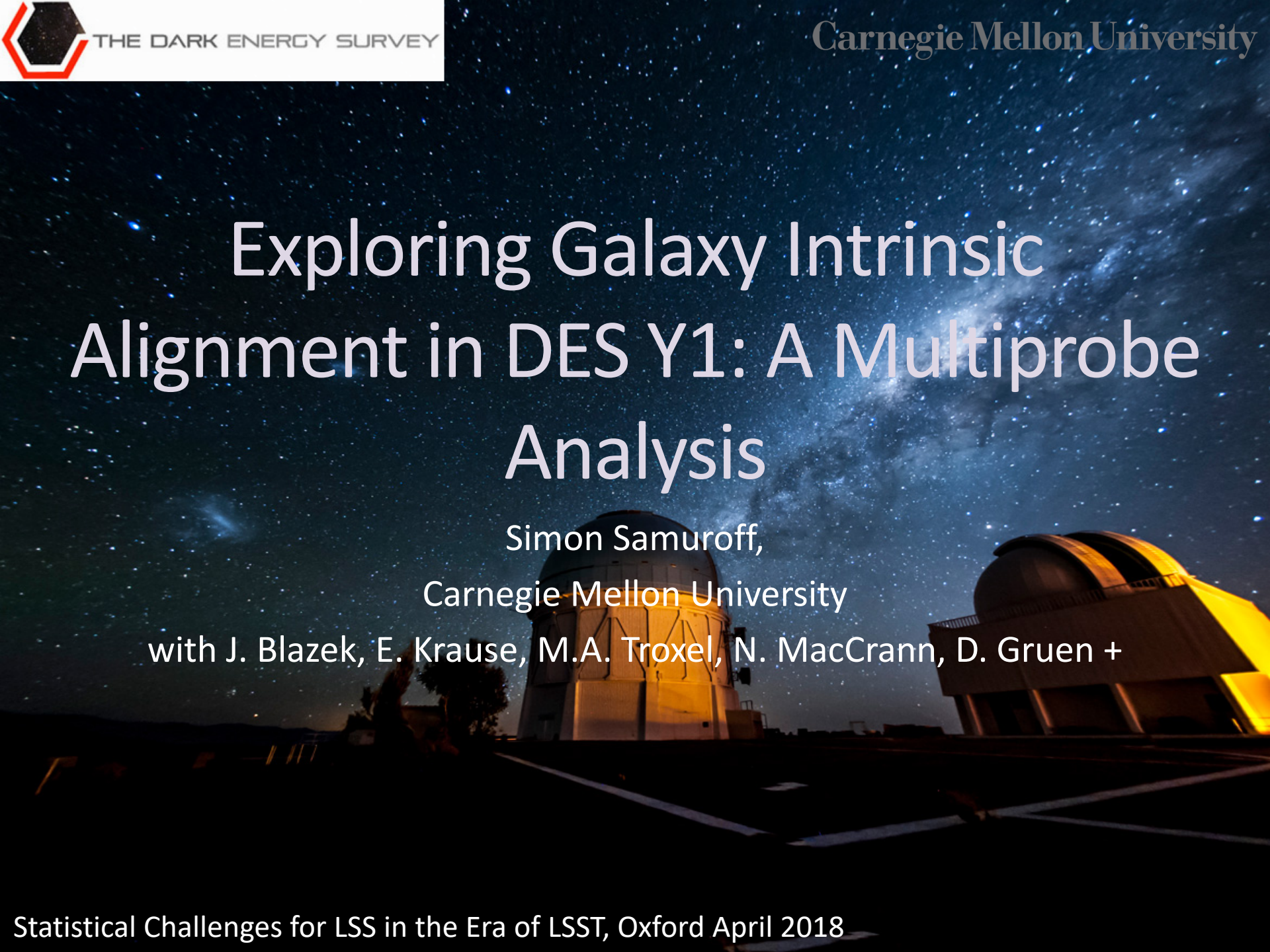

Exploring Galaxy Intrinsic Alignment in DES Y1: A Multiprobe Analysis

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Statistical Challenges for LSS in the Era of LSST, Oxford April 2018

Overview

- Colour-split 3x2pt (shear-shear + galaxy-shear + galaxy-galaxy) analysis with DES Y1
- Metacalibration shear catalogue (*Zuntz, Sheldon et al 2017*): ~26M galaxies total
- Two colour subsamples: ‘red’ & ‘blue’
- redMaGiC Lens Catalogue: ~660,000 red galaxies (*Elvin-Poole et al 2017*)
- Likelihood analysis with 26+ parameters
  - 6 Cosmological (Ω_m, h, A_s, n_s, Ω_b, $\Omega_v h^2$)
  - 4 Shear calibration $m^{(i)}$
  - 4 Shear photo-z $\Delta z^{(i)}$
  - 5 Lens photo-z $\Delta z^{(j)}$
  - 5 Lens bias $b_g^{(j)}$
  - 2+ intrinsic alignment

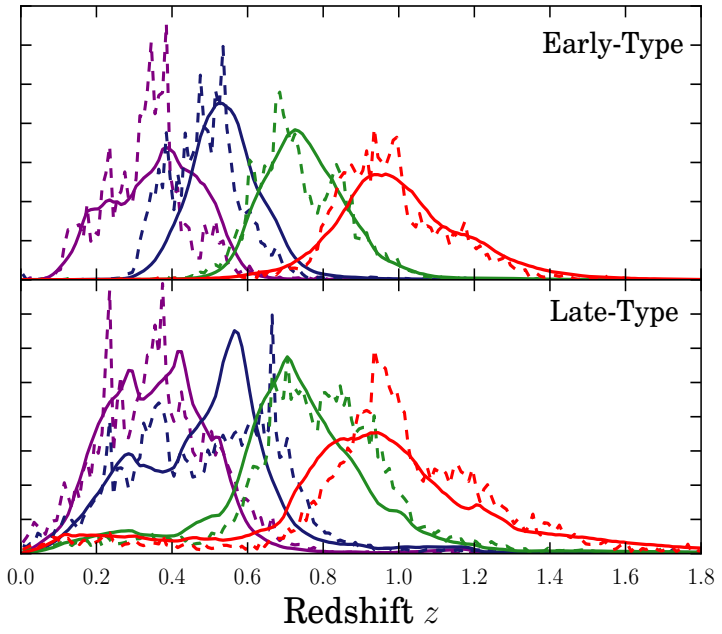
Splitting Galaxy Catalogues: How to Very Easily Break Everything

In general, imposing additional splits to a calibrated shear catalogue is not a good idea.

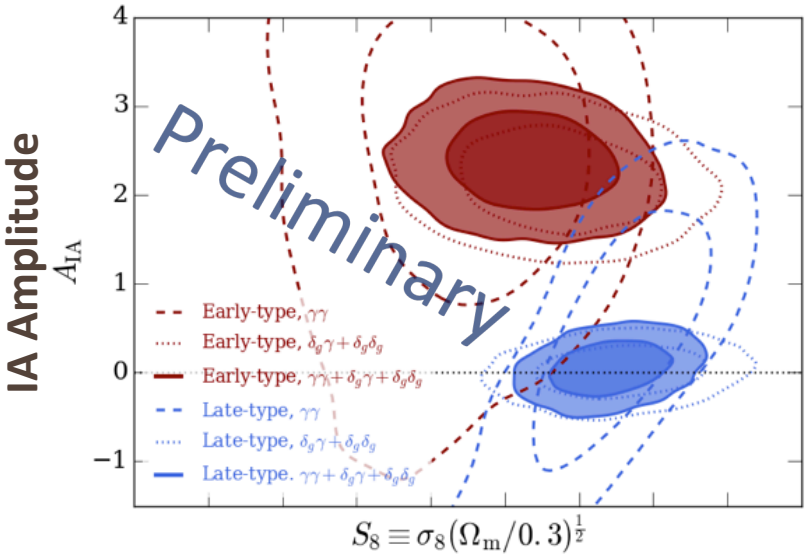
Many possible dangers:

- Shear Selection Bias
- Estimated $n(z)$ no longer valid
- Photo-z Calibration Bias
- Covariance Matrix no longer valid

→ requires careful recalibration

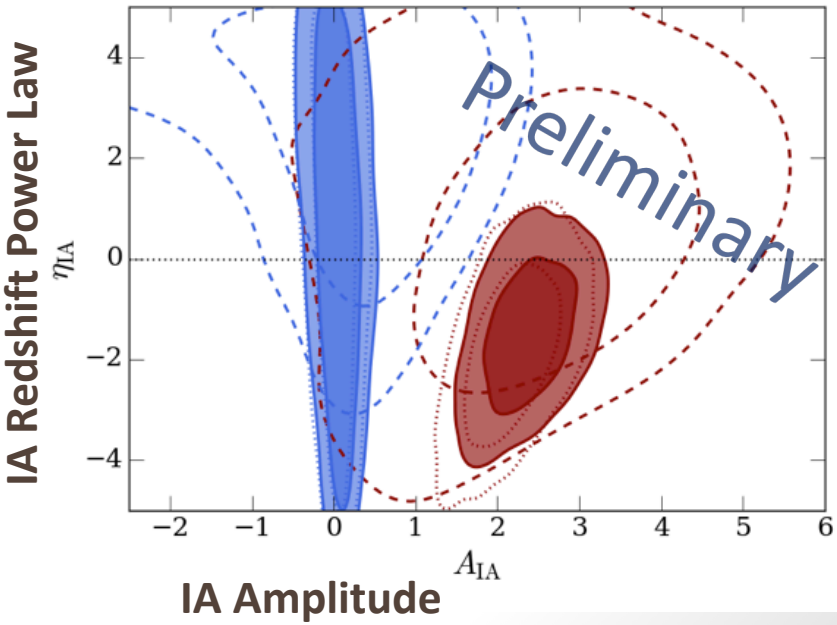


Nonlinear Alignment Model (Bridle & King 2007)



- ‘Standard’ IA model for cosmology used in e.g. DES Y1, KiDS-450, DLS, CFHTLenS
- Well tested on red low-*z* galaxies
- But little evidence (from theory, hydro sims or observation) it should work well for blue/high-*z* galaxies

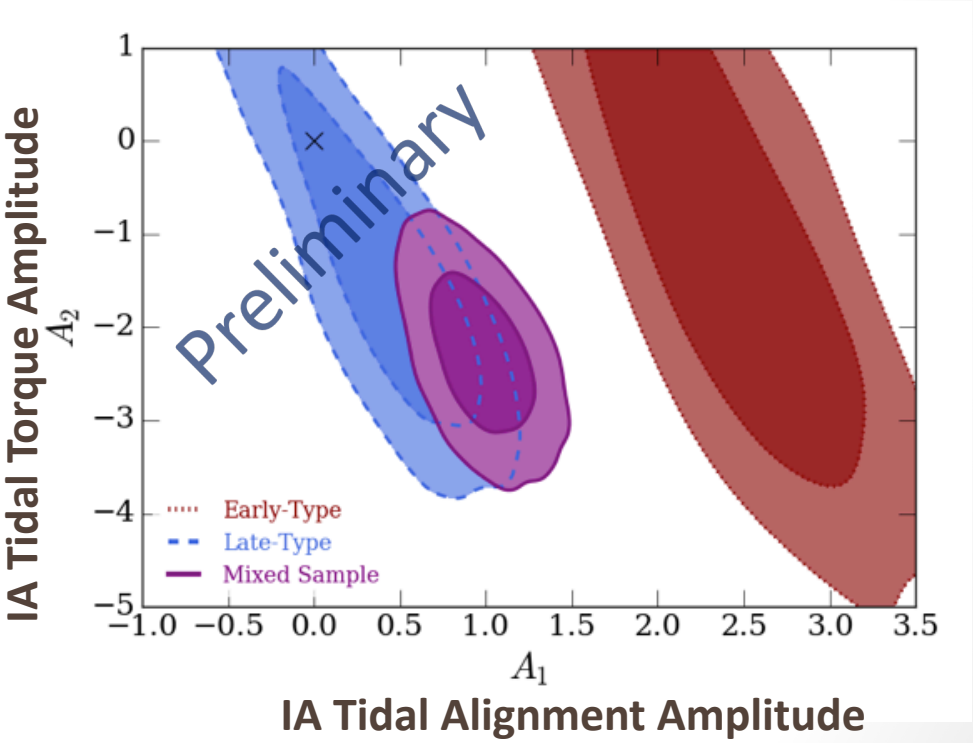
- Fit two-parameter NLA model to red & blue samples separately
- Consistent with null alignments in blue galaxies
- Amplitude $A_{\rm IA}$~2.5 in red sample



TATT Model (Blazek et al 2017)

- More sophisticated model, based on perturbation theory (see Jonathan's talk Thurs)
- Designed to naturally include tidal alignment and torque

- Two free IA parameters (TA and TT amplitudes)
- A_1 consistent with zero for blue galaxies
- A_1~2.5 in red sample
- Poor constraint on A_2 in split samples
- ~few sigma measurement in unsplit catalogue



Conclusions

- Run a split-sample 3x2pt reanalysis of DES Y1
- Recomputed 2pt observables, redshift distributions, covariance, shear & photo-*z* nuisance parameter priors
- We presented constraints on two IA parameterisations
- At DES Y1 precision, our results are consistent is with zero alignments in blue galaxies
- Clear detection of a positive alignment in red galaxies
- Moderate negative tidal torque amplitude A_2 favoured by unsplit catalogue.