LSST - WFIRST Synergy: A New Domain of Blending Challenges

Wide Field InfraRed Surveys: Science & Techniques

2014 November 18

Will Dawson with Michael D. Schneider

Lawrence Livermore National Laboratory

Collaborators:
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LLNL-PRES-664360

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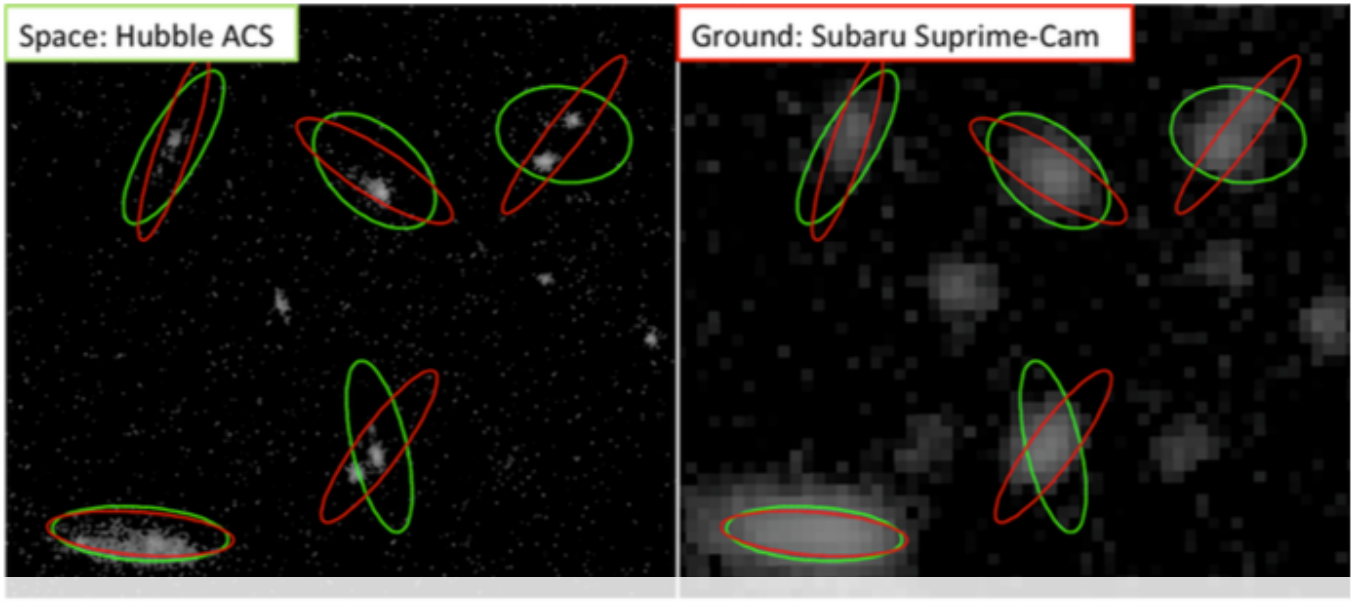
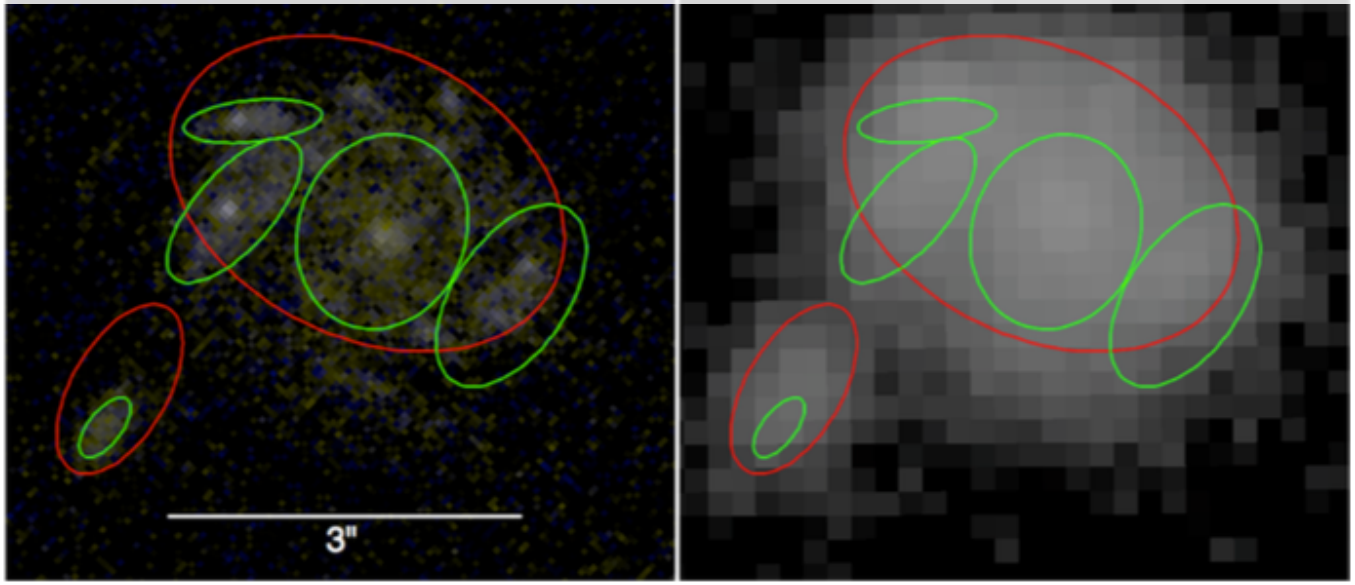
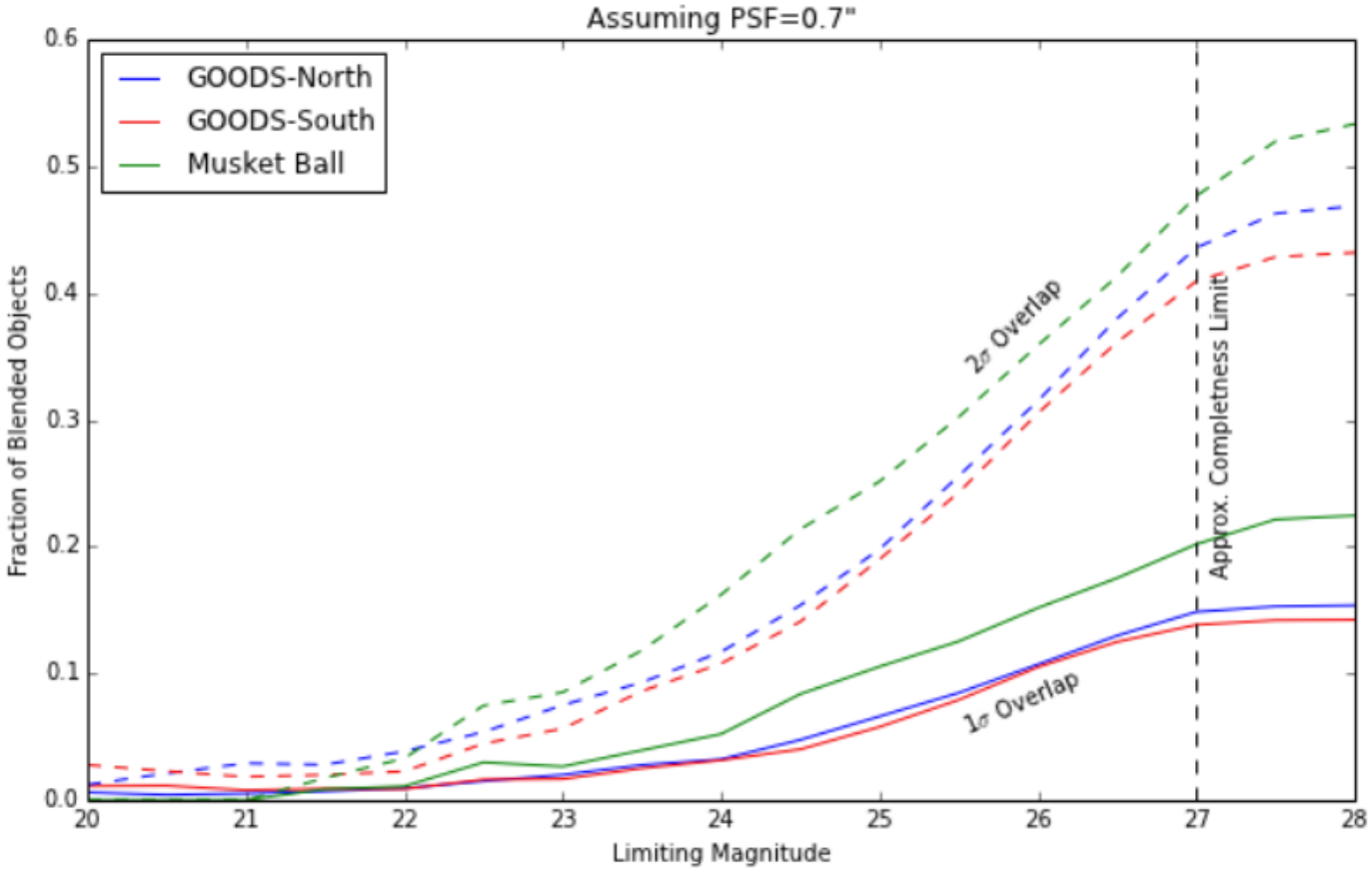
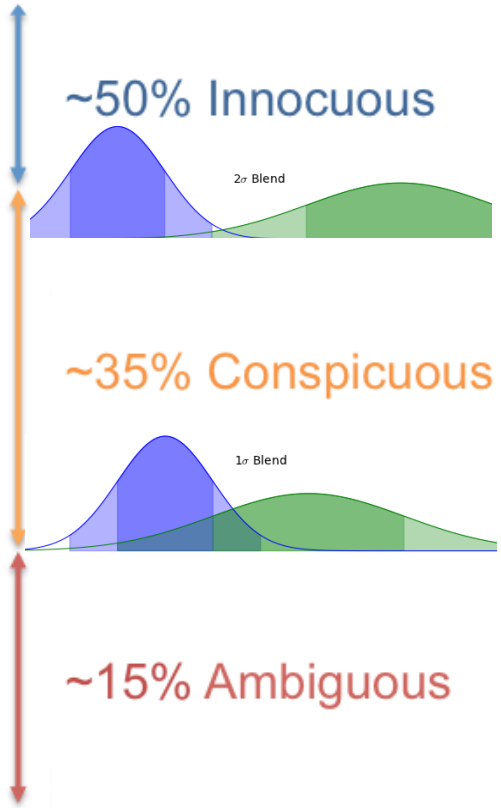


Failure modes from ground & space



Blend fractions vs depth

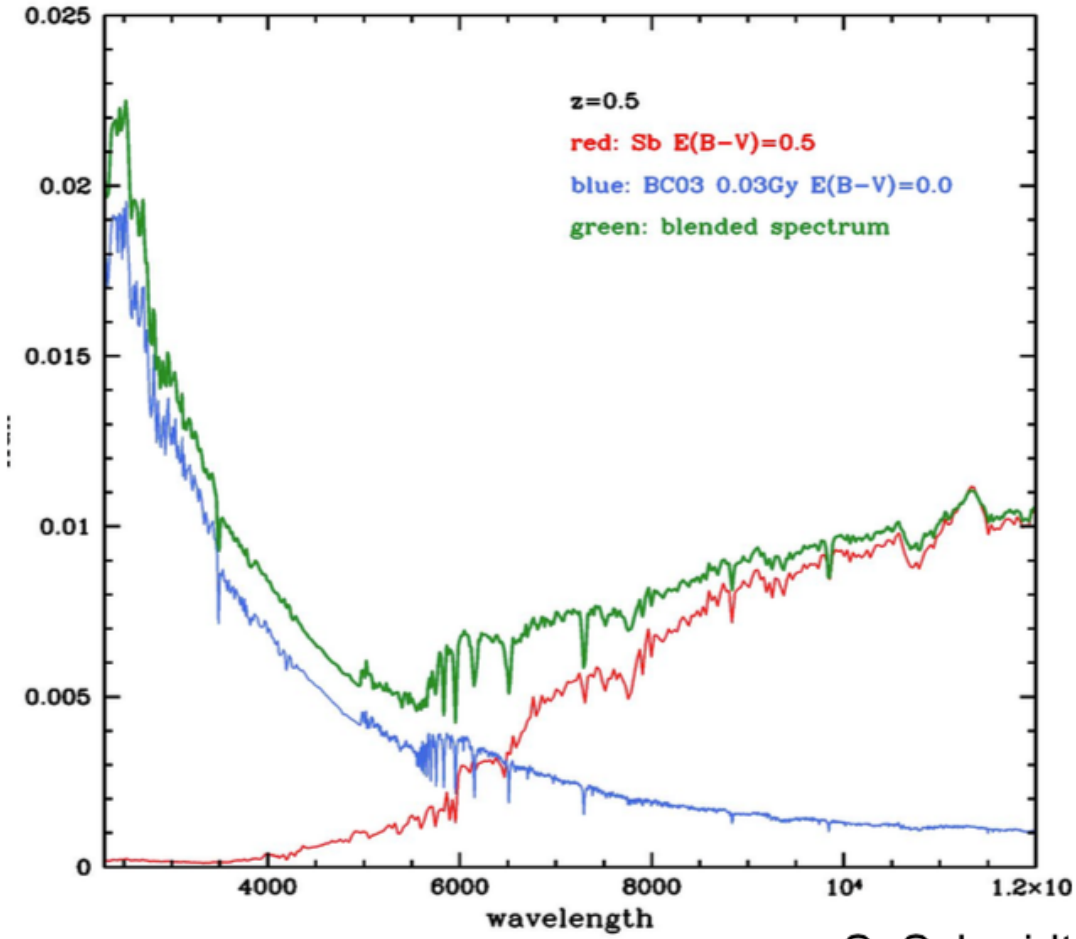




See also: Dawson et al. (2014); The Ellipticity Distribution of Ambiguously Blended Objects

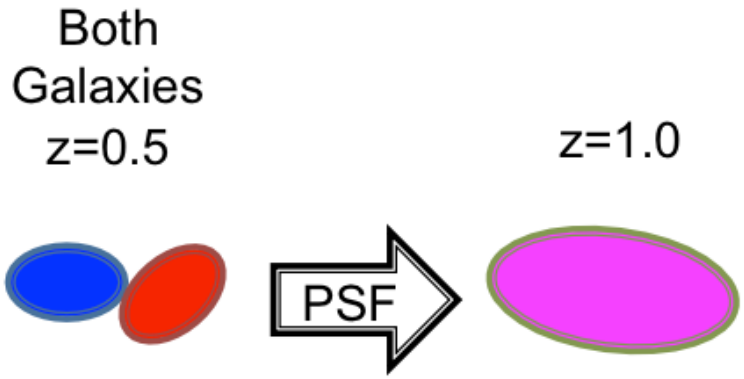
Photo-z's of blended galaxies can be biased

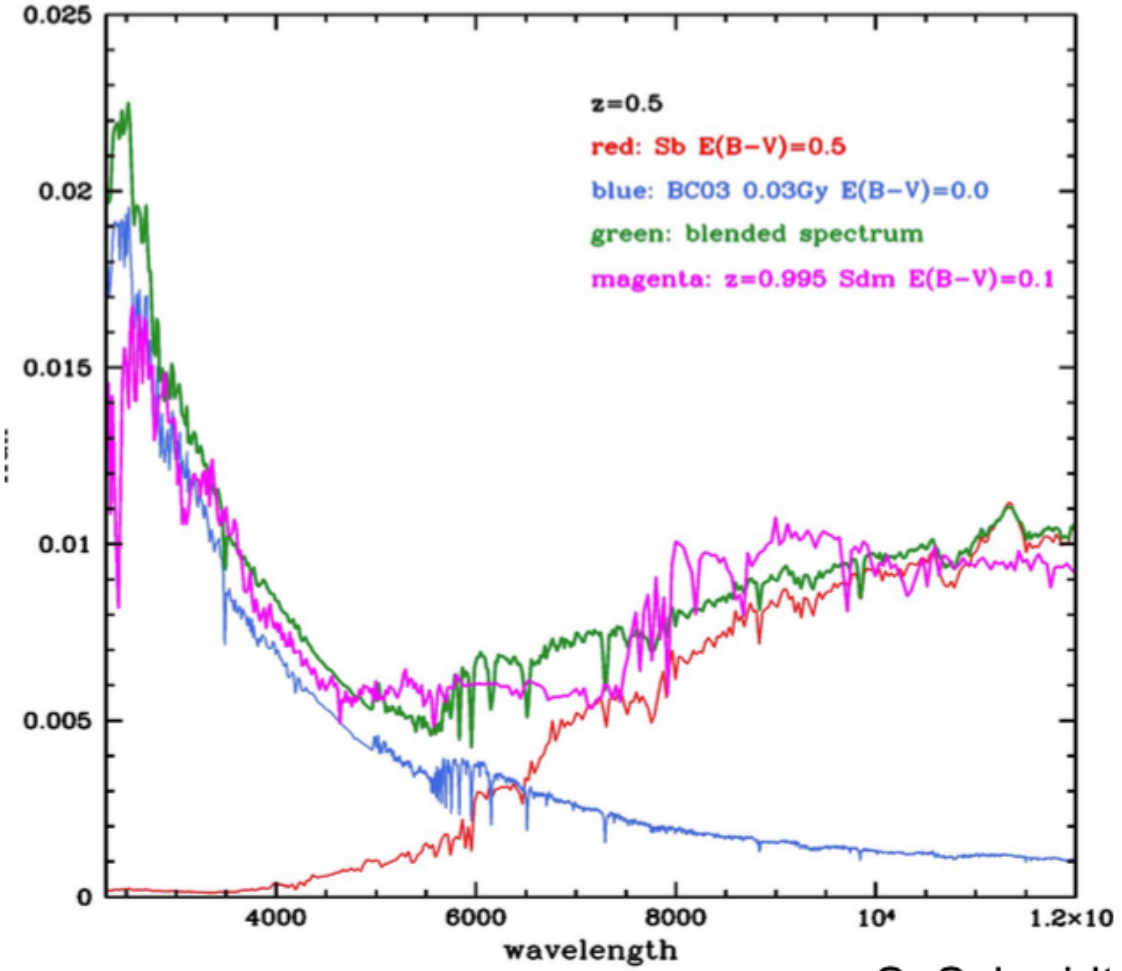
Both Galaxies z=0.5



S. Schmidt

Photo-z's of blended galaxies can be biased





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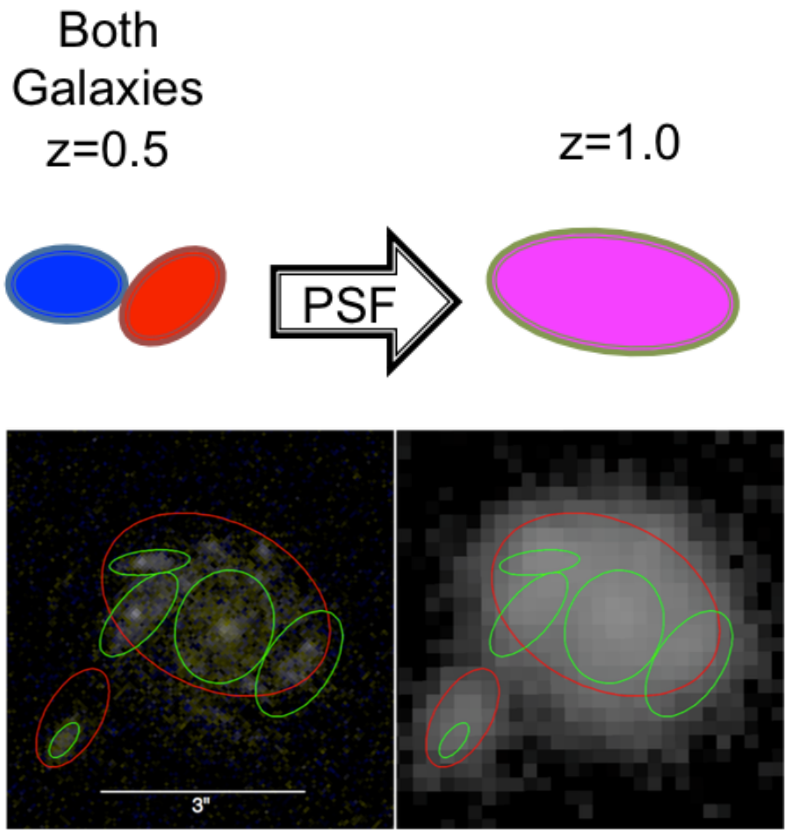

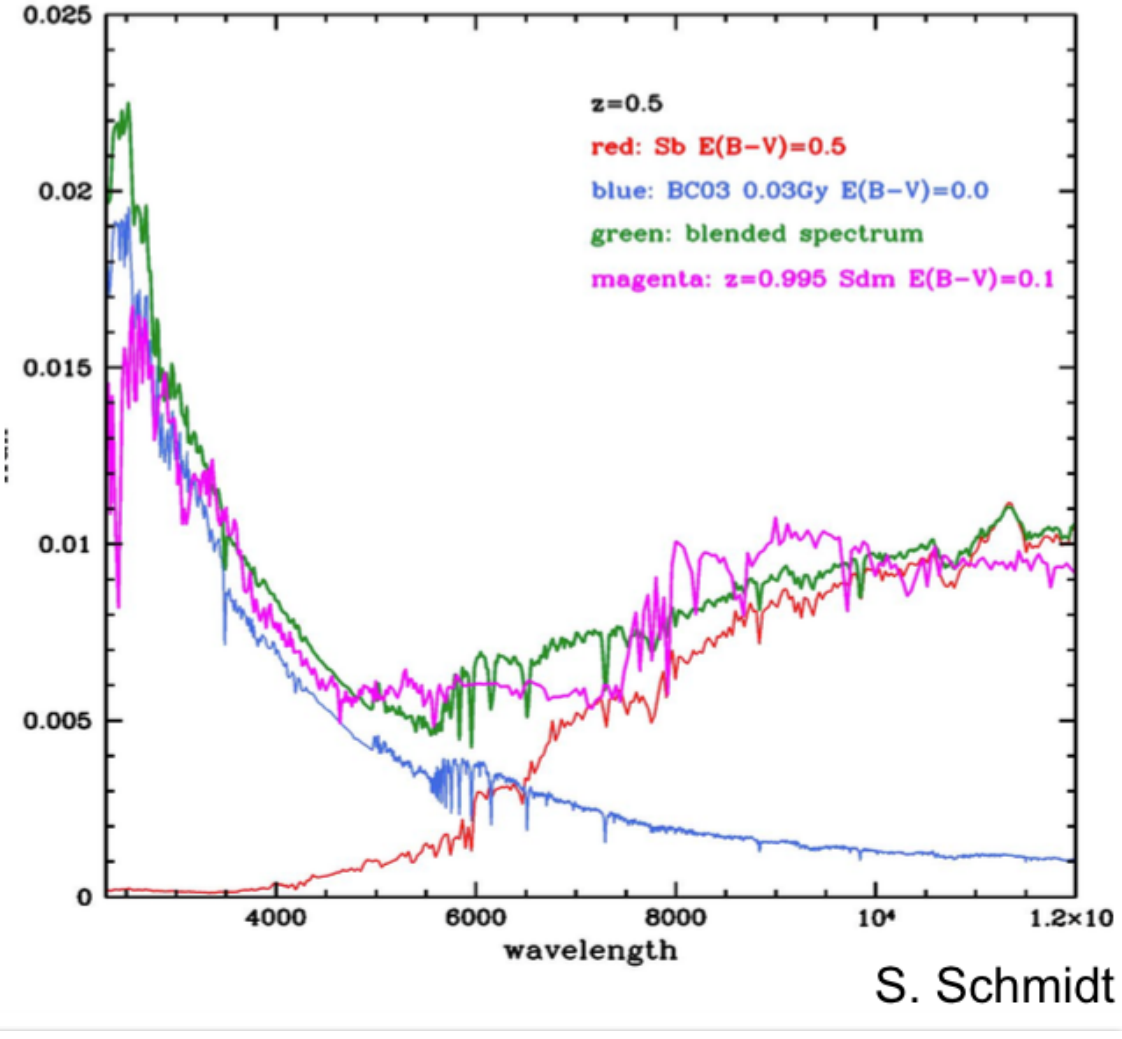

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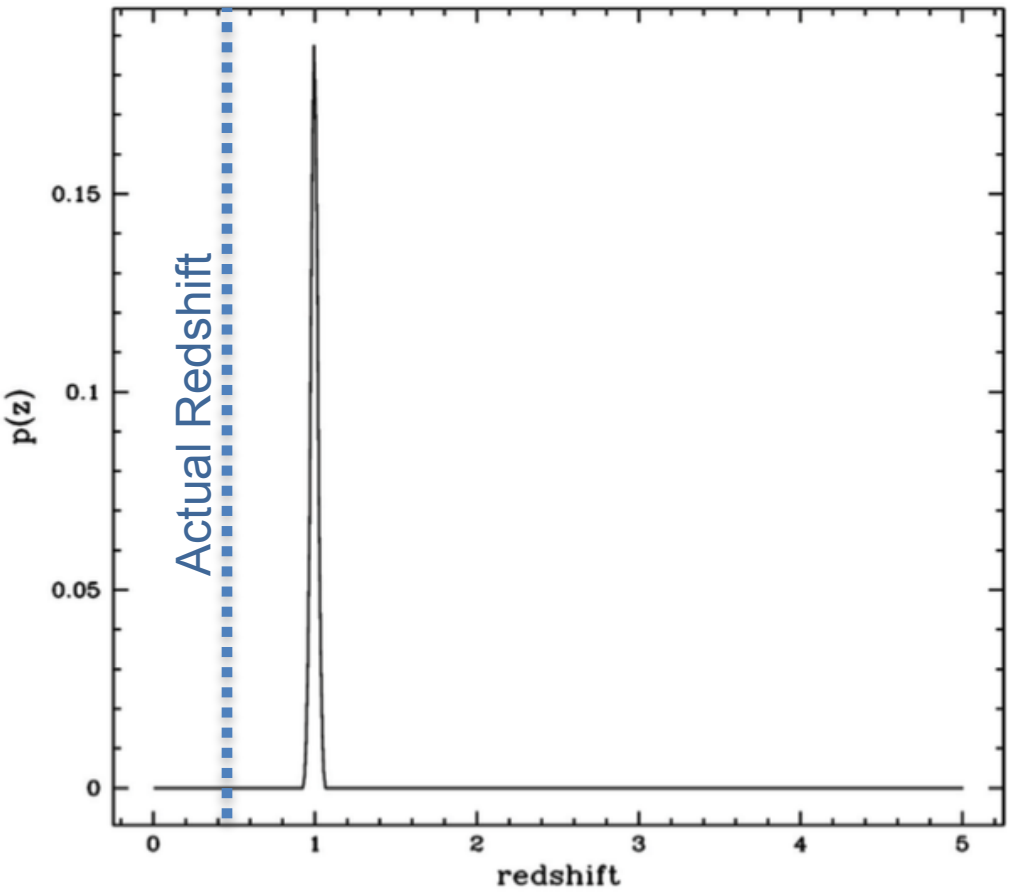
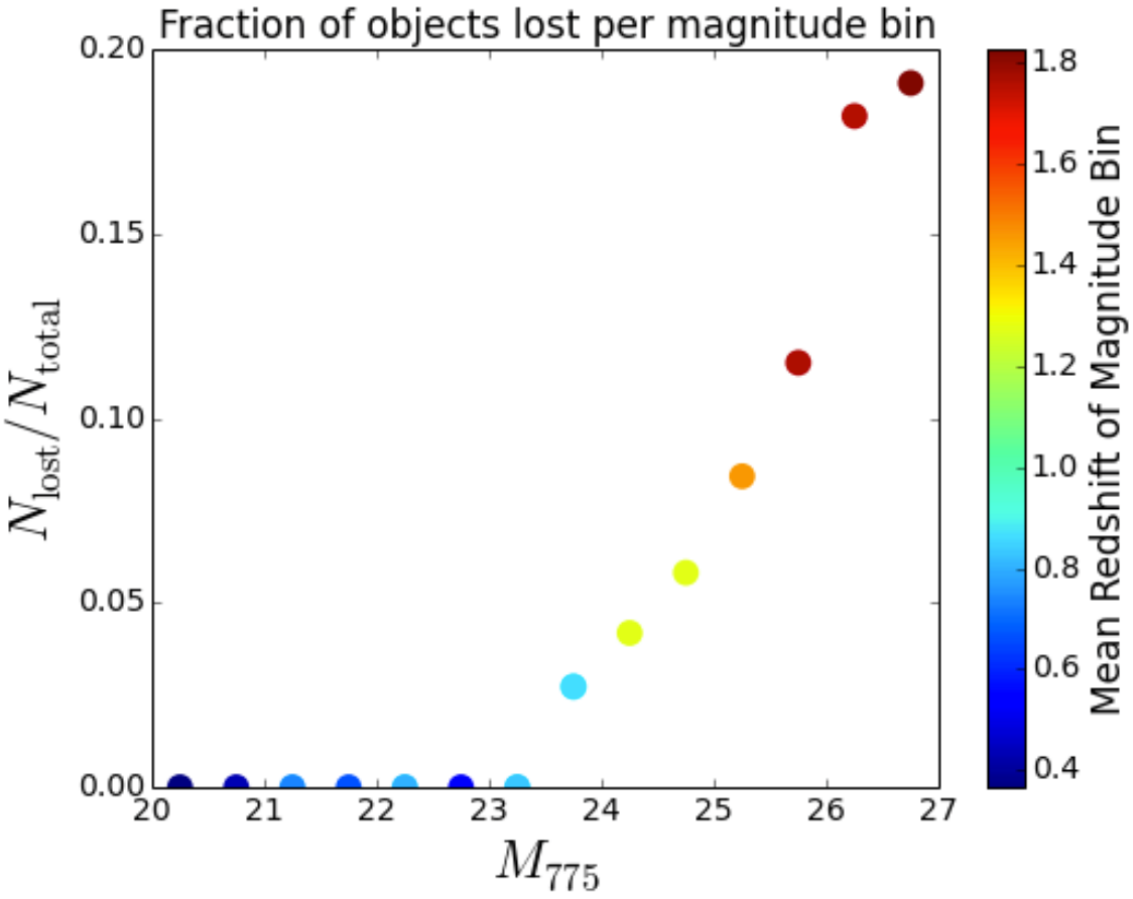


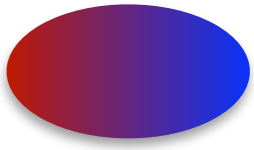
S. Schmidt

Perhaps a more common ambiguous blend scenario

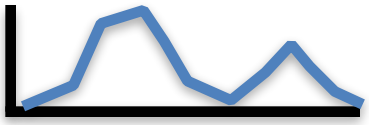
Fainter space galaxies more likely to be “lost”



Key observables: tools in mitigating blending

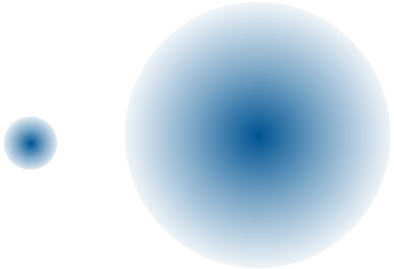


- Color spatial gradients



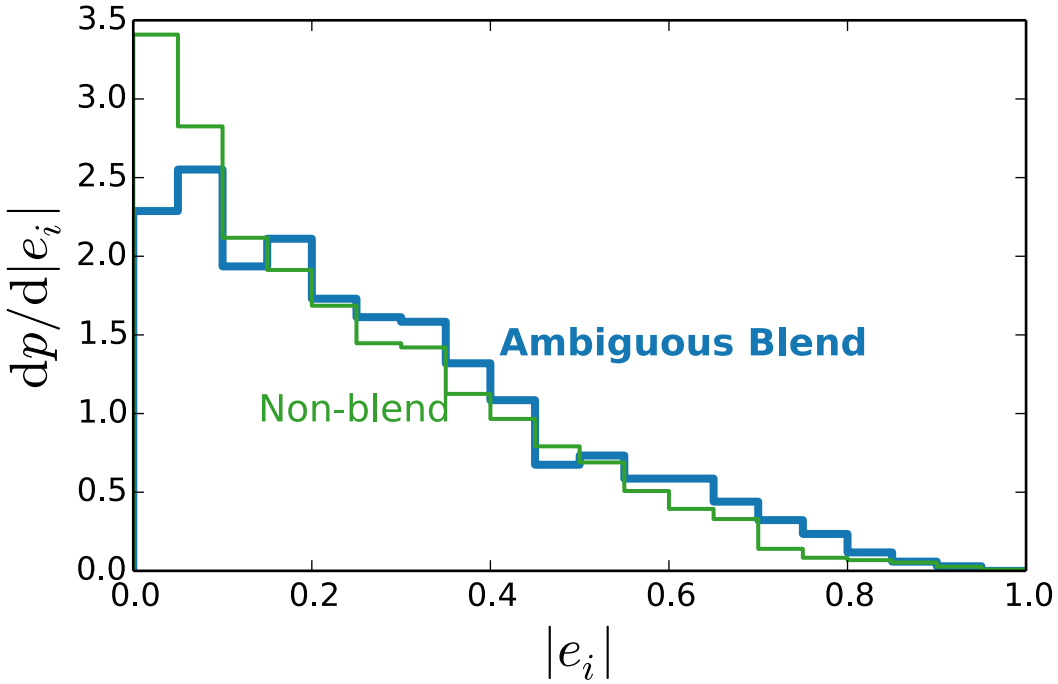
- Photometric redshifts

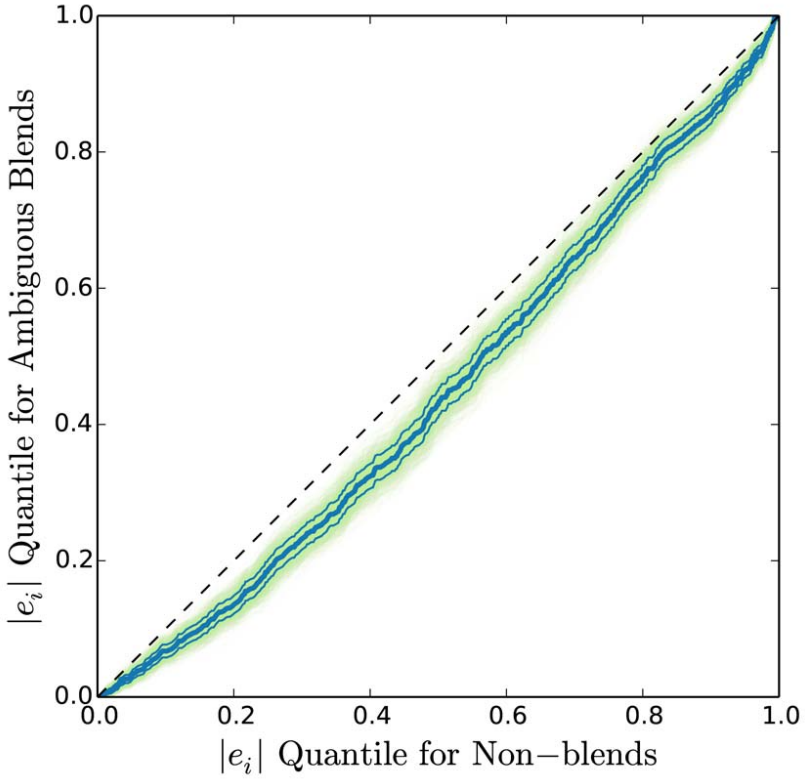
- Light profile morphology



- Space imaging
  - Best ground seeing epochs (more for LSST)

Ex.: using space-based imaging to learn about ground-based imaging





Dawson et al. (2014)

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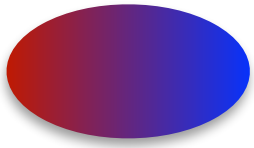

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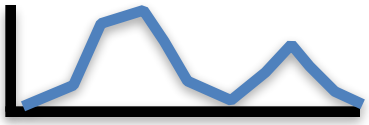

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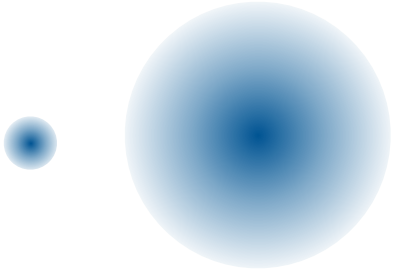

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  - Best ground seeing epochs (more for LSST)

How to combine these tools in a consistent/meaningful way

HIERARCHICAL PROBABILISTIC INFERENCE OF COSMIC SHEAR

MICHAEL D. SCHNEIDER[1, 2], DAVID W. HOGG[3], PHILIP J. MARSHALL[4], WILLIAM A. DAWSON[1], JOSHUA MEYERS[5], DEBORAH J. BARD[4], DUSTIN LANG[6]

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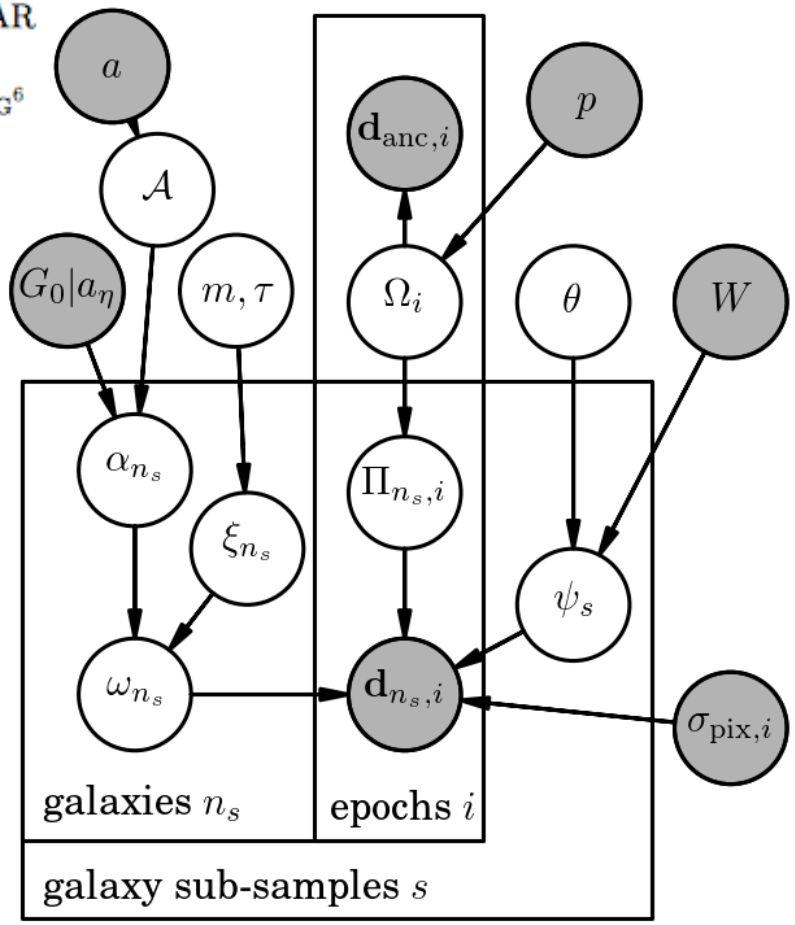
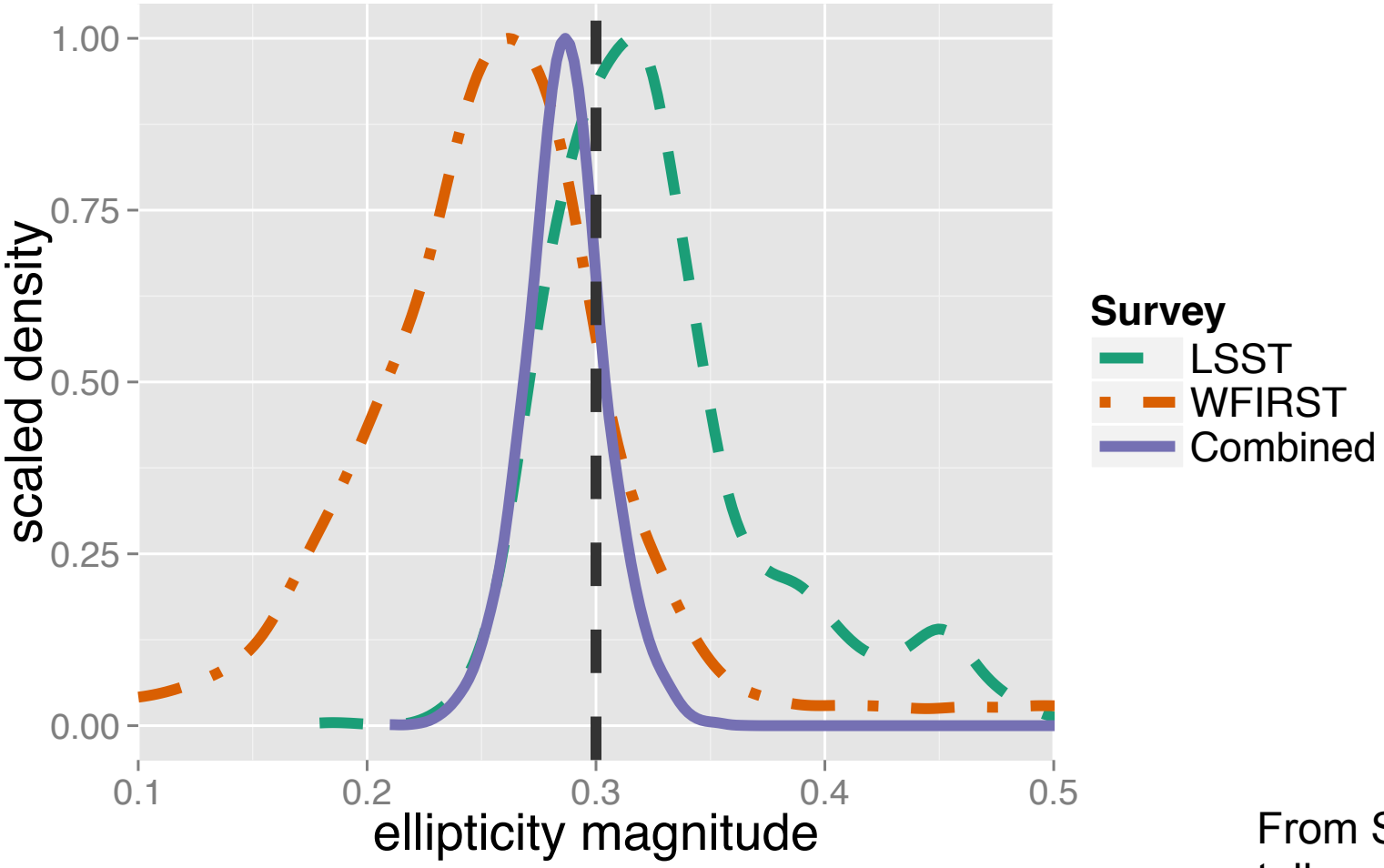
LLNL-JRNL-661076

arXiv:1411.2608

$$\Pr(\boldsymbol{\theta}, \{\psi_s\}, \{\Pi_i, \Omega_i\}, \{\omega_n, \alpha_n, \xi_n\}, \mathcal{A}, \tau, m, a_\eta | \{\mathbf{d}_n\}, \mathcal{X}) \propto$$
$$\Pr(\boldsymbol{\theta}) \cdot \Pr(\{\psi_s\} | W, \{s\}, \boldsymbol{\theta}) \cdot \Pr(\mathcal{A}|a)$$
$$\times \prod_{n=1}^{n_{\rm gal}} \Pr(\omega_n|\alpha_n, I) \cdot \Pr(\alpha_n|\mathcal{A}, a_\eta) \cdot \Pr(\xi_n|m, \tau)$$
$$\times \prod_{i=1}^{n_{\rm epoch}} \Pr(\Pi_{n,i}|\Omega_i, I) \cdot \Pr(\Omega_i|p, \mathbf{d}_{{\rm anc},i})$$
$$\times \Pr(\mathbf{d}_{n,i}|\omega_n, \xi_n, \psi_s, \Pi_{n,i}) \quad (18)$$



Measuring galaxy ellipticity (and other properties) from combined survey data



From Schneider talk on Monday

Methods for combining survey data

1. Catalog comparison
2. Interim samples from 1 survey + pixel-level analysis in 2nd survey
   - Need many samples
3. Interim samples from both surveys
   - Need many samples + binning of model parameters
4. Joint analysis of pixel data

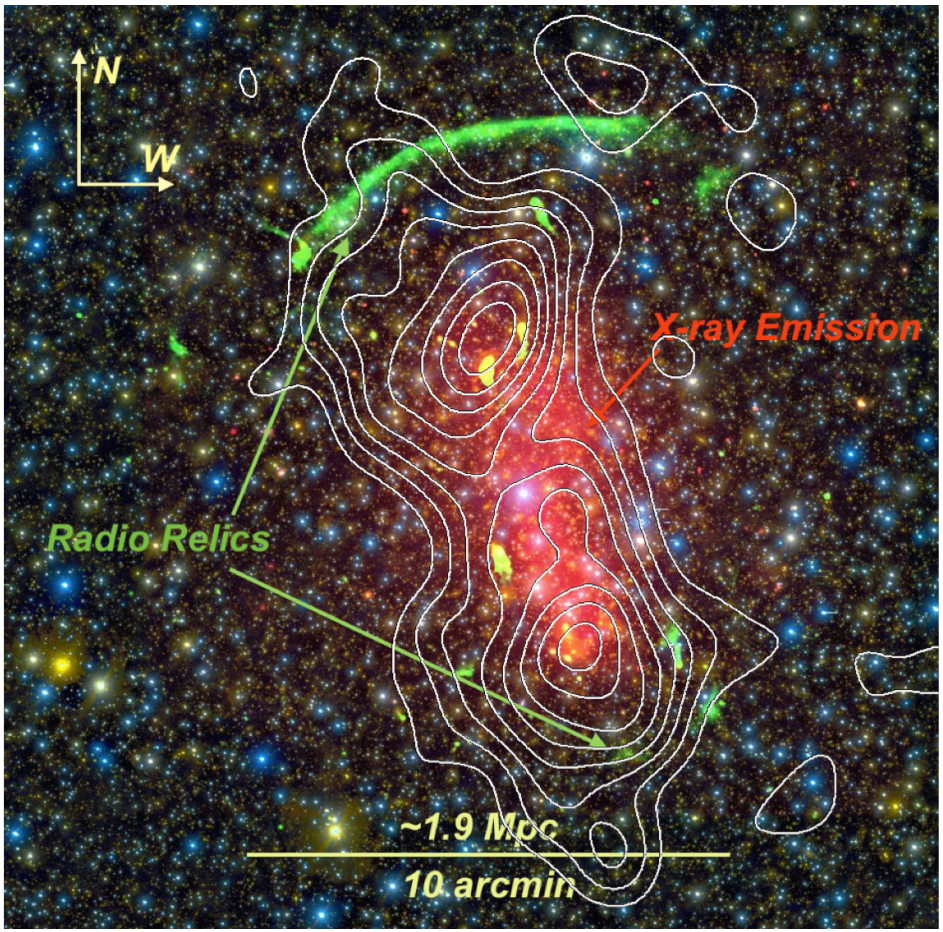
From Schneider talk on Monday

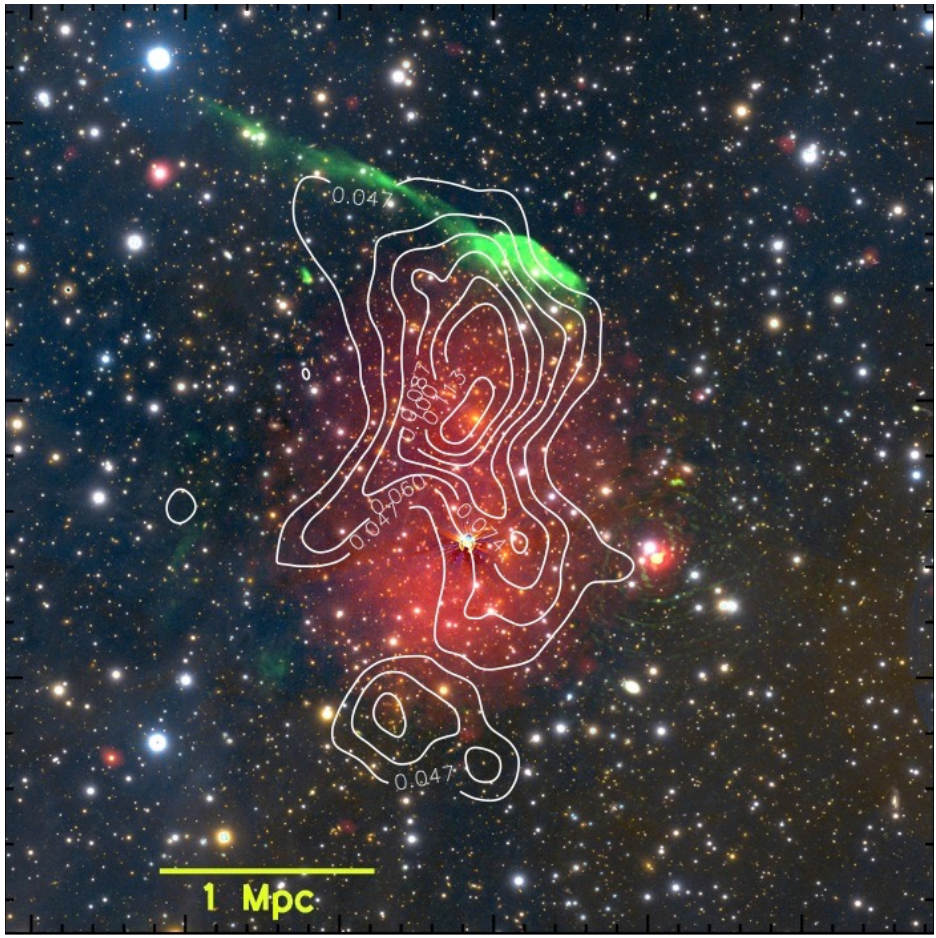
Challenge: methods 2 - 4 often require re-analyzing pixel data

Implications for the Future

- Area vs. Depth: new considerations
  - What's good for WFIRST?
  - What's good for LSST?
- Best means of integrating WFIRST and LSST?
- Computational requirements (joint fitting)

Galactic Plane Deep Fields





See Huub Rottgering's Talk Tomorrow

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