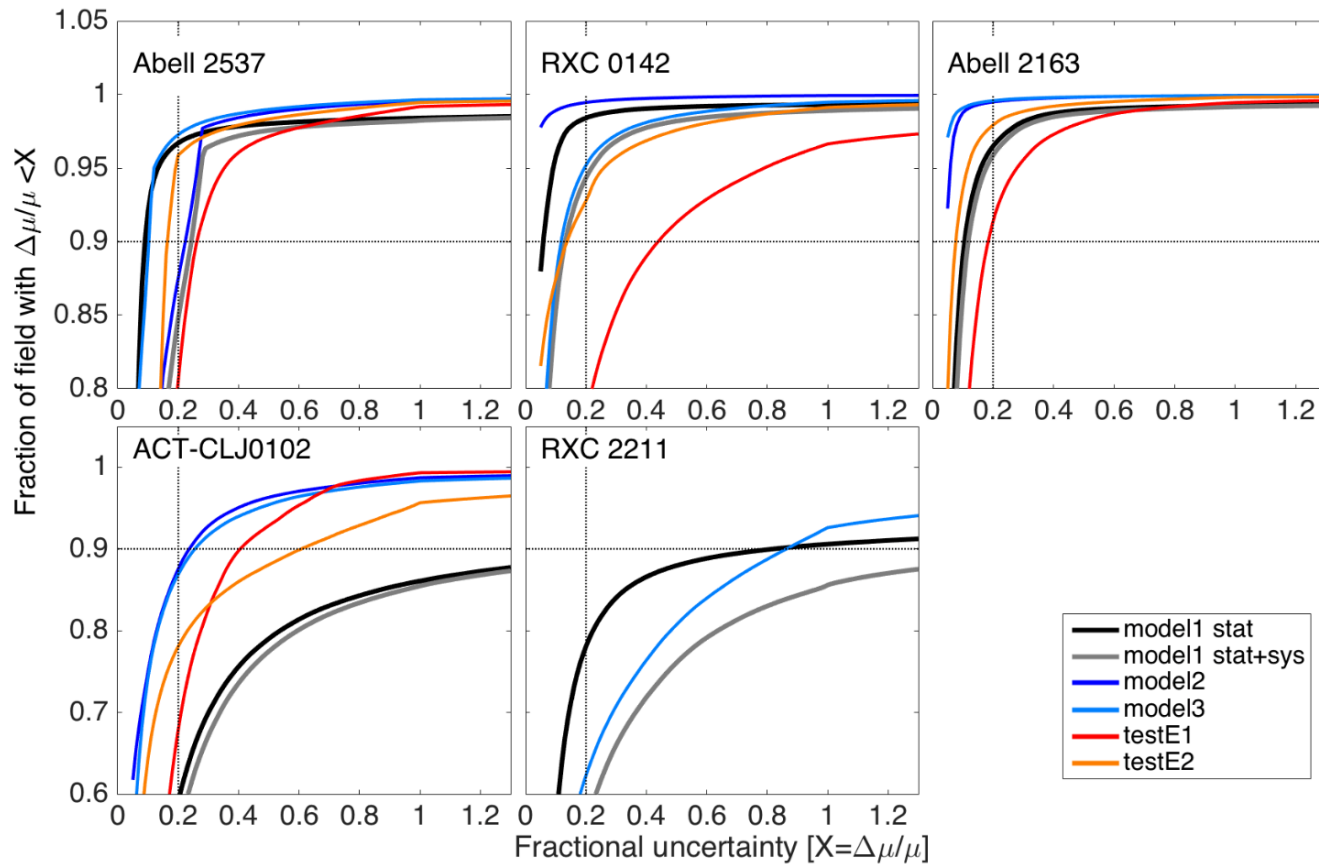
What if there are no spectroscopic redshifts, I



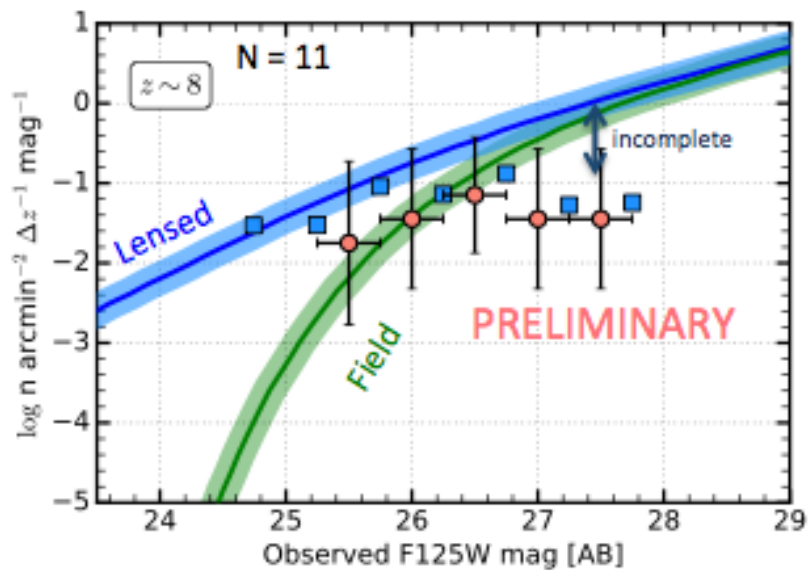
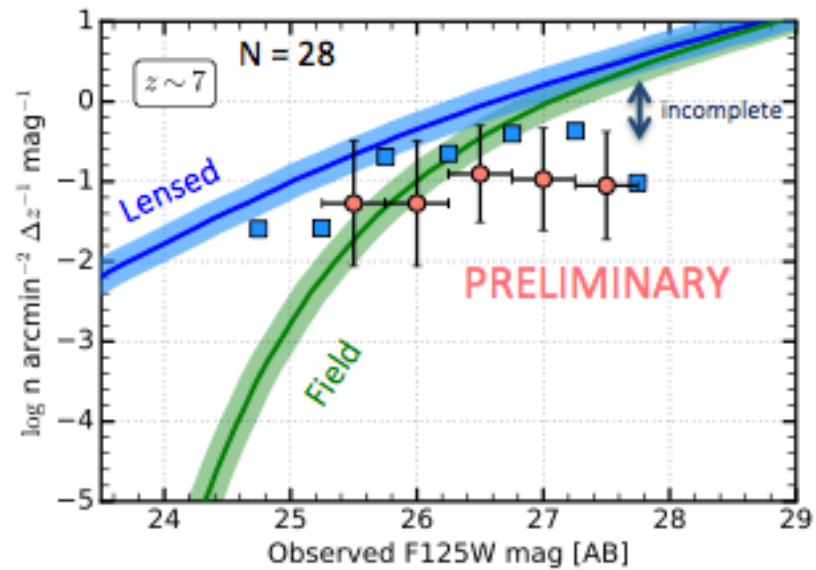
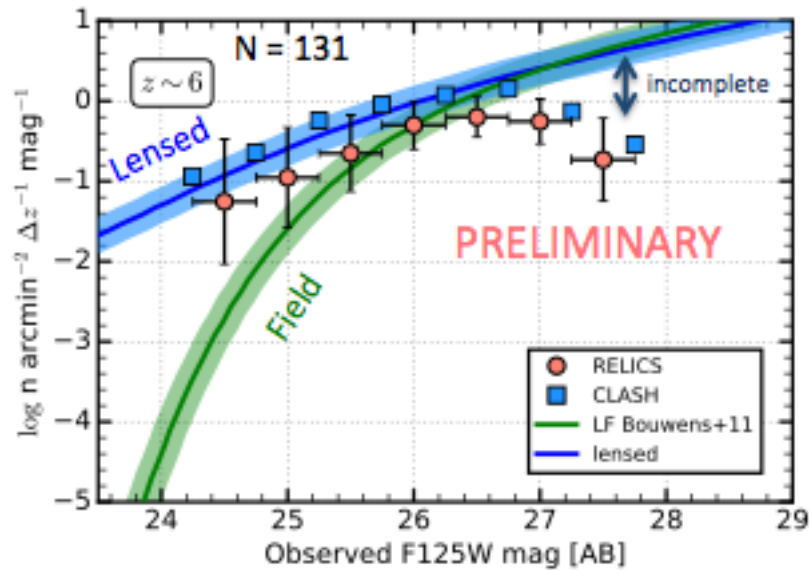
Magnification Map



What if there are no spectroscopic redshifts, II



Preliminary High Redshift Candidates



Salmon et al. in prep.: 26 / 41 RELICS clusters



Future Work

- All models will be public in the fall
- Can do much cluster physics
 - Compare DM and X-ray centroid offsets
 - Explore DM – concentration relation
 - Scaling relations with the X-ray data