Measuring intrinsic alignments using multiple shear estimates

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Very quick reminder:

Intrinsic alignments are correlations in shapes of observed galaxies due to local gravitational effects rather than lensing.

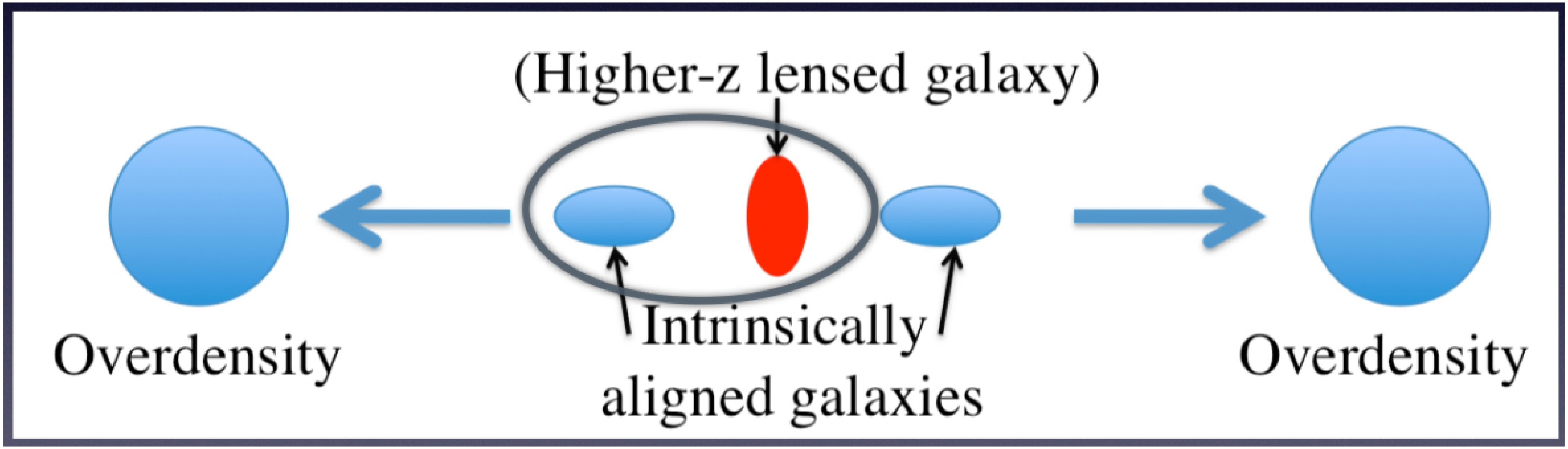

Figure credit: Rachel Mandelbaum

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We know:

Measured intrinsic alignment amplitude ⟷ Radial sensitivity of shear-estimation method

(Tenneti 2014, 2015, Velliscig 2015, Hilbert 2017, Schneider 2013, Singh 2016)

We can exploit this to learn about the scale-dependence of IA:

$$\tilde{\gamma}_t(r_p) - \tilde{\gamma}'_t(r_p) \propto (1-a)\bar{\gamma}_{\rm IA}(r_p)$$

(where a is a constant)

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Consider: Galaxy-galaxy lensing with **LSST sources** and **DESI LRG lenses**

Compare with: Subtracting lensing from two source photo-z bins (*Blazek et al. 2012)*

Question 1: Is our method more robust to photo-z uncertainties in the source galaxy redshift distribution?

Answer: For both methods, photo-z related errors are necessarily sub-dominant to statistical uncertainty.

$$\left(\frac{\sigma_{\rm sys}}{\sigma_{\rm stat}}\right)^{\rm max}_{\rm B2012} = 27\% \qquad \left(\frac{\sigma_{\rm sys}}{\sigma_{\rm stat}}\right)^{\rm max}_{\rm L2018} = 4\%$$

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Question 2: Does our method provide stronger constraints in the regime dominated by statistical uncertainty?

Answer: Yes – depending on the shear estimation methods in question.