

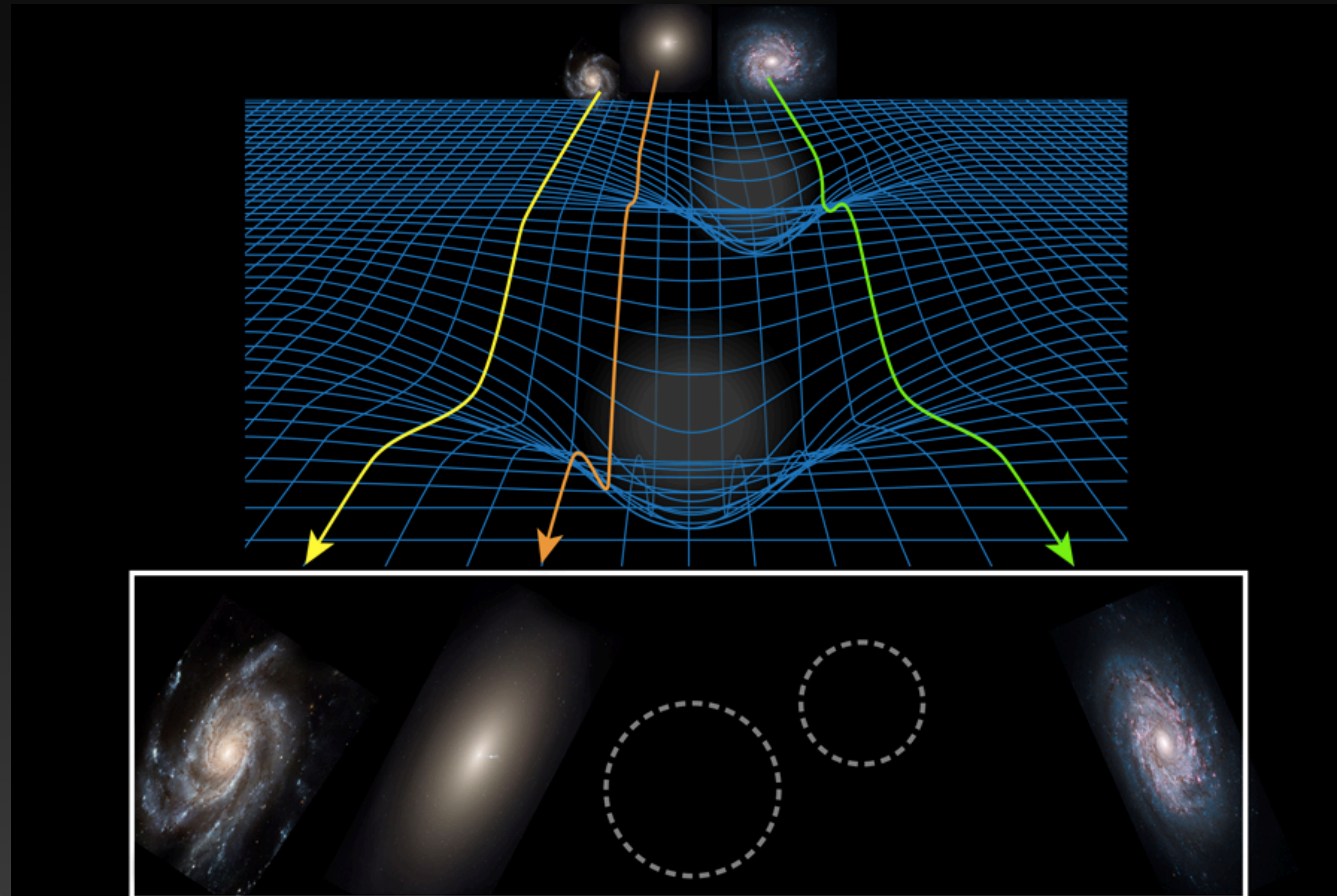


Slicing through the tension: Getting more cosmology from weak lensing

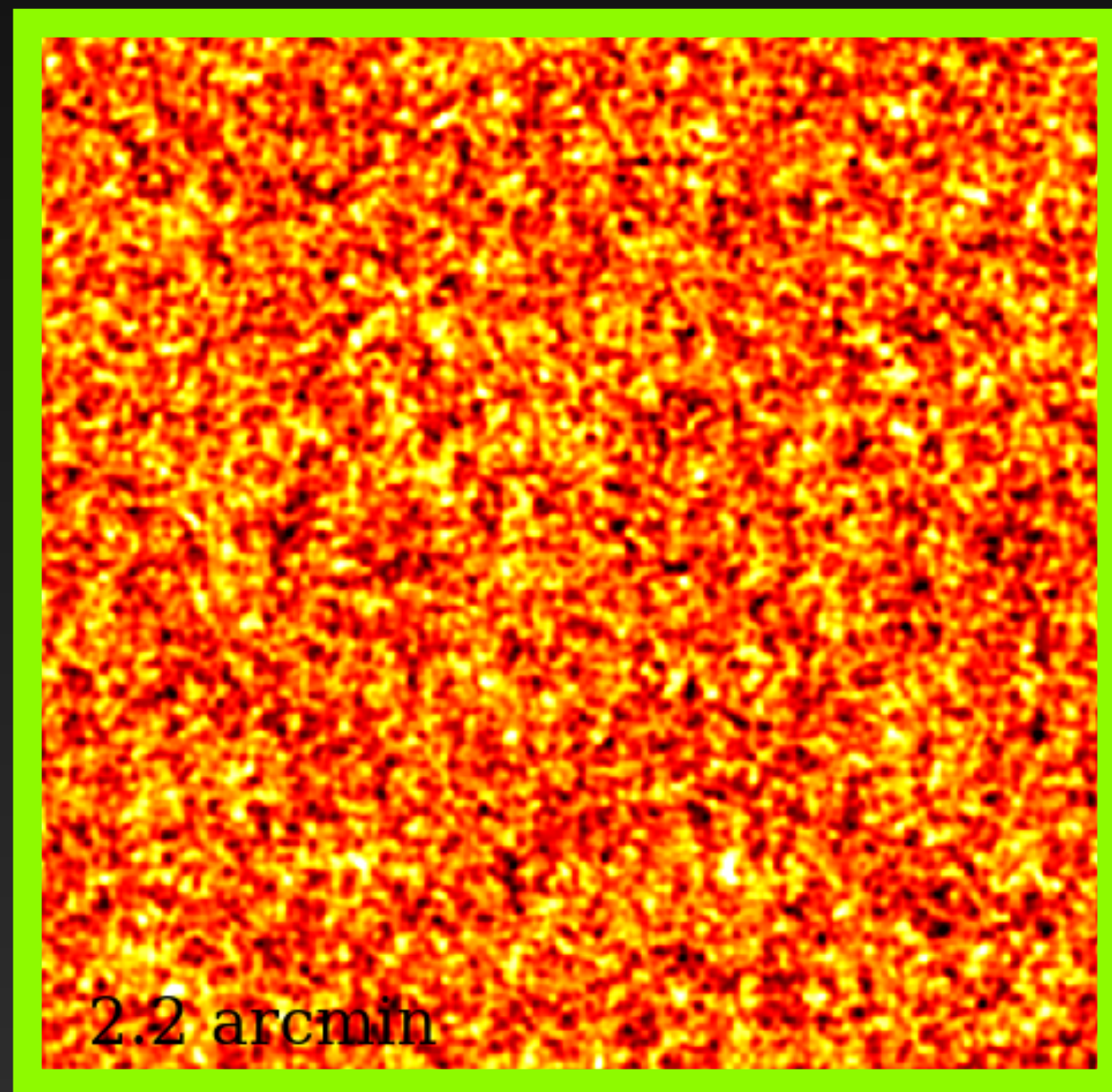
**Benjamin Giblin,
Yanchuan Cai,
Joachim Harnois-Déraps**

Tensions in Cosmology, Corfu
Sep 2022

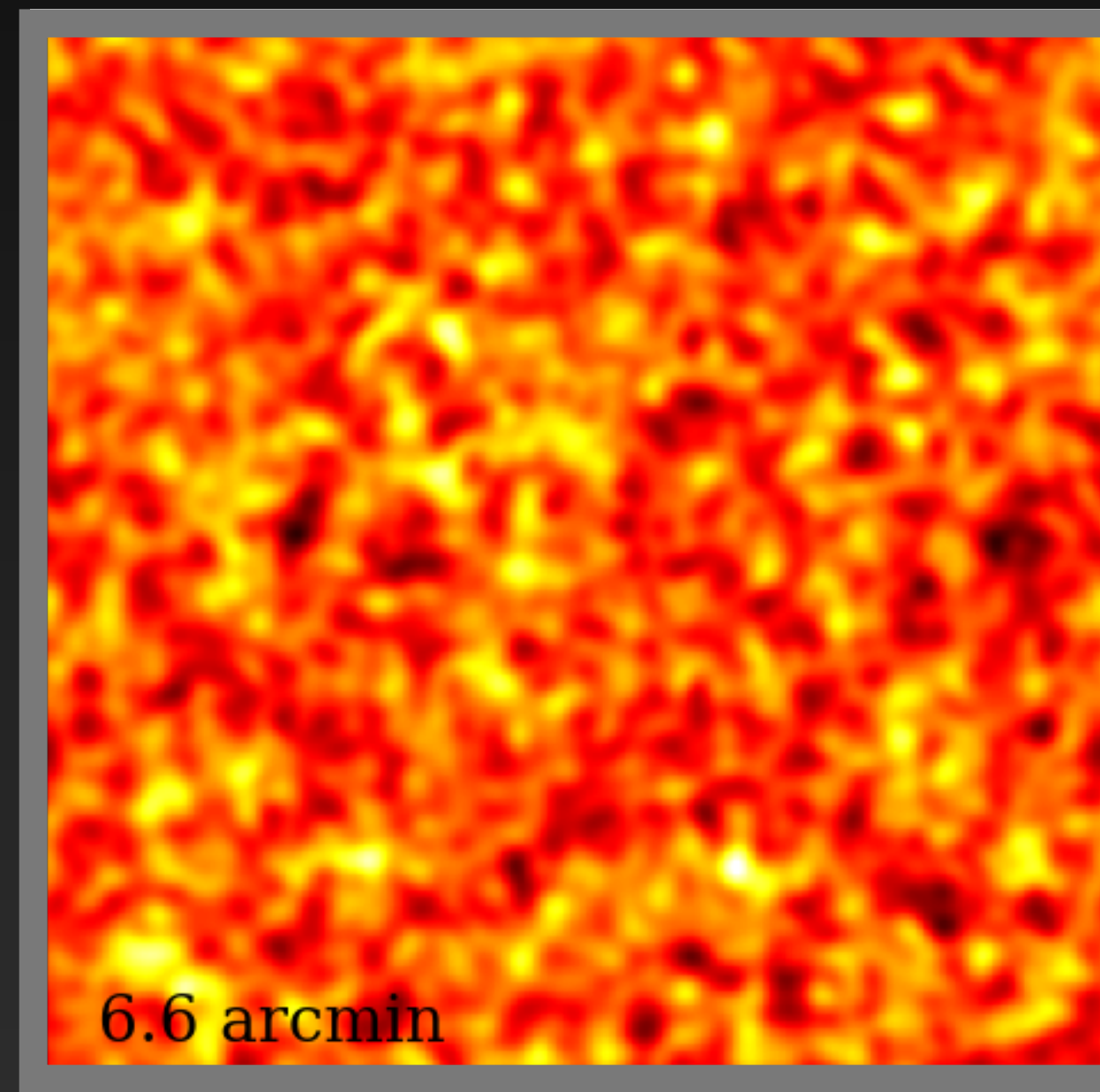
Weak lensing: A powerful cosmological probe



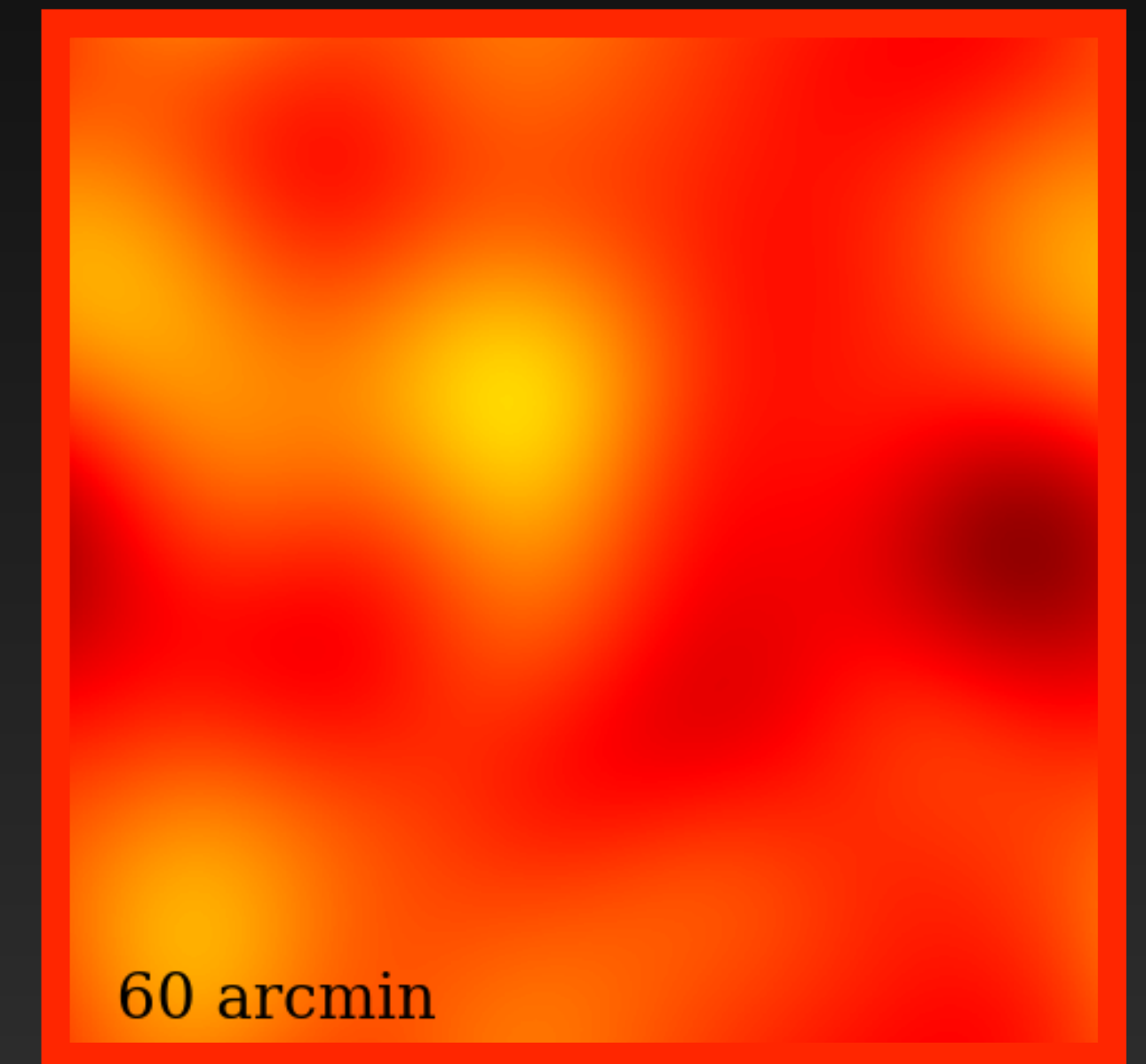
Projected density from weak lensing



Low smoothing



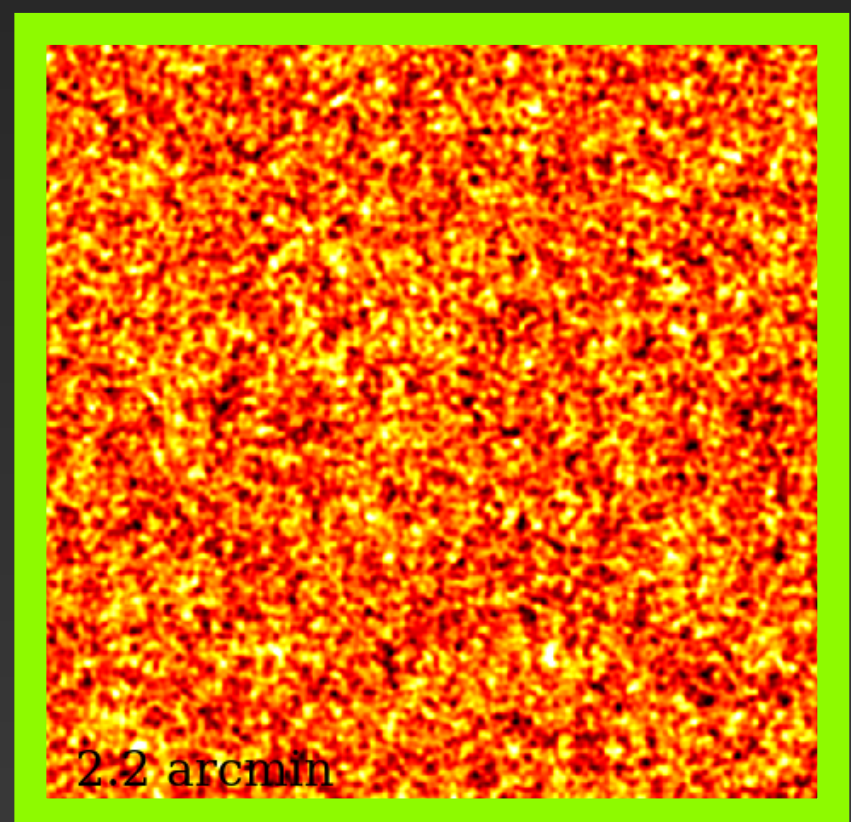
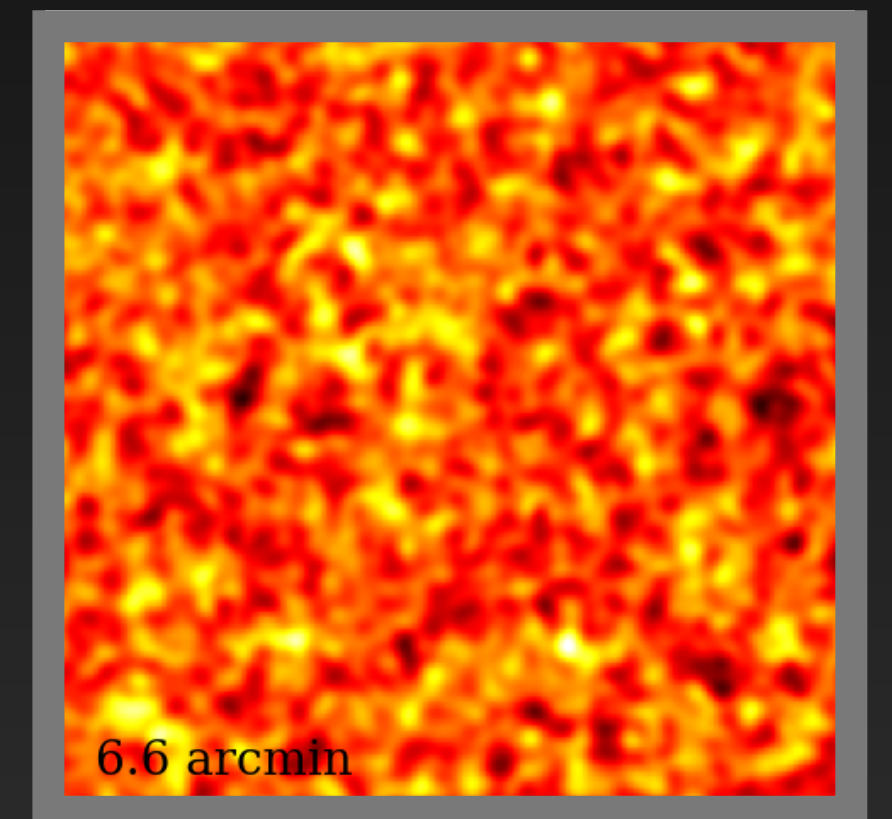
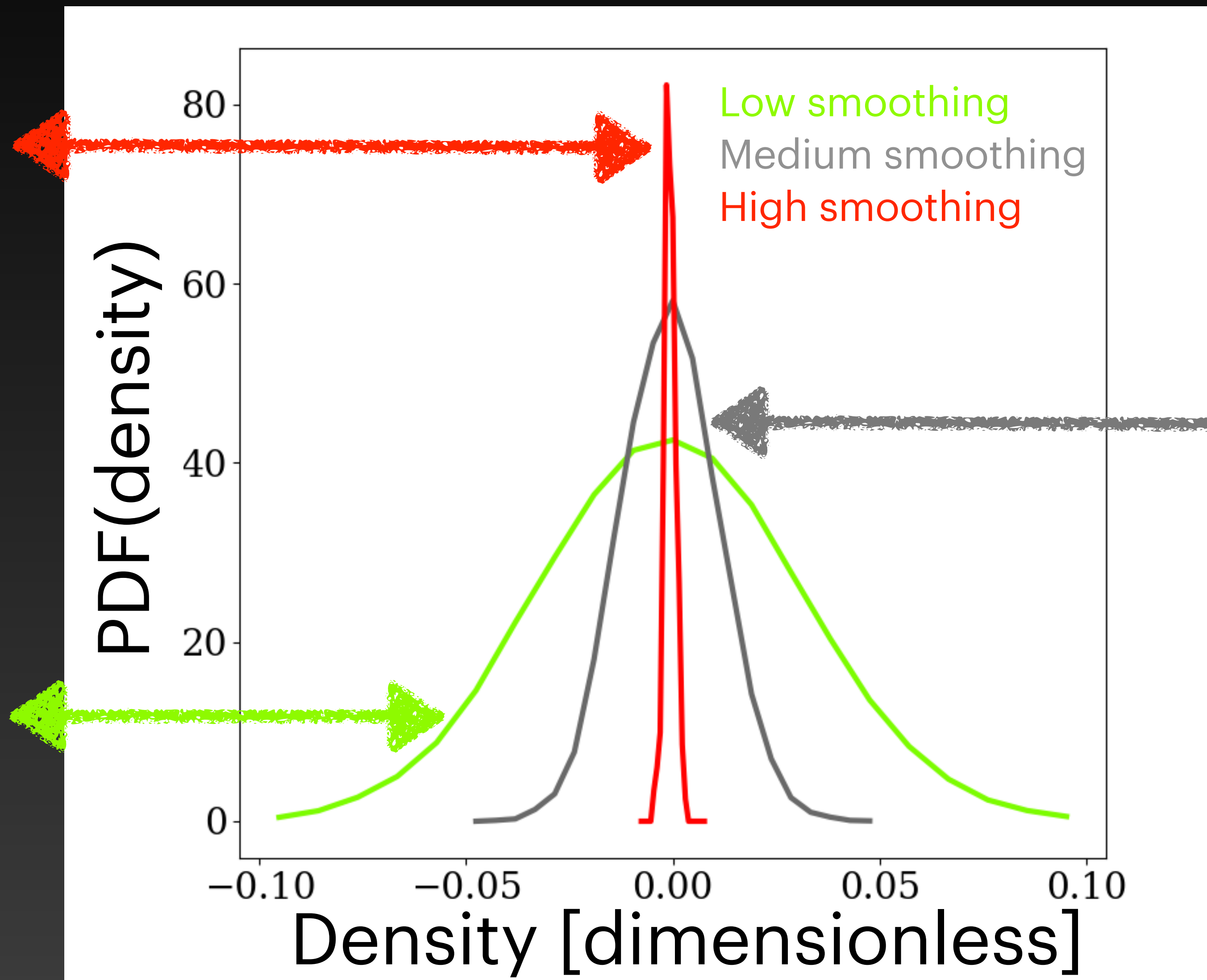
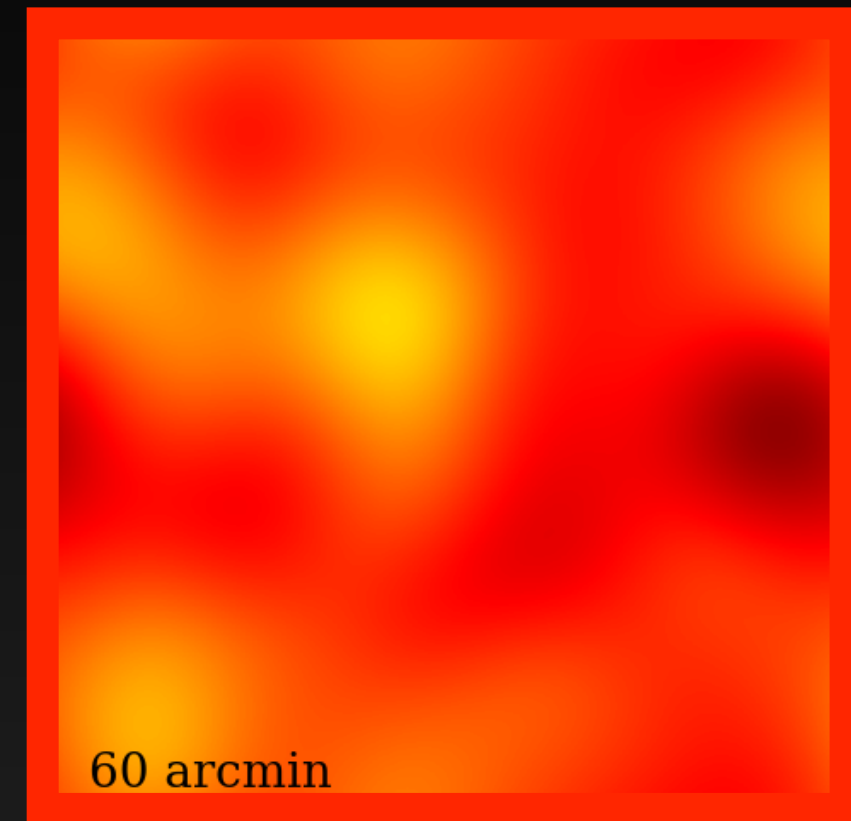
Medium smoothing



High smoothing


Constraining cosmology with the weak lensing density

"The lensing PDF"



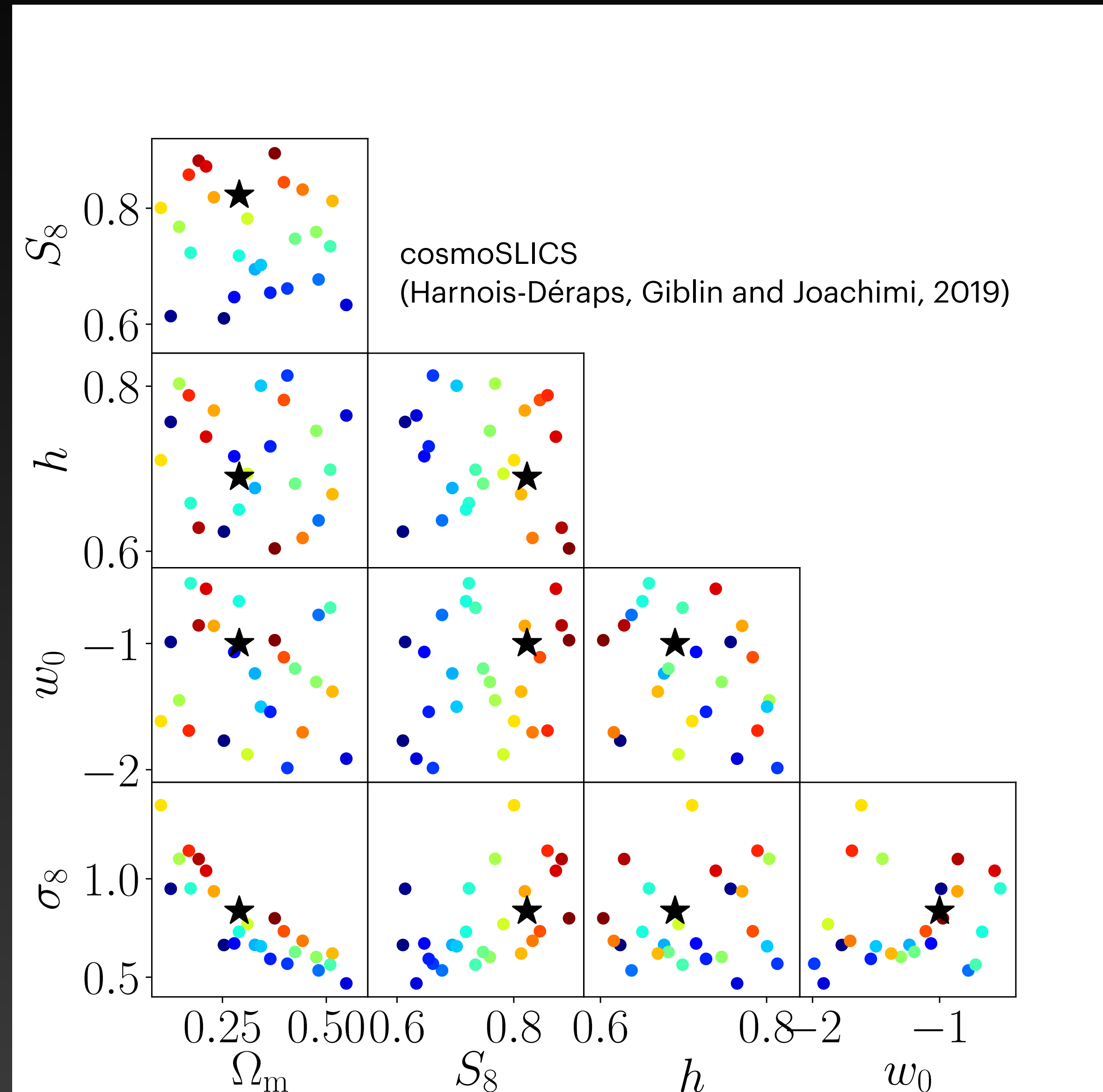
How do we model the cosmological dependence...?

$$\mathcal{L}(\mathbf{d}|\boldsymbol{\pi}) \propto \exp\left(-\frac{1}{2} [\mathbf{d} - \mathbf{m}(\boldsymbol{\pi})]^\top \boldsymbol{\Sigma}^{-1} [\mathbf{d} - \mathbf{m}(\boldsymbol{\pi})]\right)$$

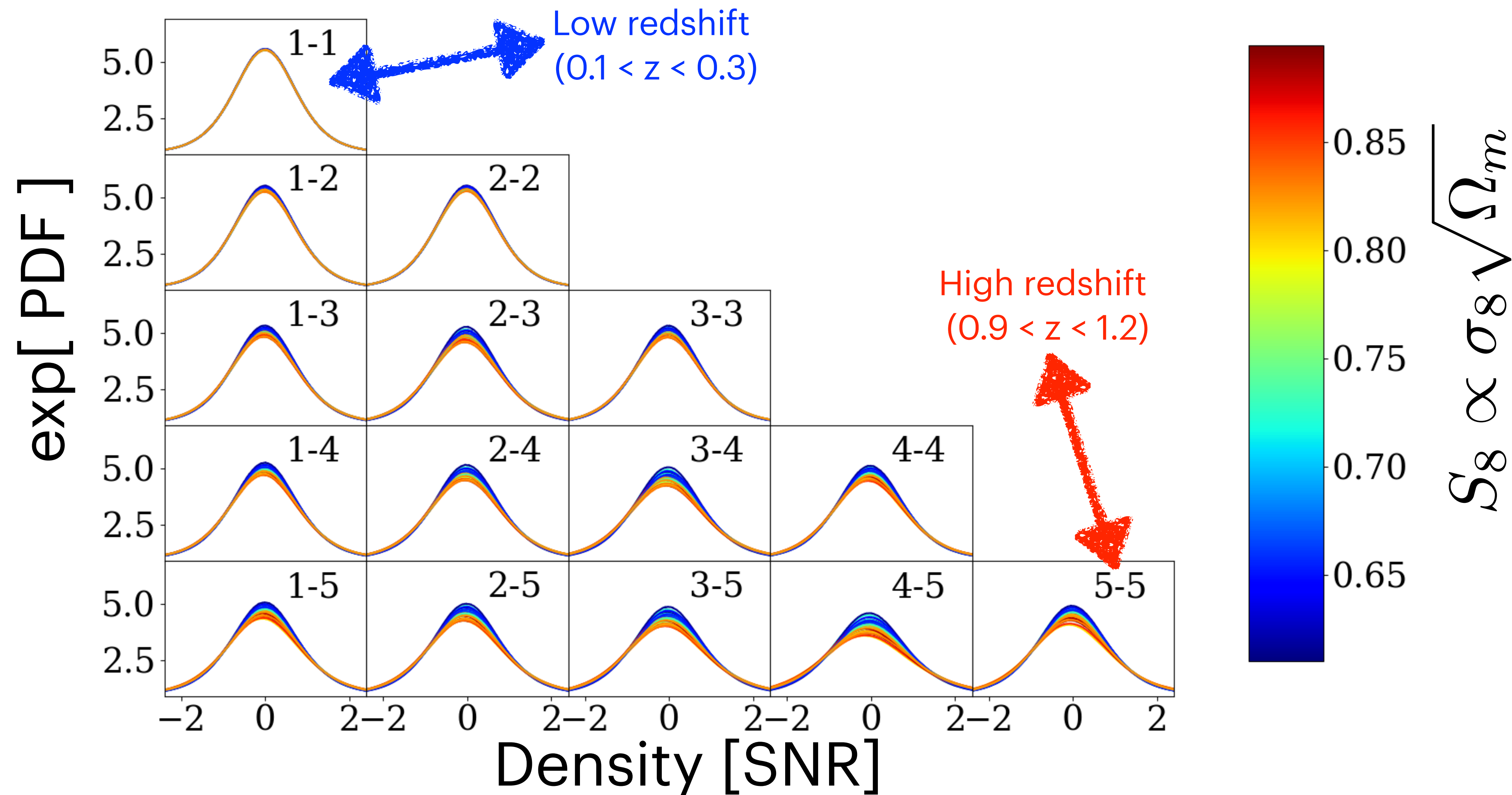


Require a model for
our statistics as a function of
cosmological parameters $\boldsymbol{\pi}$

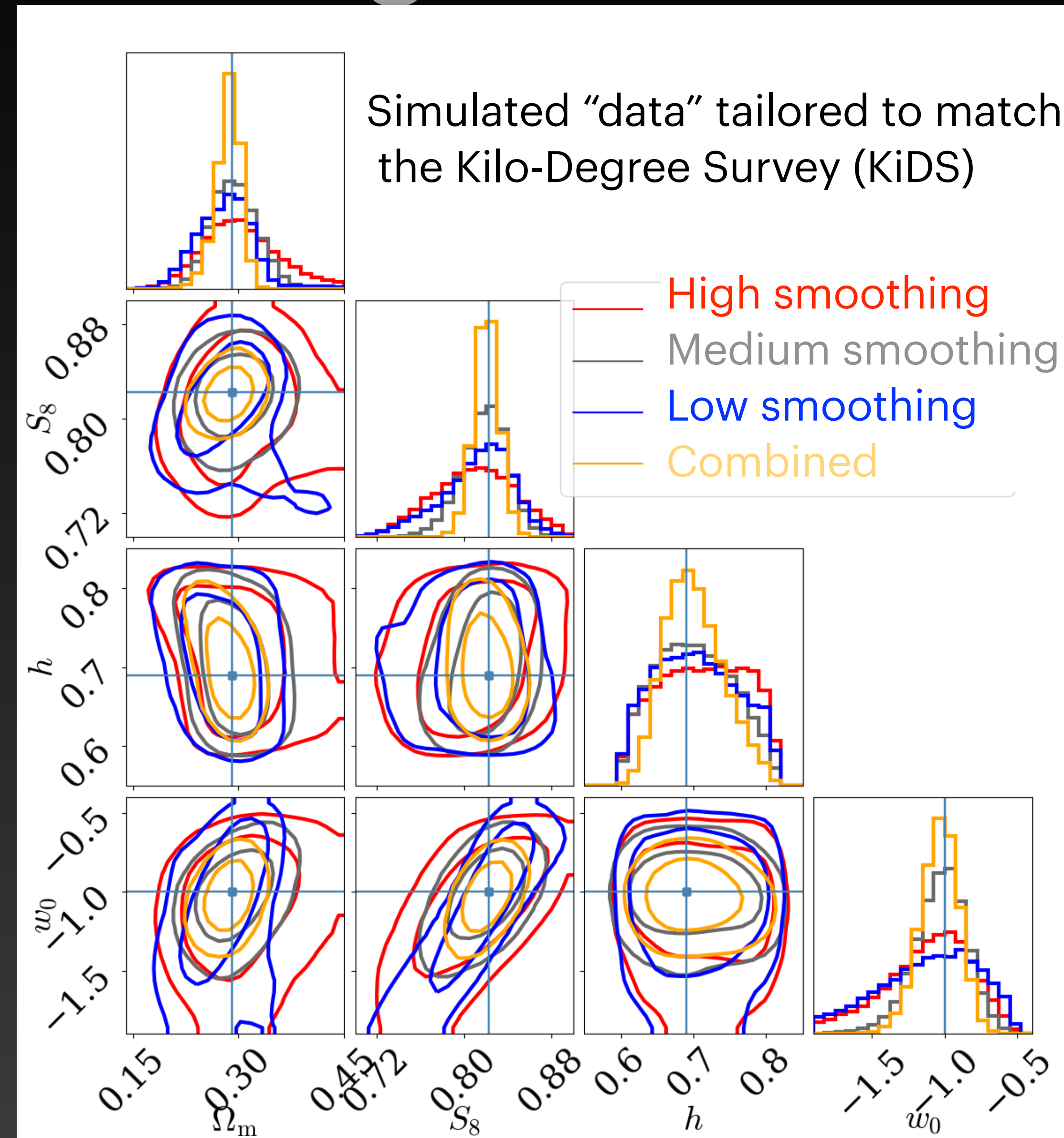
....with numerical simulations!



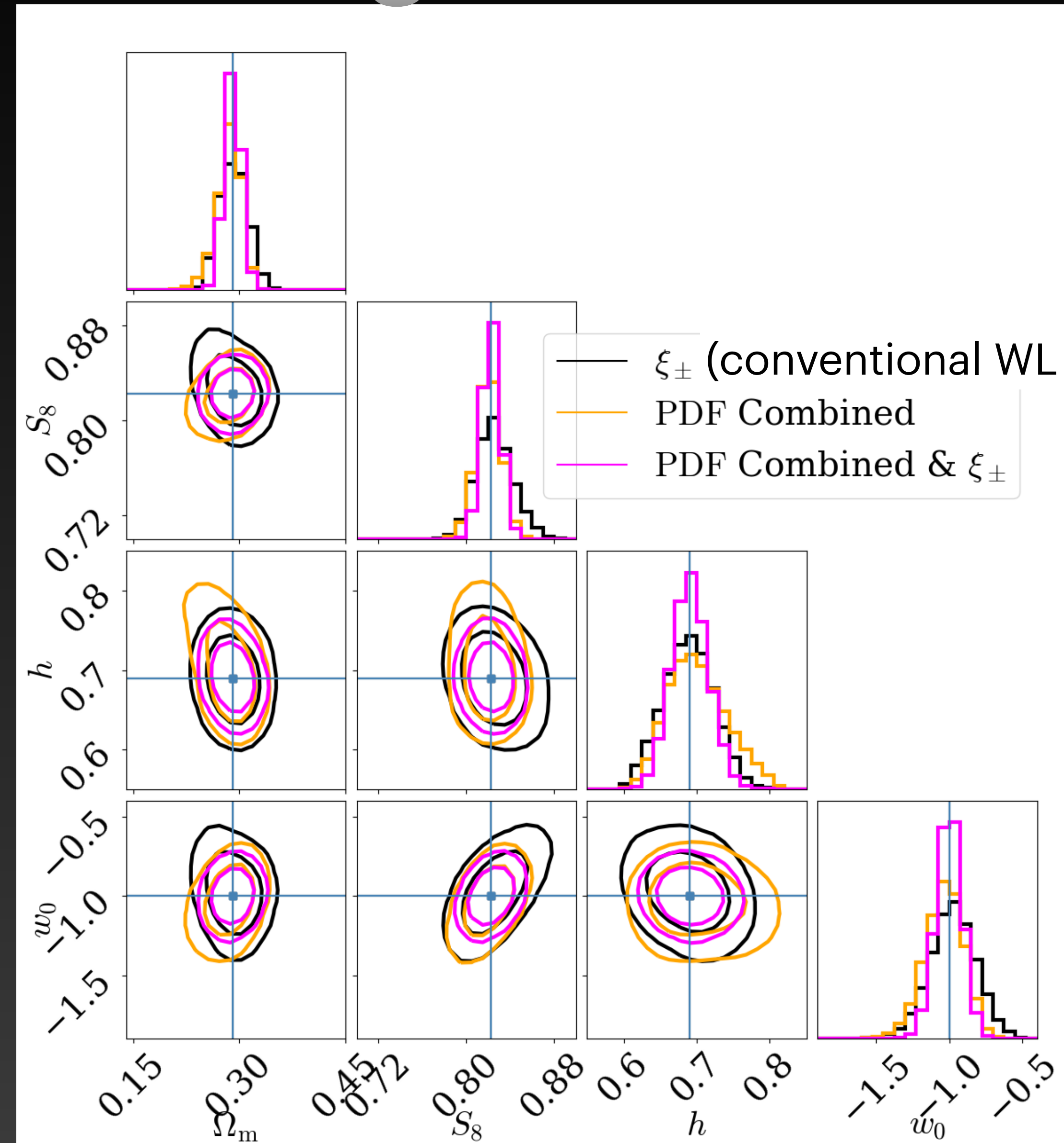
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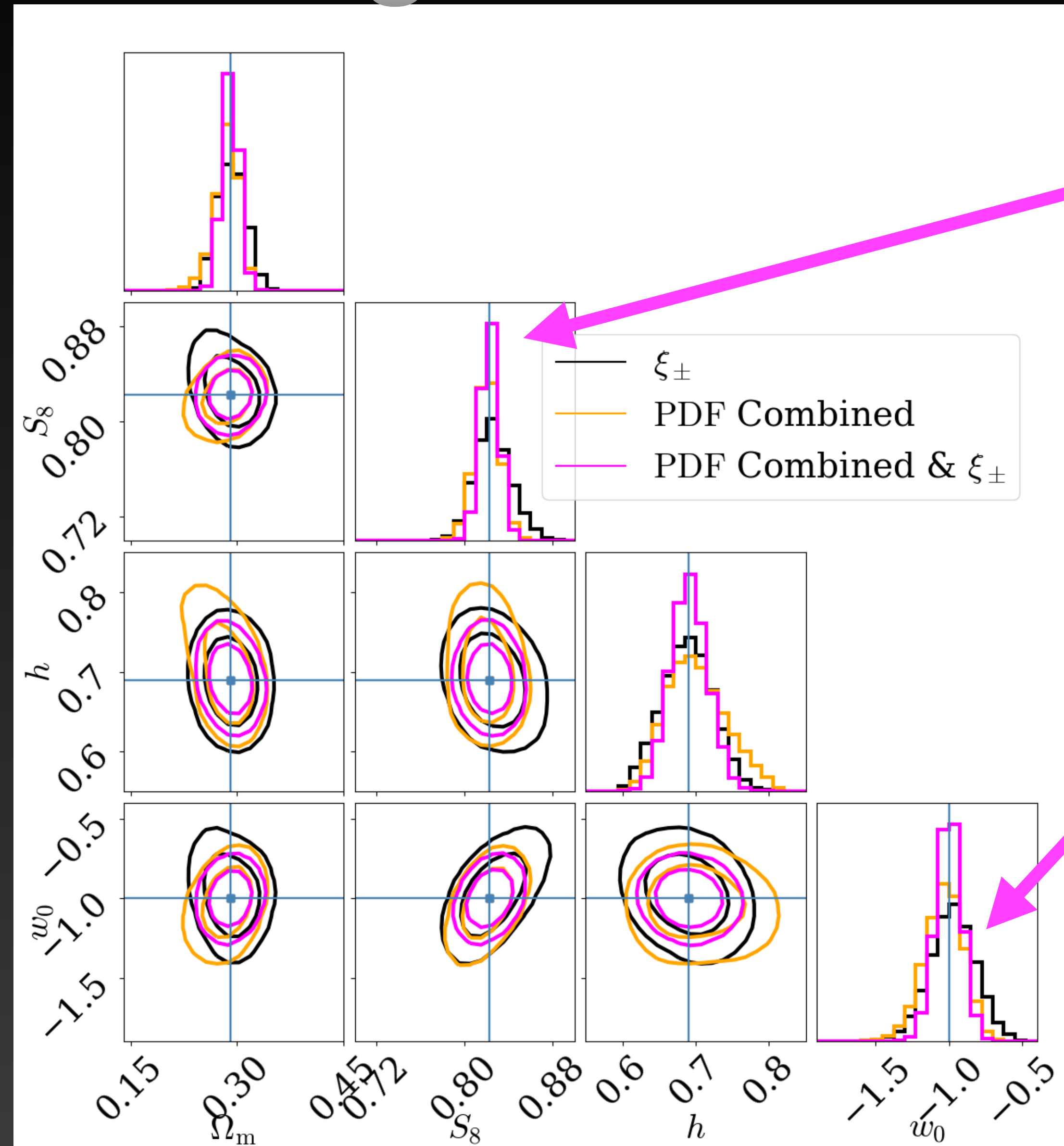
Cosmological constraints



Cosmological constraints



Cosmological constraints



~50% improvement on S_8 constraint

~45% improvement for w_0

Summary

- The projected density of LSS can be measured with weak lensing and used to constrain cosmology.
- We build a model for the PDF of the lensing density and forecast the constraints from this new probe.
- For a current WL survey, we expect the lensing PDF to improve upon the constraints from conventional WL stats by 30-50%.
- The future is bright! These benefits are expected to double [PRELIMINARY!] for future surveys such as LSST.

EXTRA SLIDES

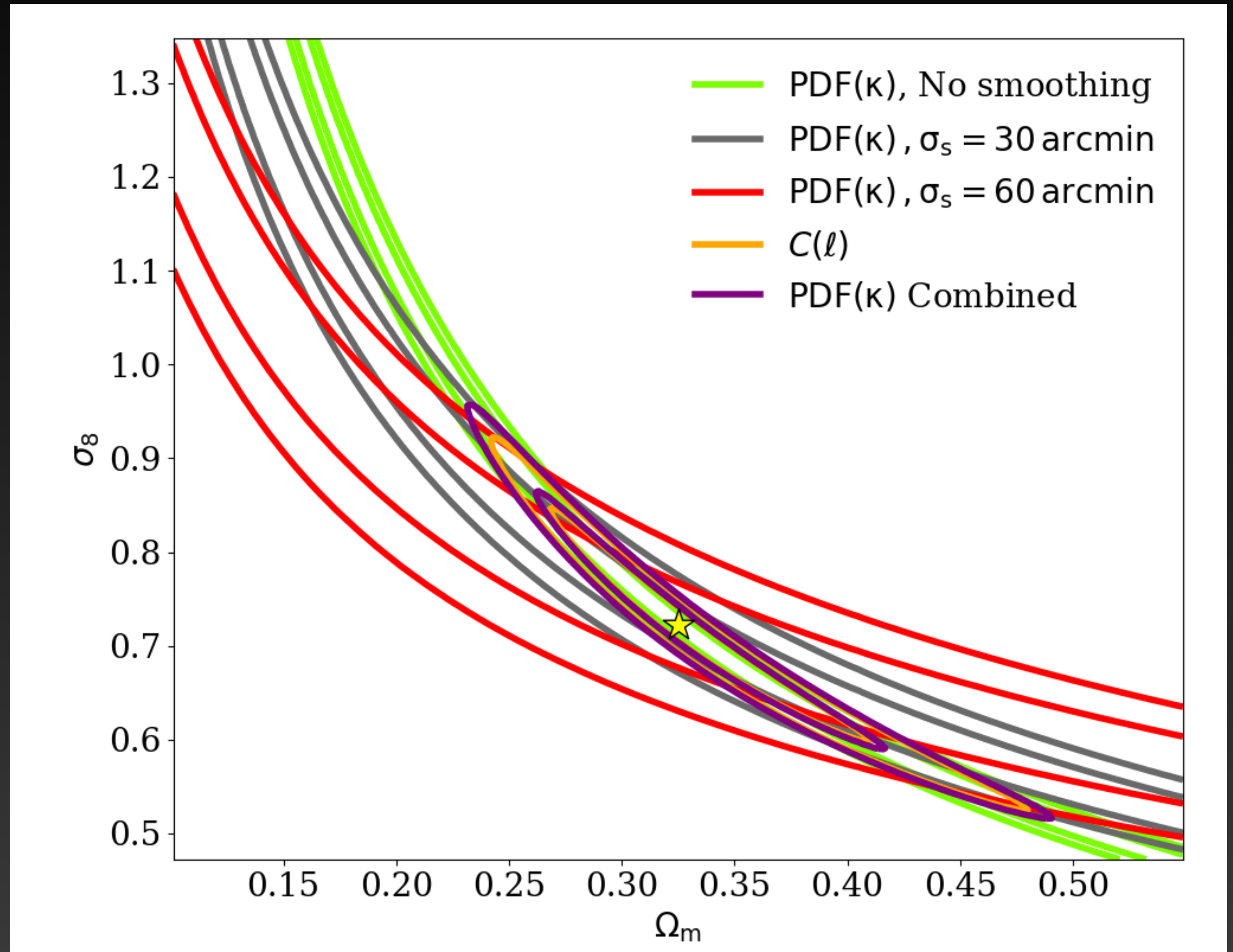
Q:

Is PDF cosmic shear worth it?

PDF vs 2pt Stats

The sanity test: a Gaussian field

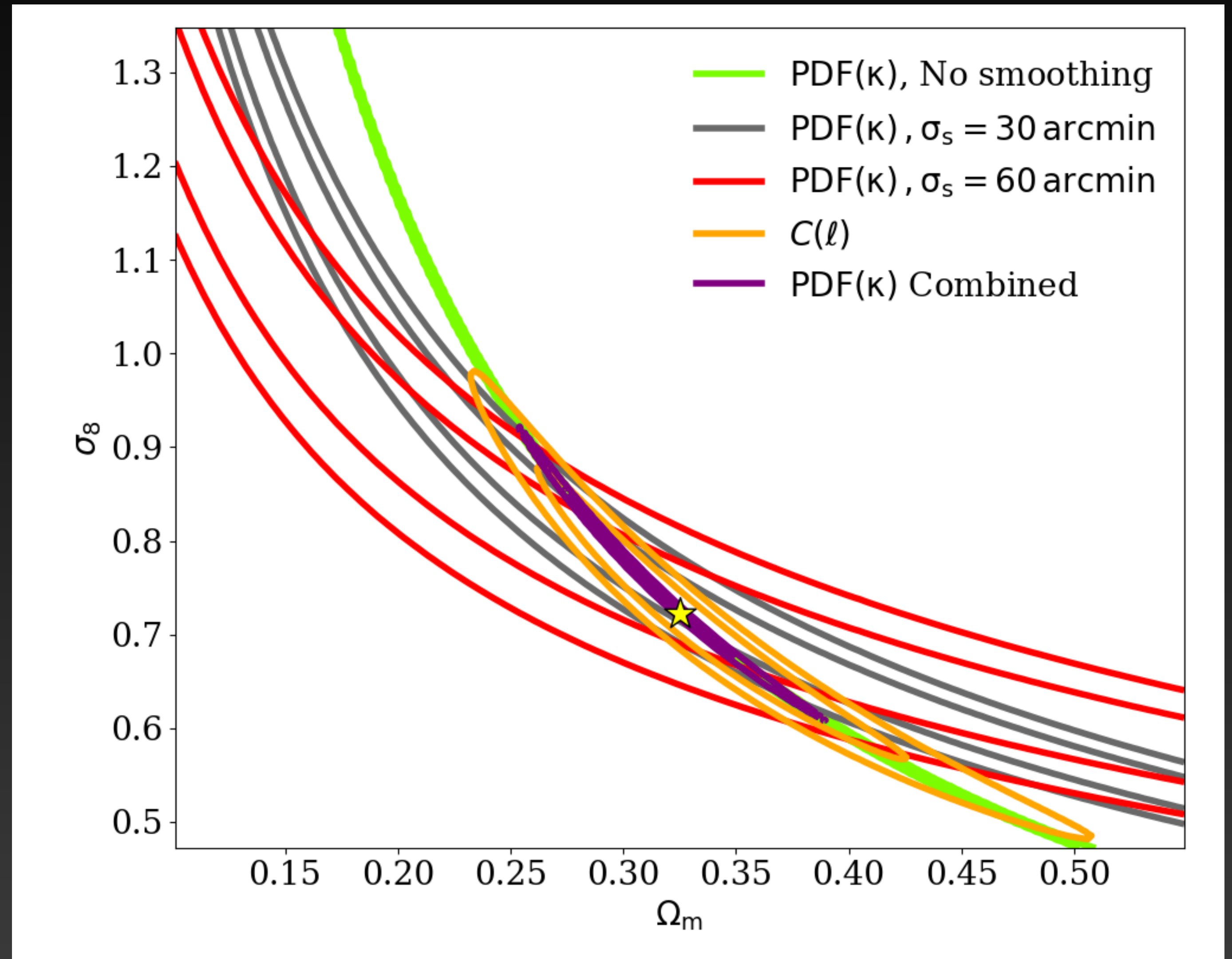
- $C(\ell)$ and $\text{PDF}(\kappa)$ predictions from healpy.
- Combined PDF constraints converge to $C(\ell)$ constraints.



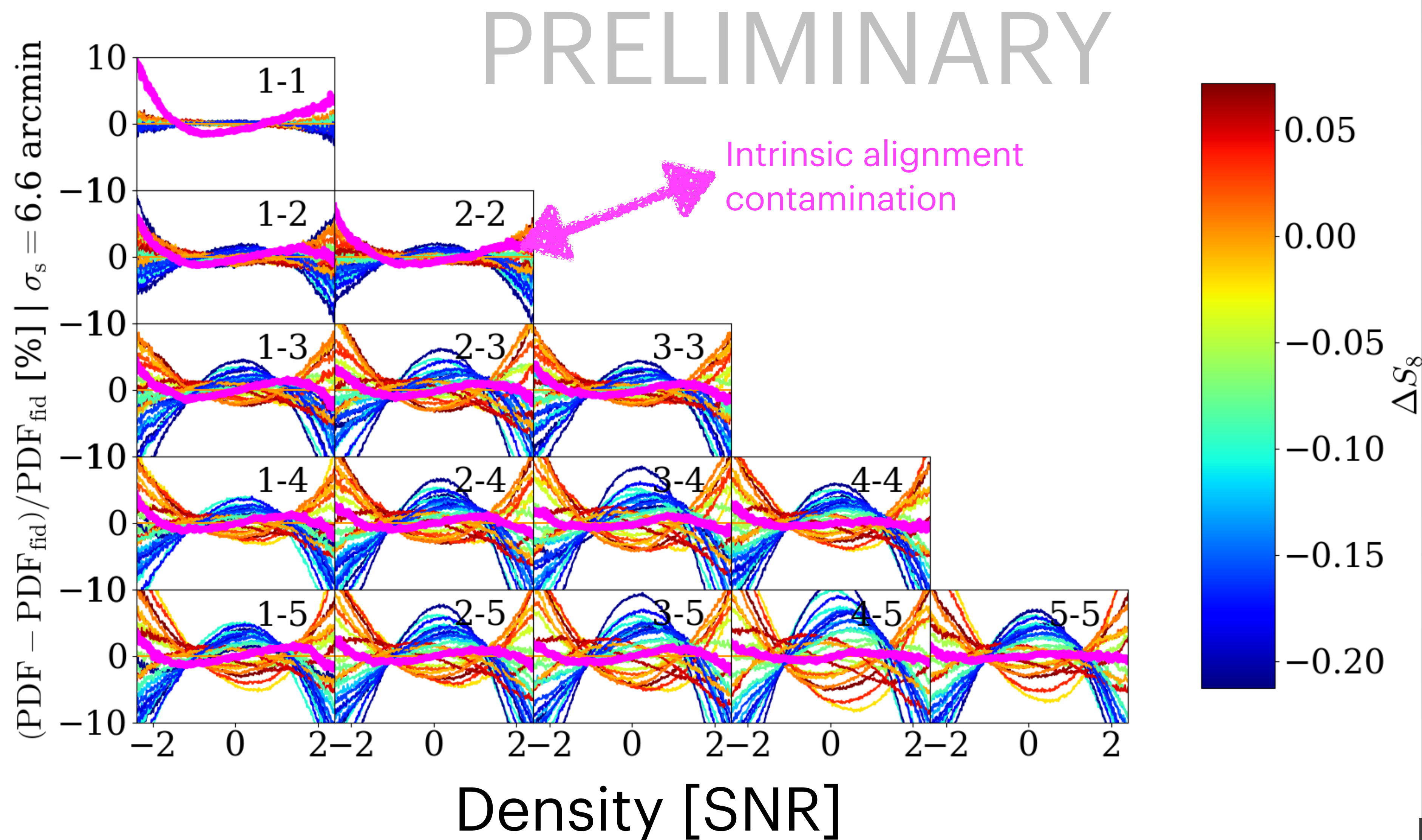
PDF vs 2pt Stats

The test case: a lognormal field

- $C(\ell)$ and $\text{PDF}(\kappa)$ predictions from FLASK.
- Combined PDF constraints offer significant improvement on the $C(\ell)$



The impact of intrinsic alignments



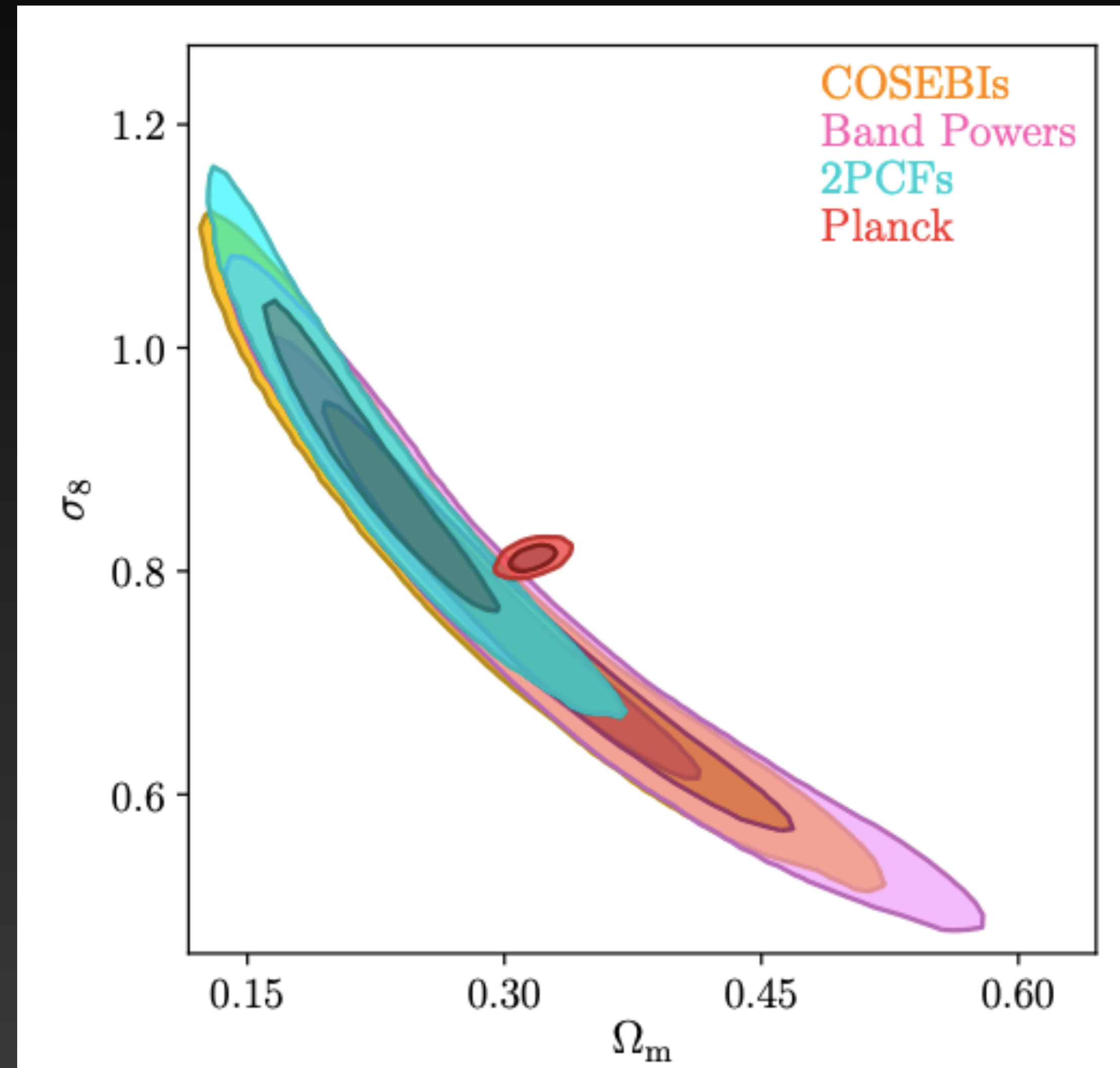
Cosmic shear:

Constraining cosmological parameters with weak lensing

The shear correlation function (2PCF) measured from data



The measurement from the data is compared to a theoretical prediction which depends on cosmological parameters (e.g. Ω_m & σ_8)



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Constraining cosmological parameters with weak lensing

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