COSMOLOGY WITH WEAK LENSING
CHALLENGES & OPPORTUNITIES

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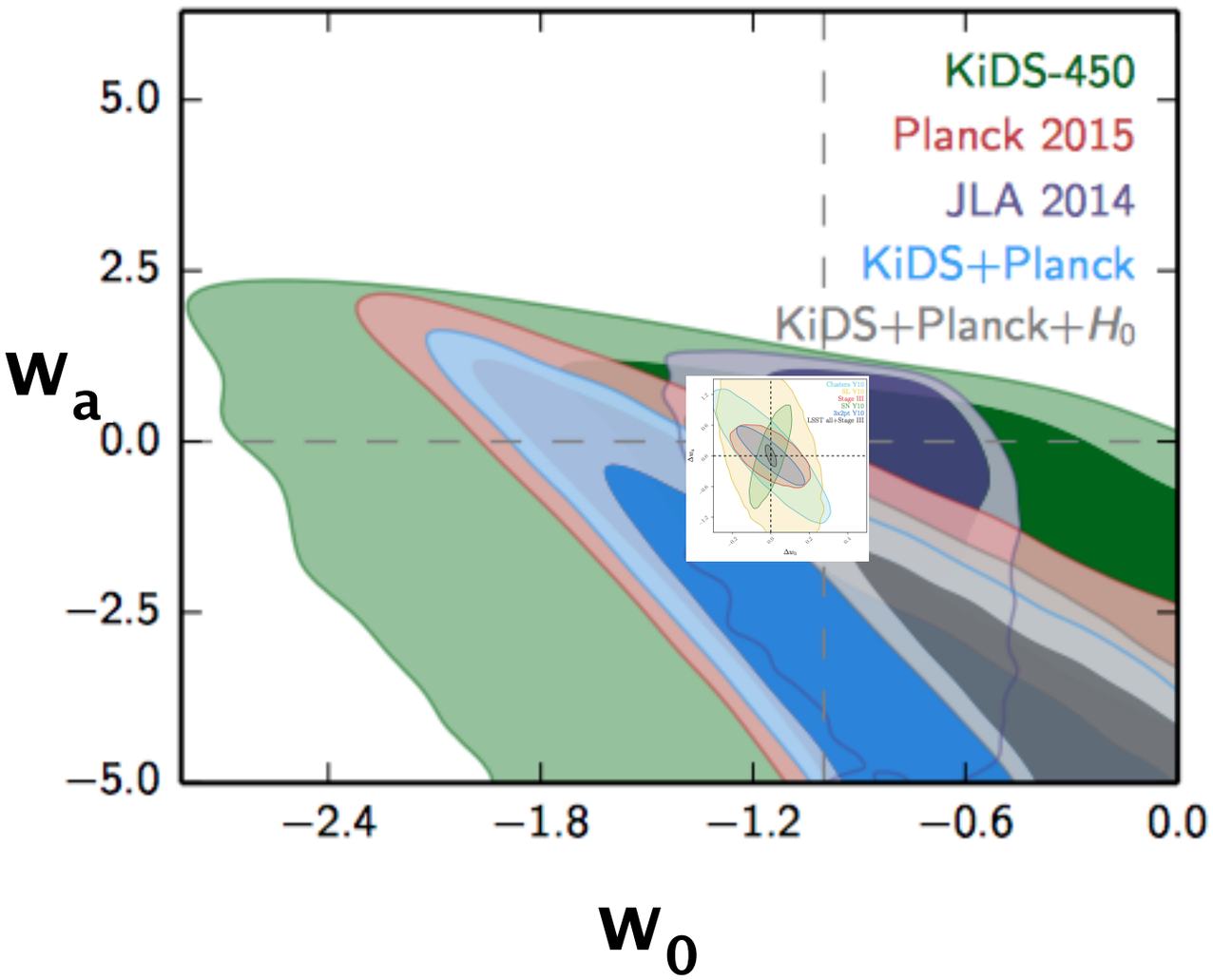
KICC 10th. Anniversary Symposium

September 17, 2019

COSMOLOGY WITH LENSING SURVEYS

Dark energy equation of state: $w = w_0 + w_a(1-a)$

Joudaki+ (2016)



LSST DESC Science Requirements Document

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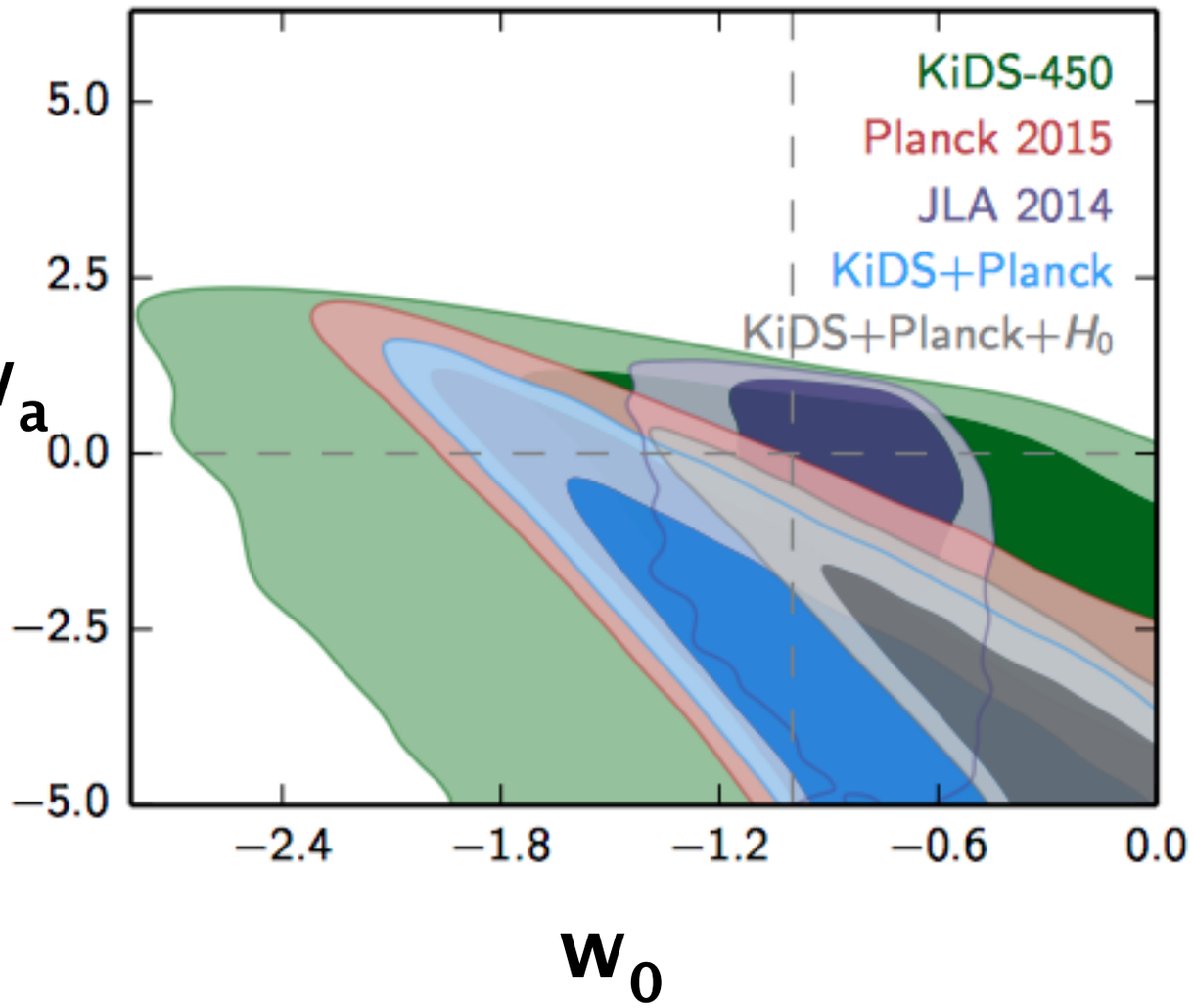

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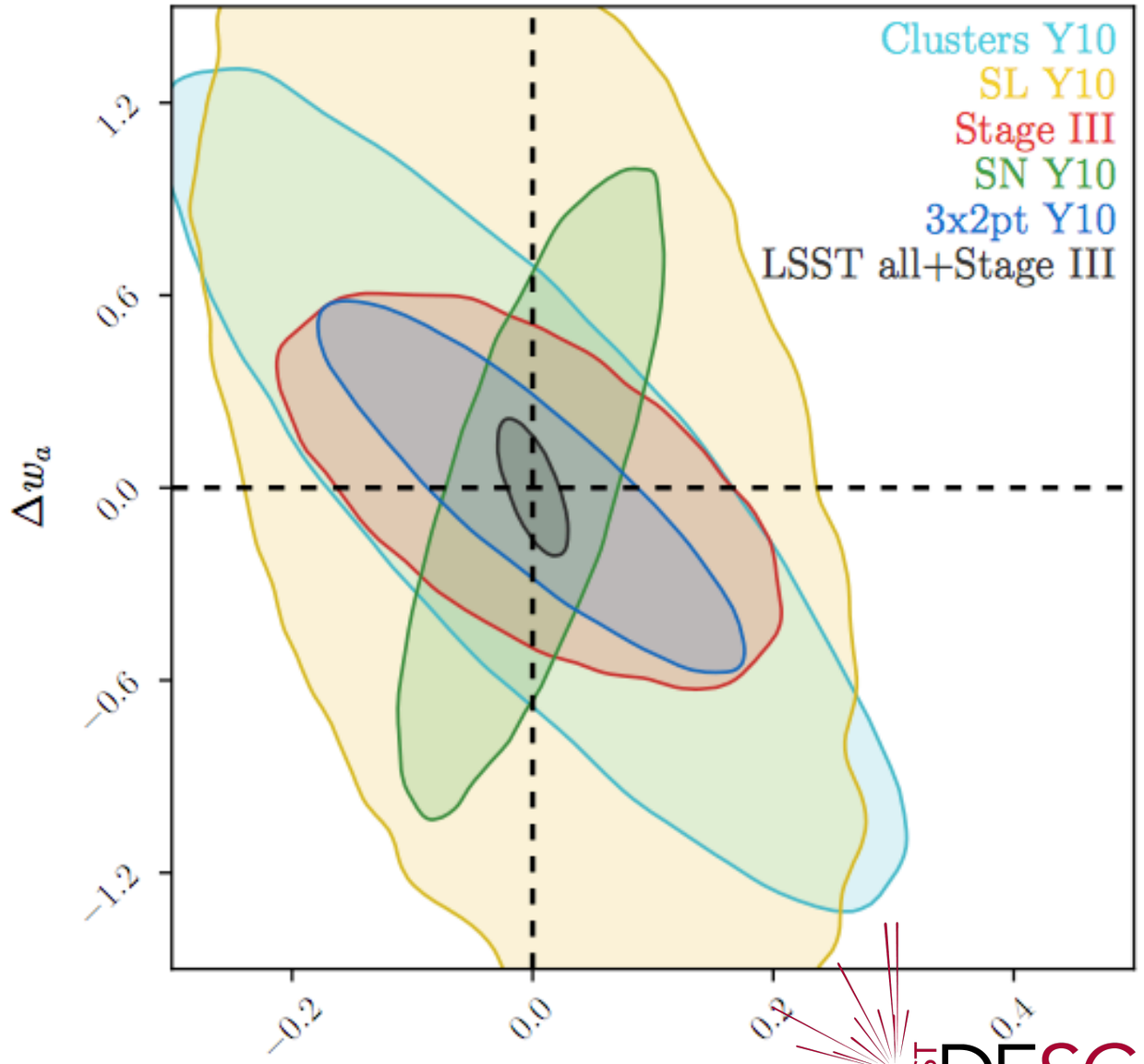
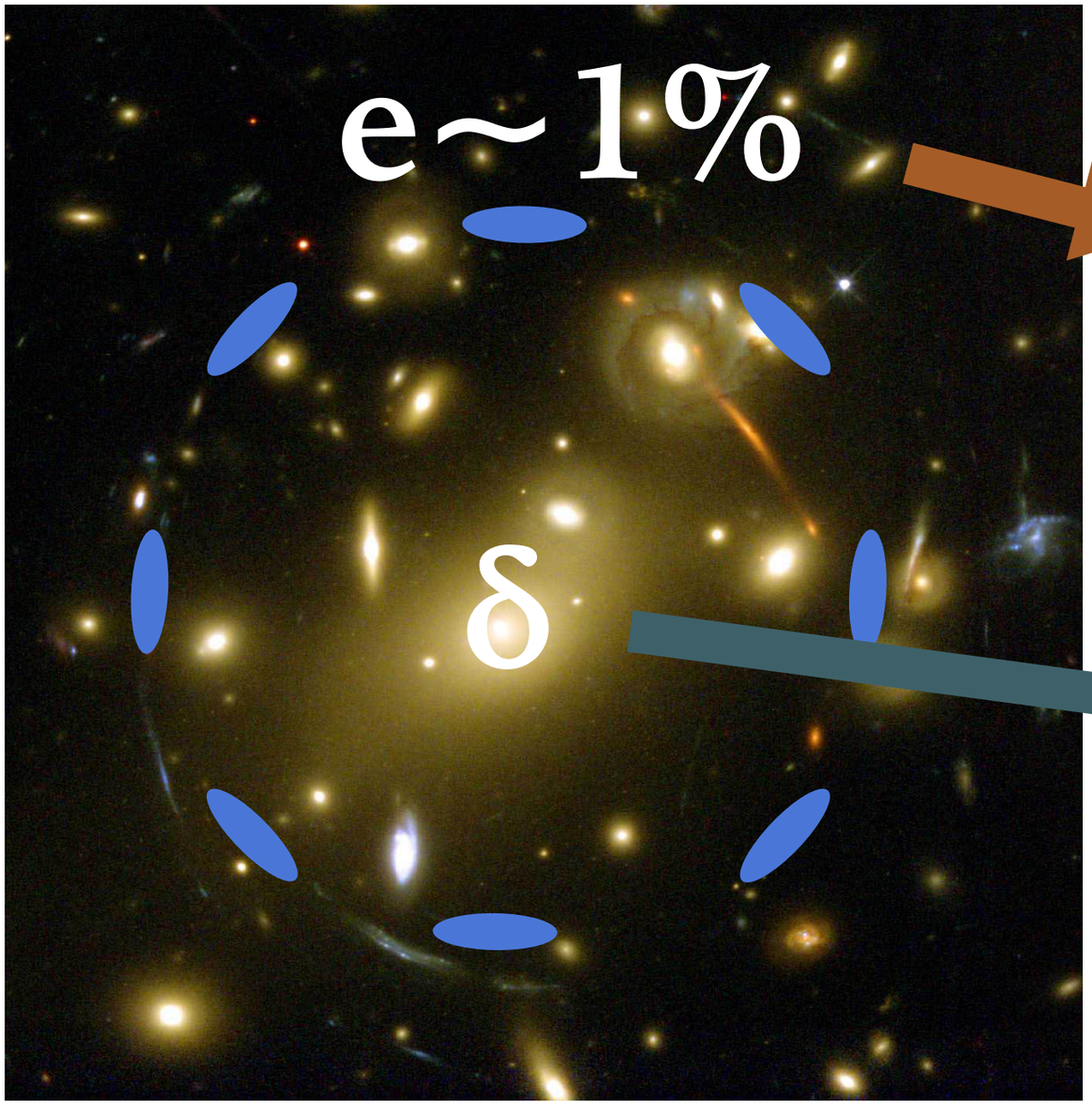


CHALLENGES TO PRECISION COSMOLOGY



INTRINSIC ALIGNMENTS OF GALAXIES

GASTROPHYSICS

H. Hildebrandt's talk

J. Dunkley's talk

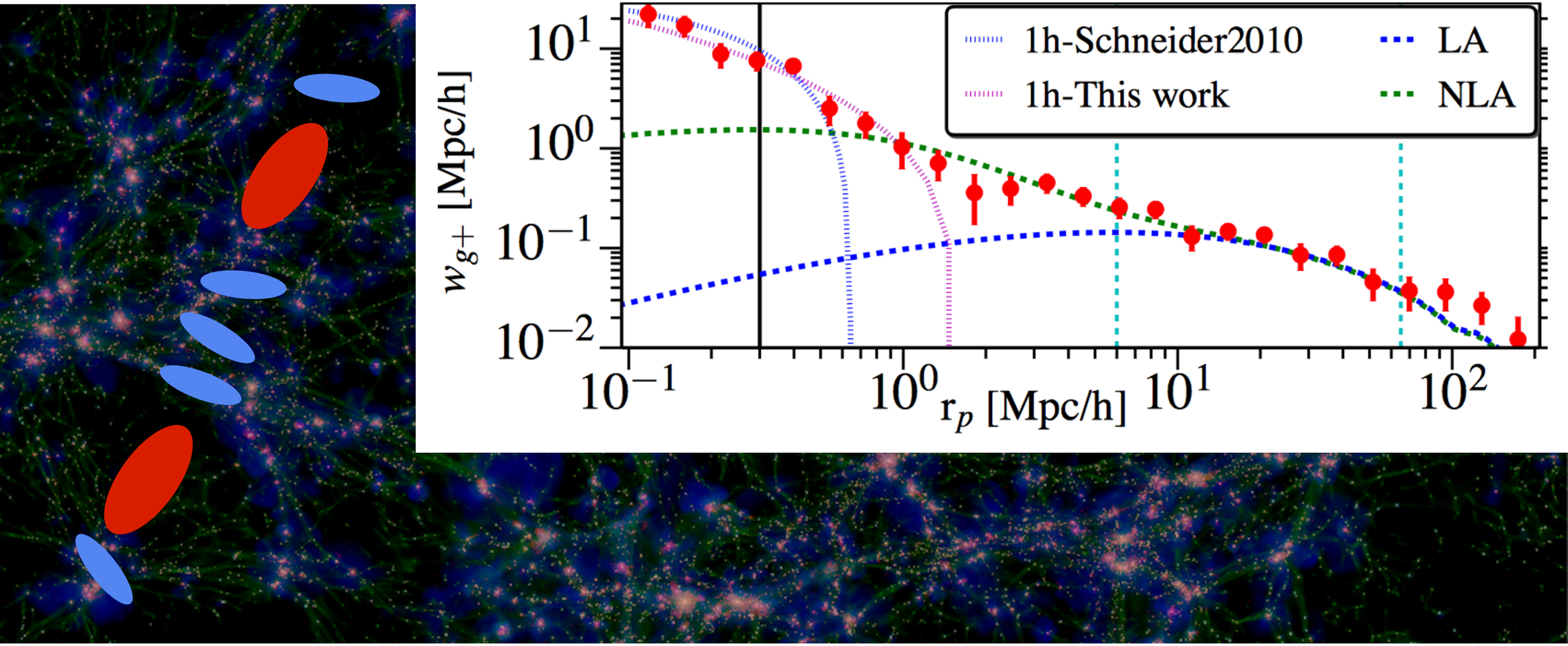
*PHOTO-Z CALIBRATION

*ROBUST PIPELINES: CCL

EC+ (2019), https://github.com/LSSTDESC/CCL

INTRINSIC ALIGNMENTS (IA)

SDSS LOWZ sample – Singh+ (2015)



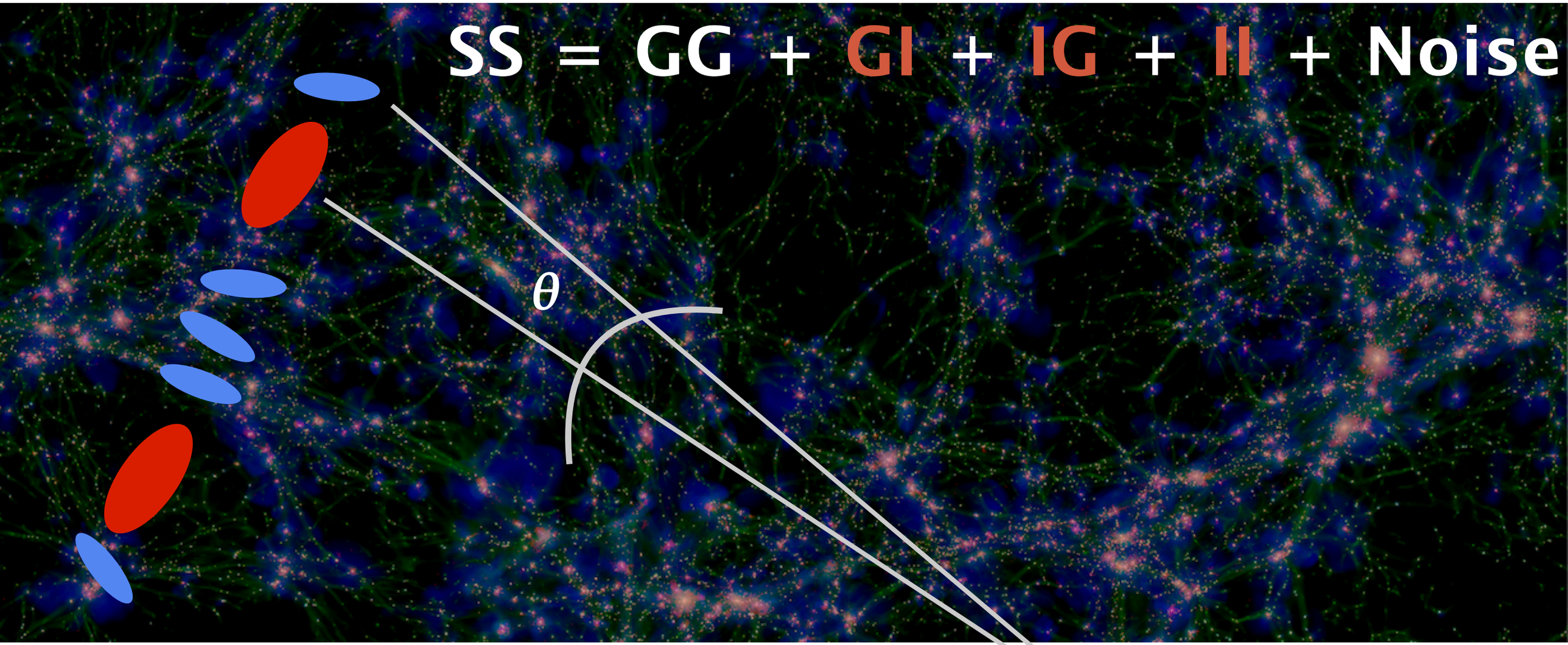
Galaxy shapes ~ *Tidal field of the large-scale structure*

Catelan+ (2001)

SPT extension – Blazek+ (2017)

EFT of galaxy shapes – Vlah, EC, Schmidt (in prep.)

INTRINSIC ALIGNMENTS (IA)



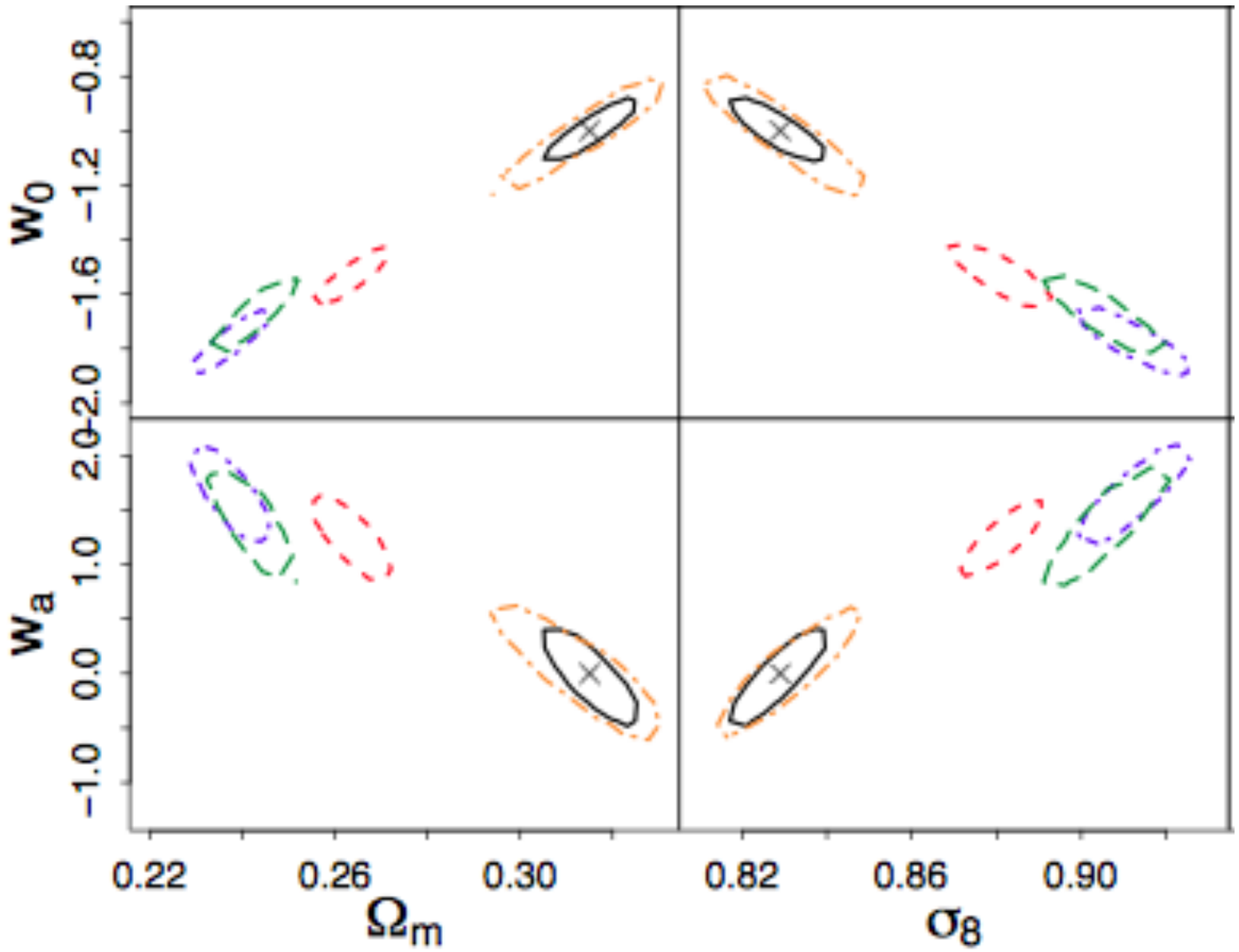
W. Percival's talk

*SPEC-SURVEY SELECTION

INTRINSIC ALIGNMENTS (IA)

Bias in cosmology due to galaxy alignments

Krause+ (2015) – LSST-like cosmic shear

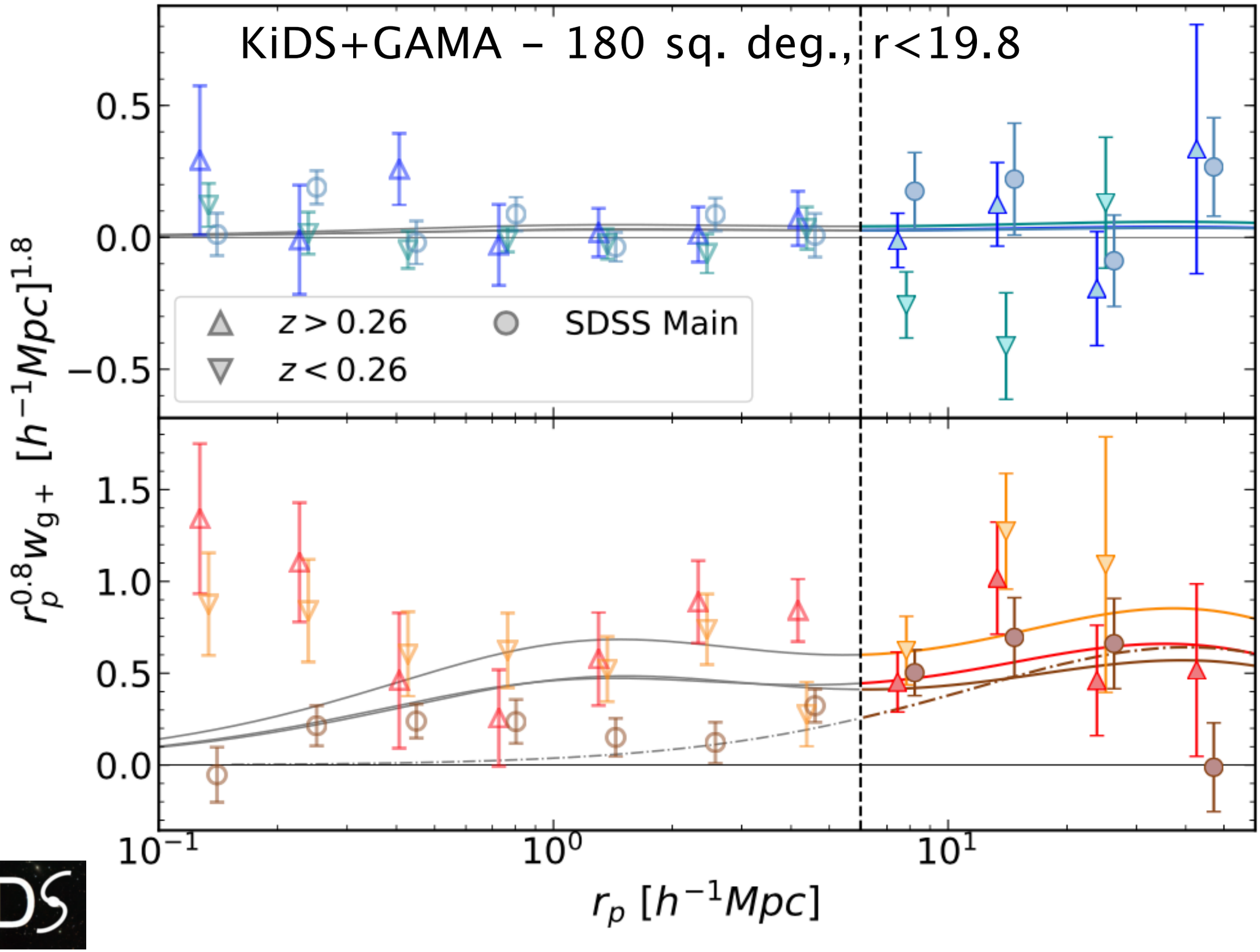


Hendrik's talk

***not responsible for current tensions**

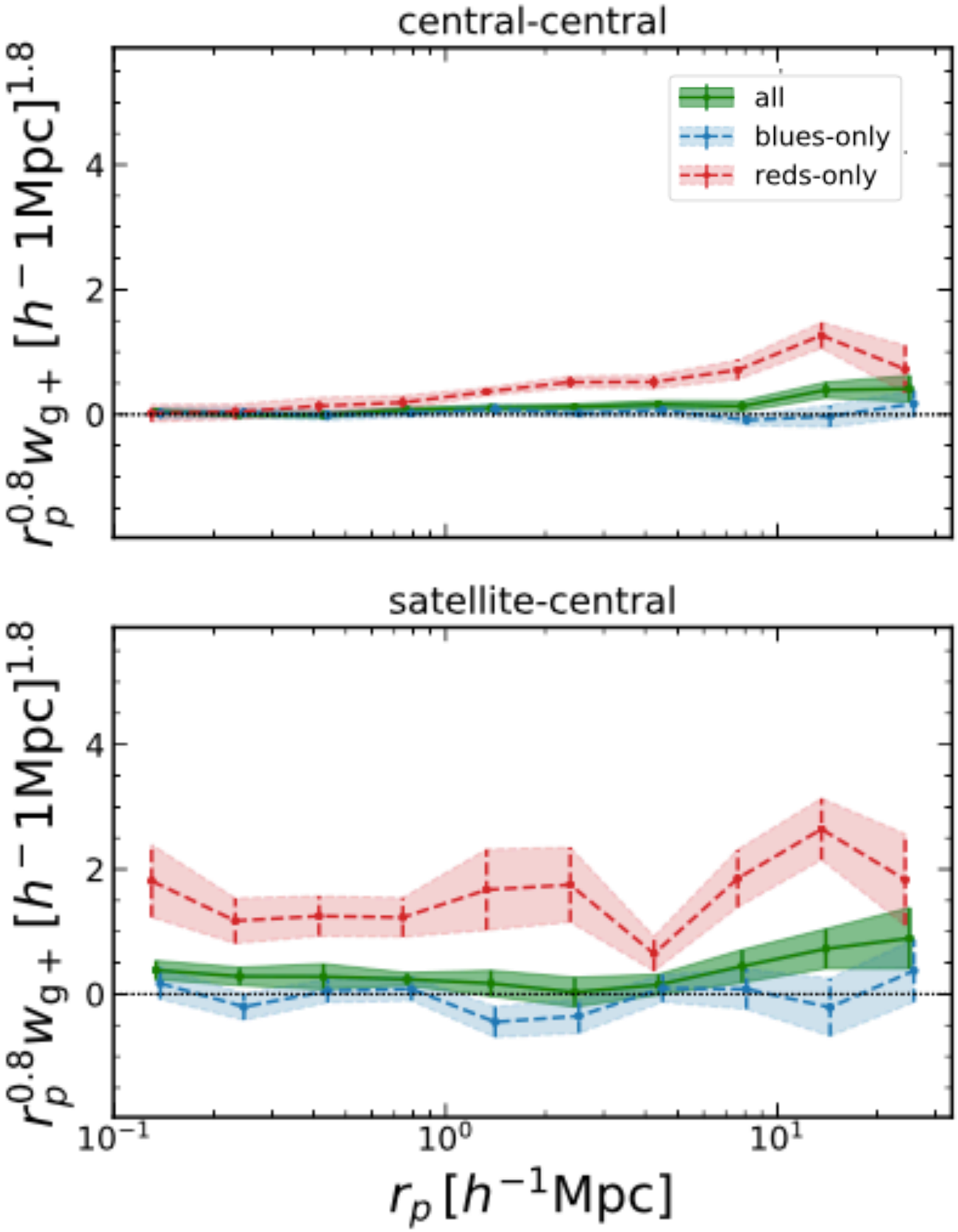
IA IN OBSERVATIONS

Johnston+, incl EC (2019)



KiDS

IA IN OBSERVATIONS

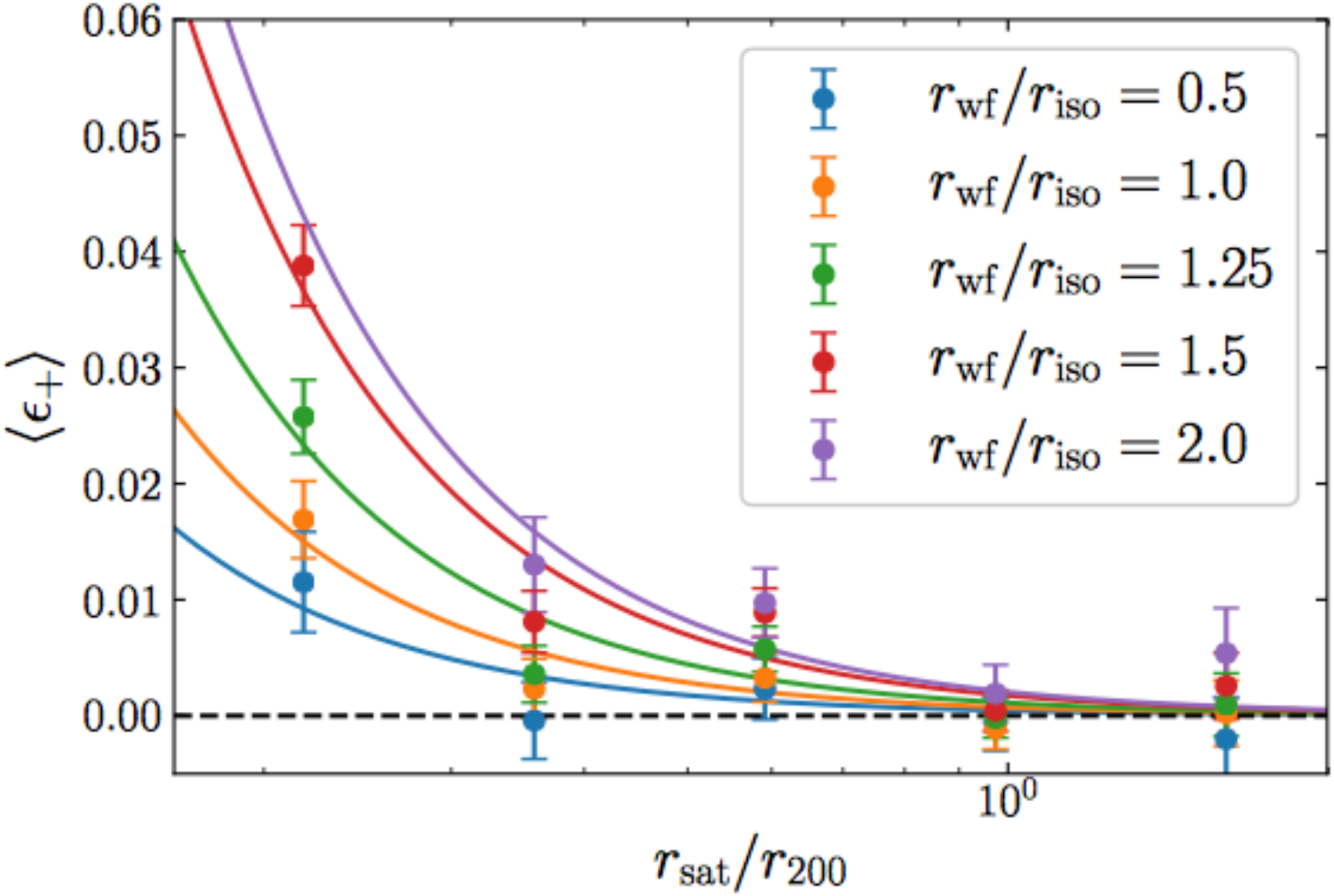


KiDS+GAMA
Johnston+, incl EC (2019)

<u>Mind your sample:</u>
A significant **satellite**-position central-shape contribution to IA

IA IN OBSERVATIONS

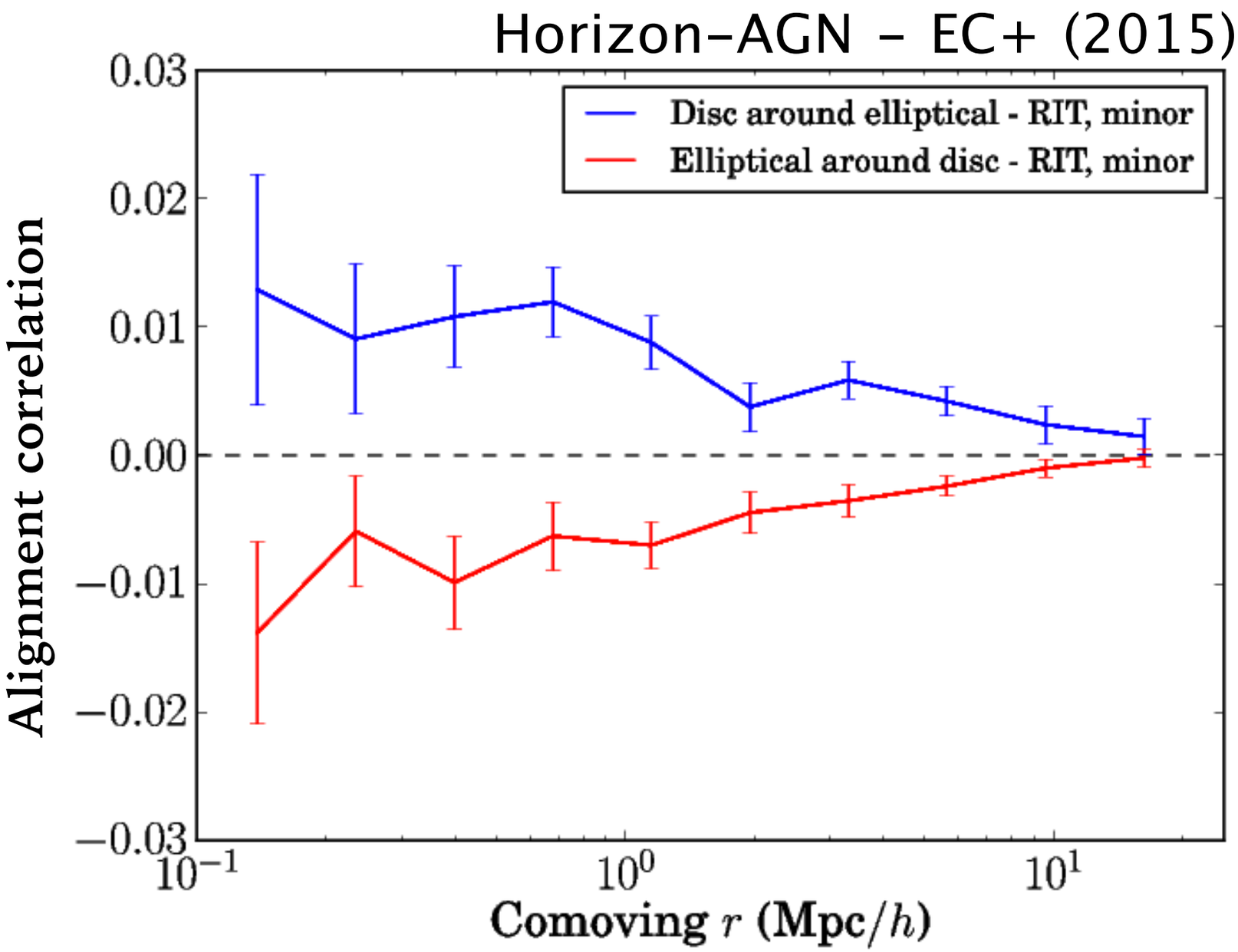
KiDS+GAMA – Georgiou, EC+ (2019)

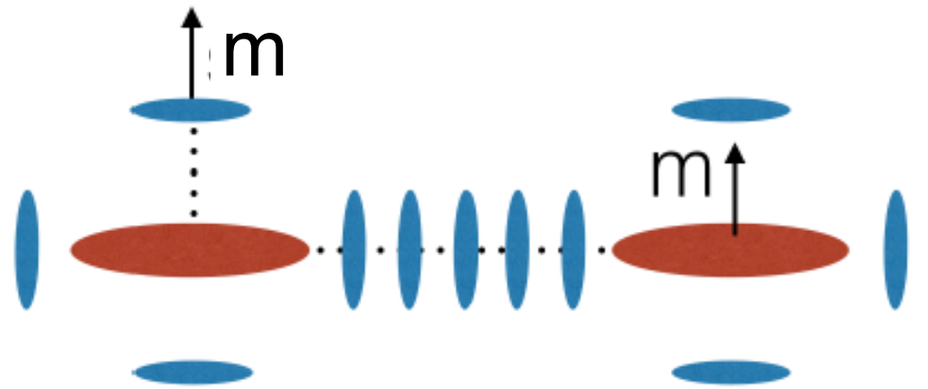


satellite–shape central–position contribution to IA

See also EC+ (2014), Sifón+ (2014), Singh+ (2016)

IA IN SIMULATIONS

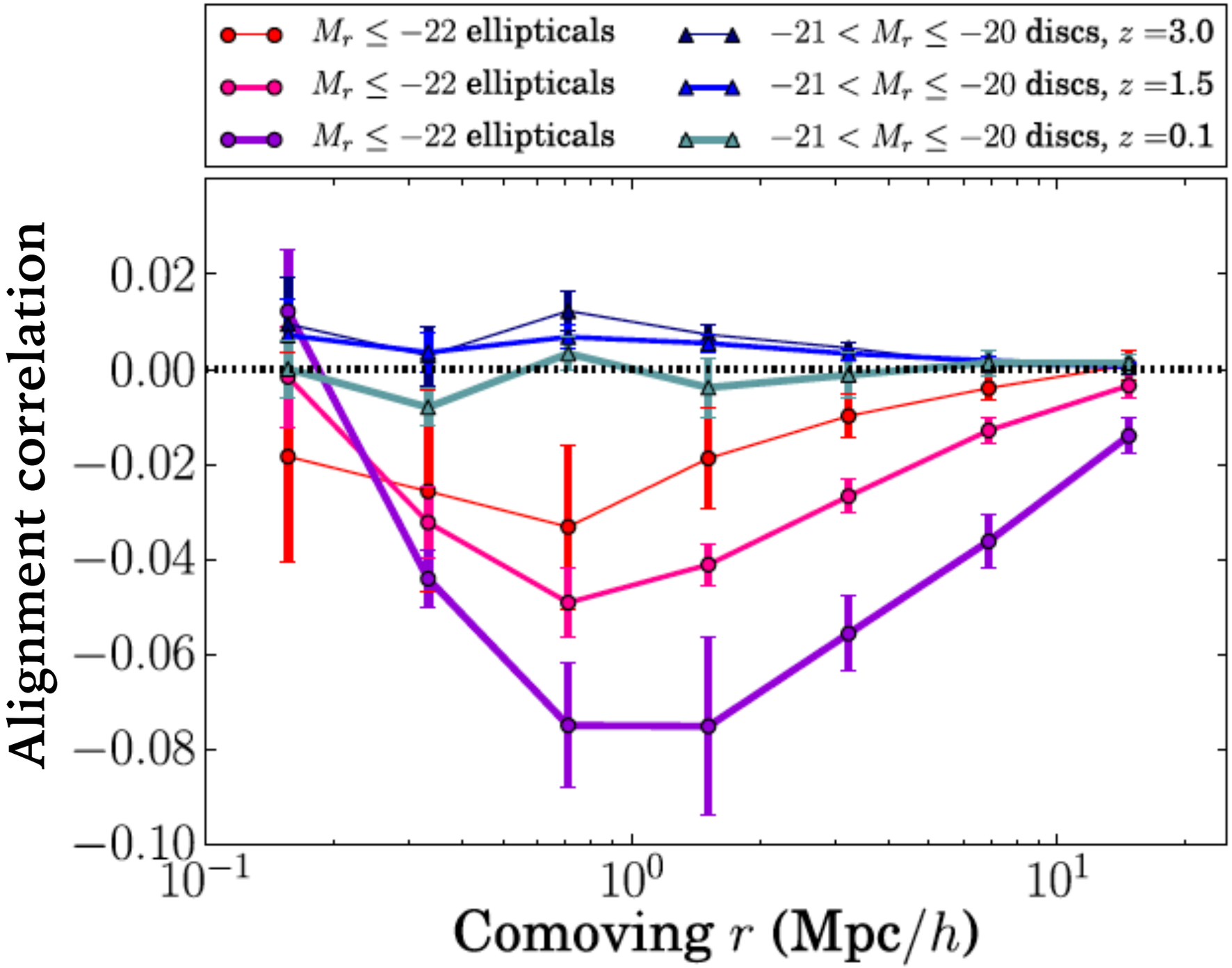




See also Tenneti+ (2015), Velliscig+ (2015), Hilbert+ (2017), Kraljic+ (2019)

IA IN SIMULATIONS

Horizon-AGN – EC+ (2016)



IA IN SIMULATIONS

- ***Galaxy-halo alignment connection***

  Risa's talk

  Joachimi+ (2013)
  Tenneti+ (2014)
  Velliscig+ (2015)
  EC, Koukoufilippas+ (2017)

- ***Alignments with the cosmic web***

  Chen+ (2015)
  Codis+, incl EC (2018)

- ***When do galaxies align?***

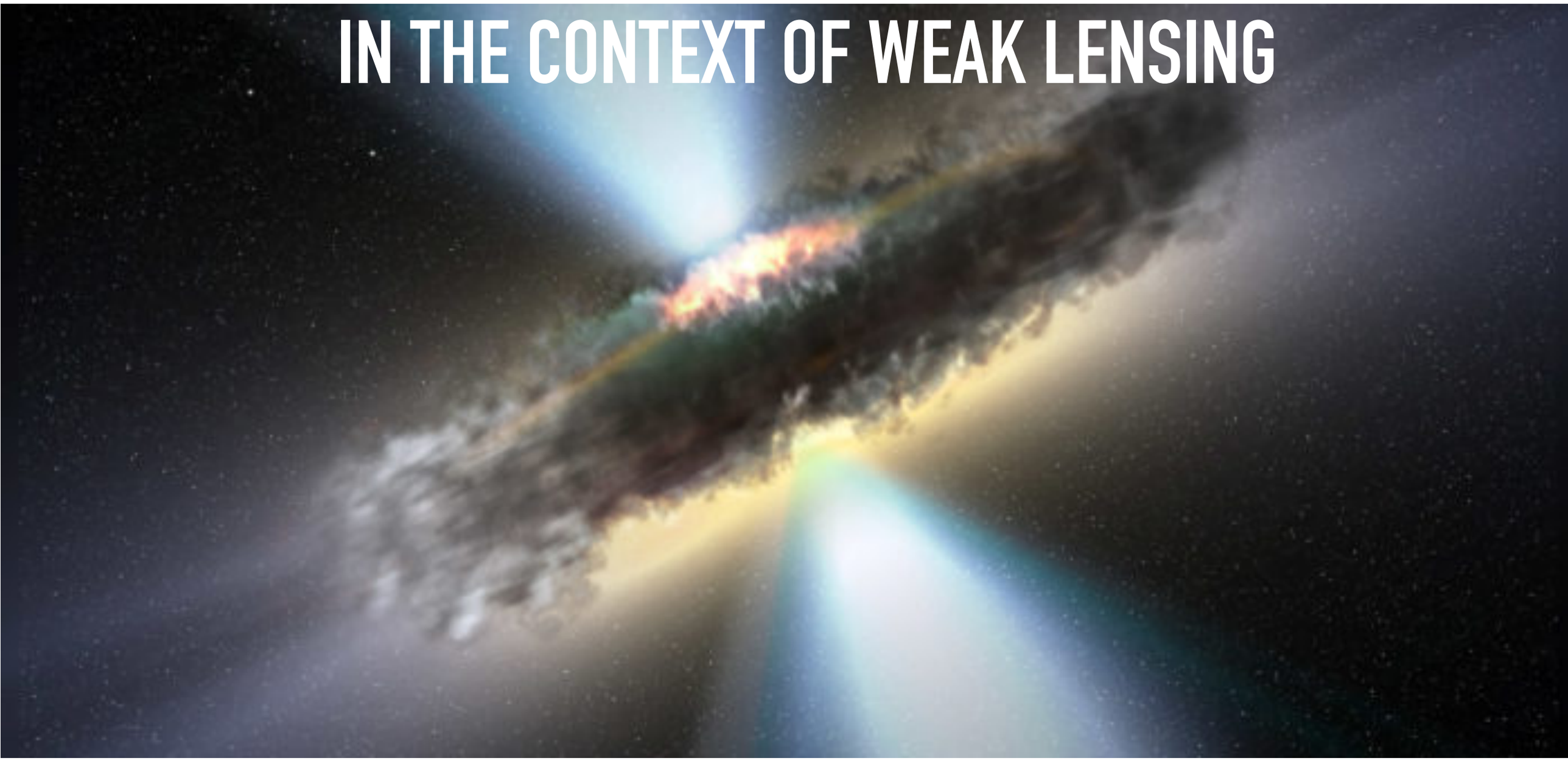
  Welker+ (2014)
  Bate, EC+ (submitted)
  Bhomwick+ (2019)

- ***Gastrophysics: the impact on IA***

  Tenneti+ (2017)
  Soussana, EC+ (submitted)

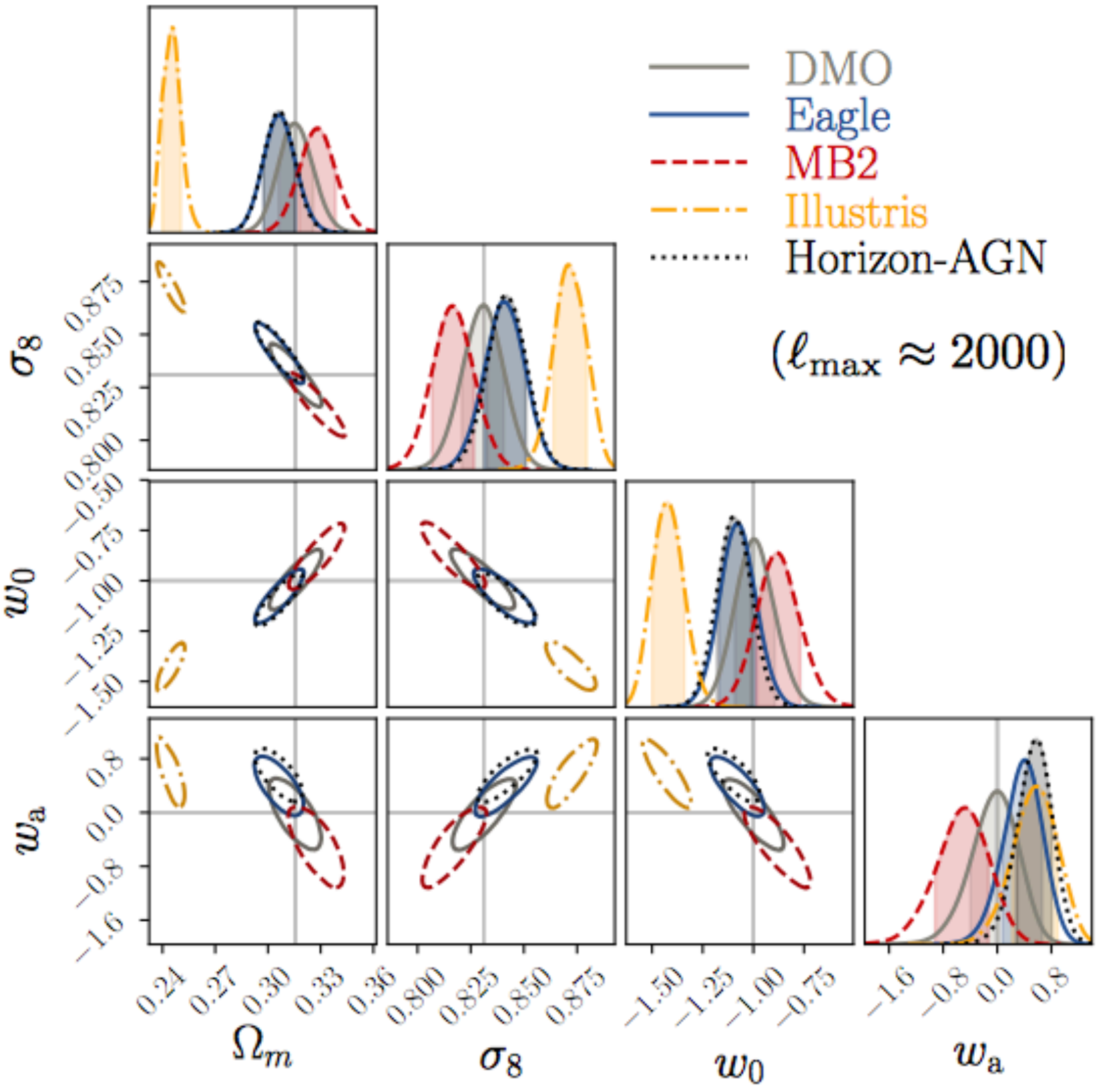
GASTROPHYSICS

"BARYONS" = ACTIVE GALACTIC NUCLEI FEEDBACK



Credit: ESA / V. Beckmann (NASA-GSFC)

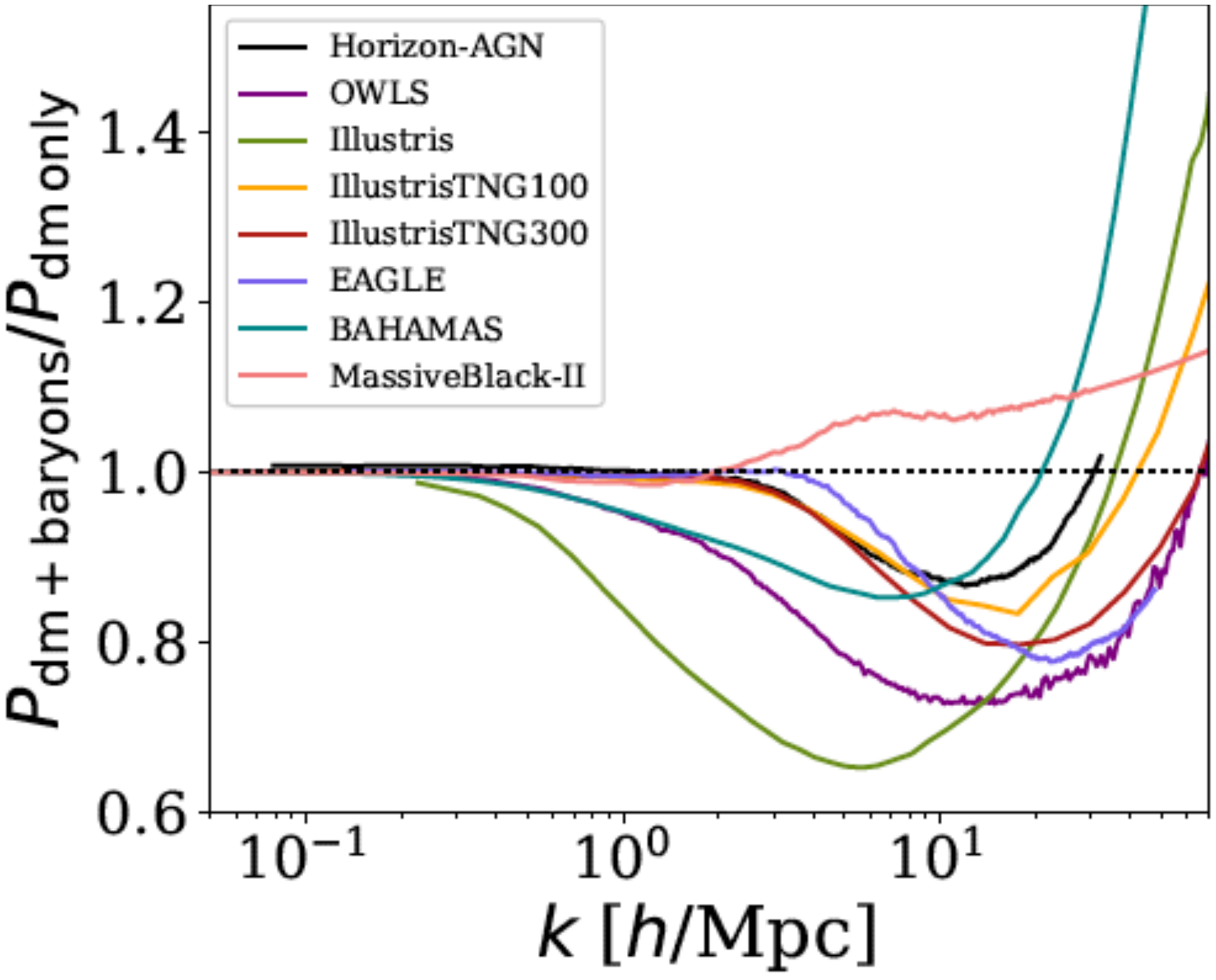
GASTROPHYSICS



An LSST-like survey
Huang+ (2018)

GASTROPHYSICS

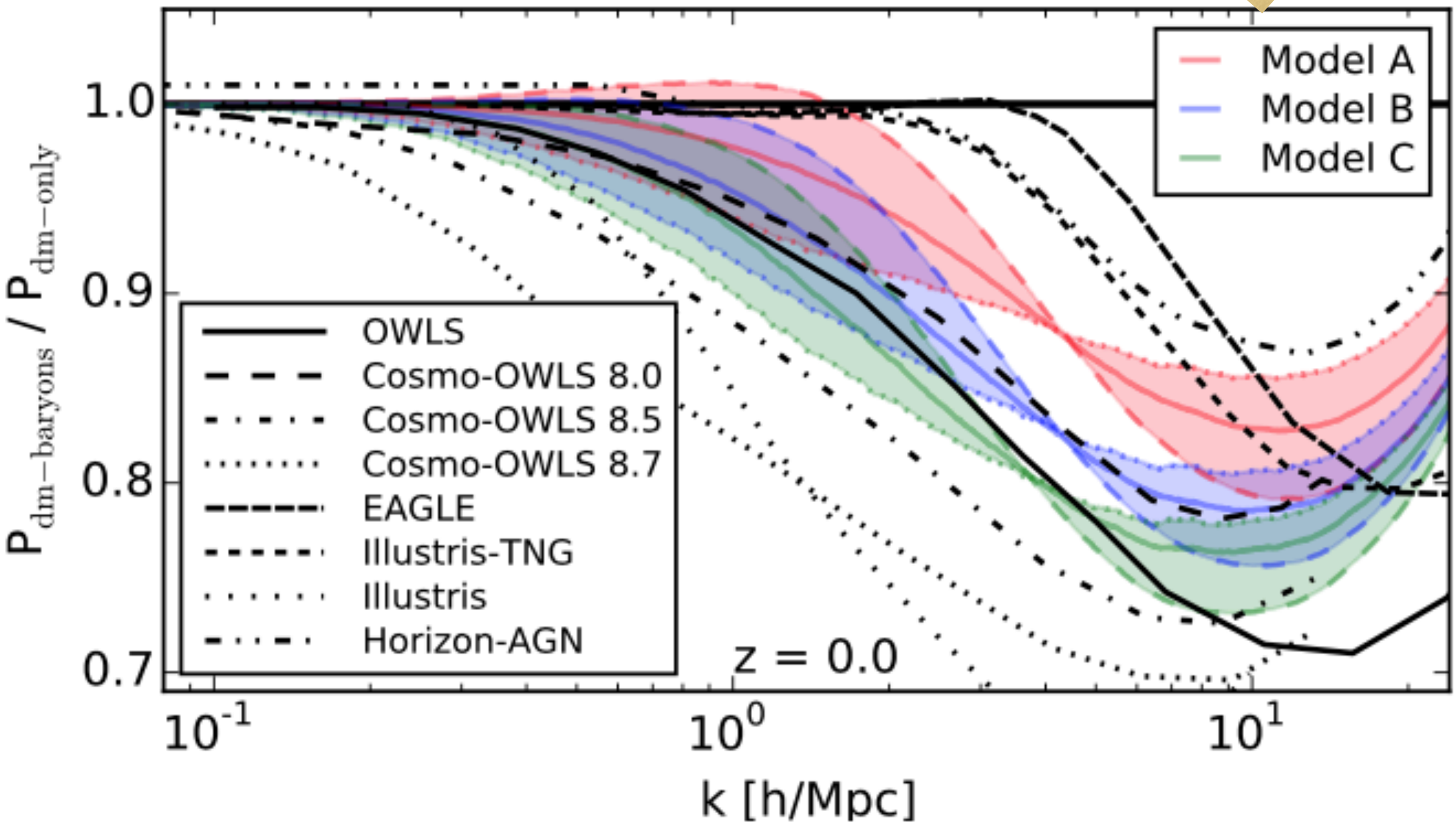
$$P(k) = \langle |\delta_{\mathbf{k}}|^2 \rangle$$



EC+ (2018/19)
van Daalen+ (2011)
ogelsberger+ (2014)
Hellwing+ (2016)
Springel+ (2017)
Huang+ (2018)

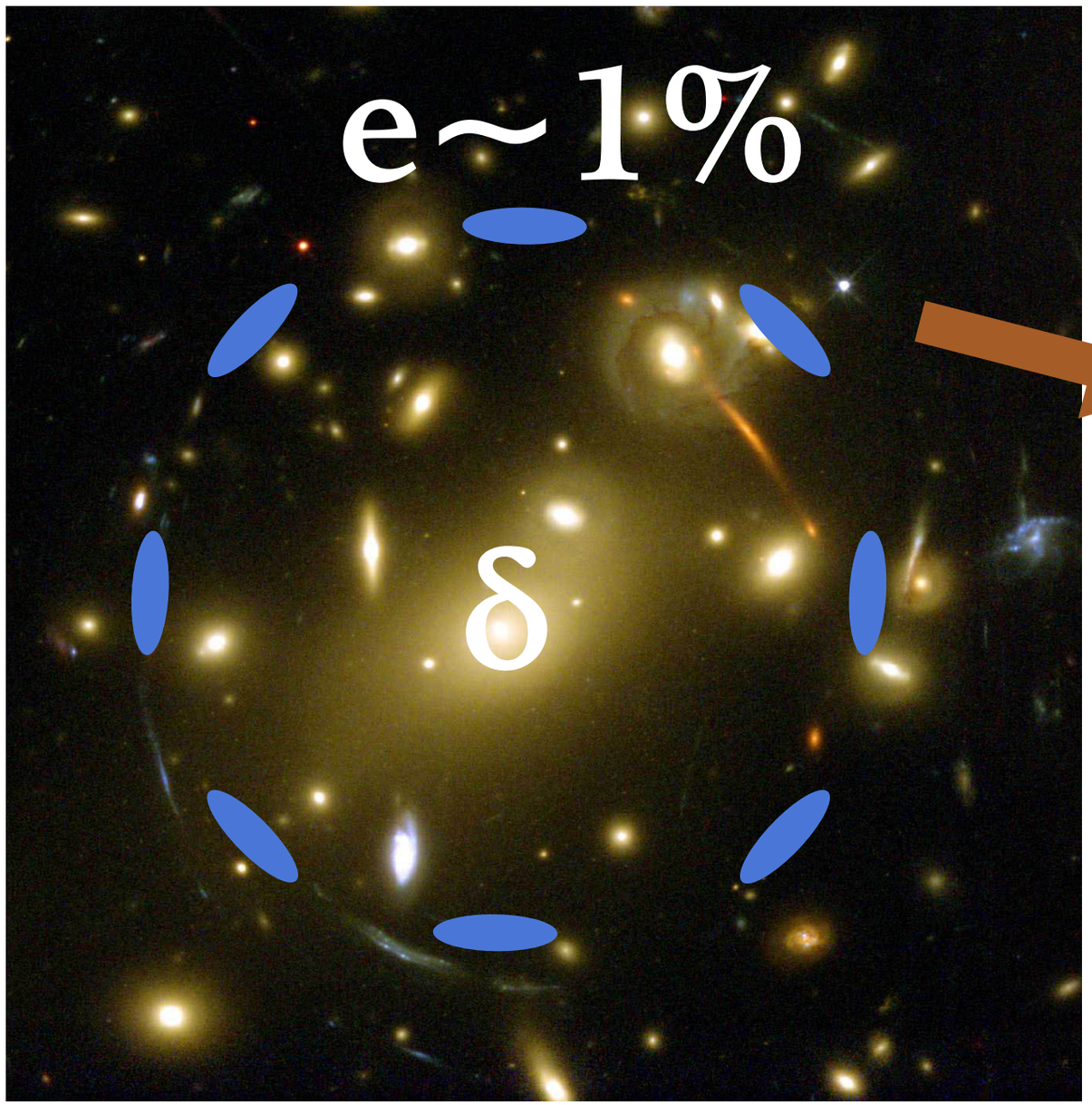
GASTROPHYSICS

Apply existing observational constraints on gas and stellar fractions and distributions to N-body simulations



See also I. McCarthy's and U. Seljak's talks

~~CHALLENGES TO~~ PRECISION COSMOLOGY
OPPORTUNITIES FOR



INTRINSIC ALIGNMENTS OF GALAXIES

COSMOLOGY WITH INTRINSIC ALIGNMENTS

Galaxy shapes ~ *Tidal field of the large-scale structure*

Catelan+ (2001)

TESTING THEORIES OF INFLATION

EC+ (2016)

Schmidt, EC & Dvorkin (2015)

PRIMORDIAL GRAVITATIONAL WAVES

EC, Dvorkin & Schmidt (2016)

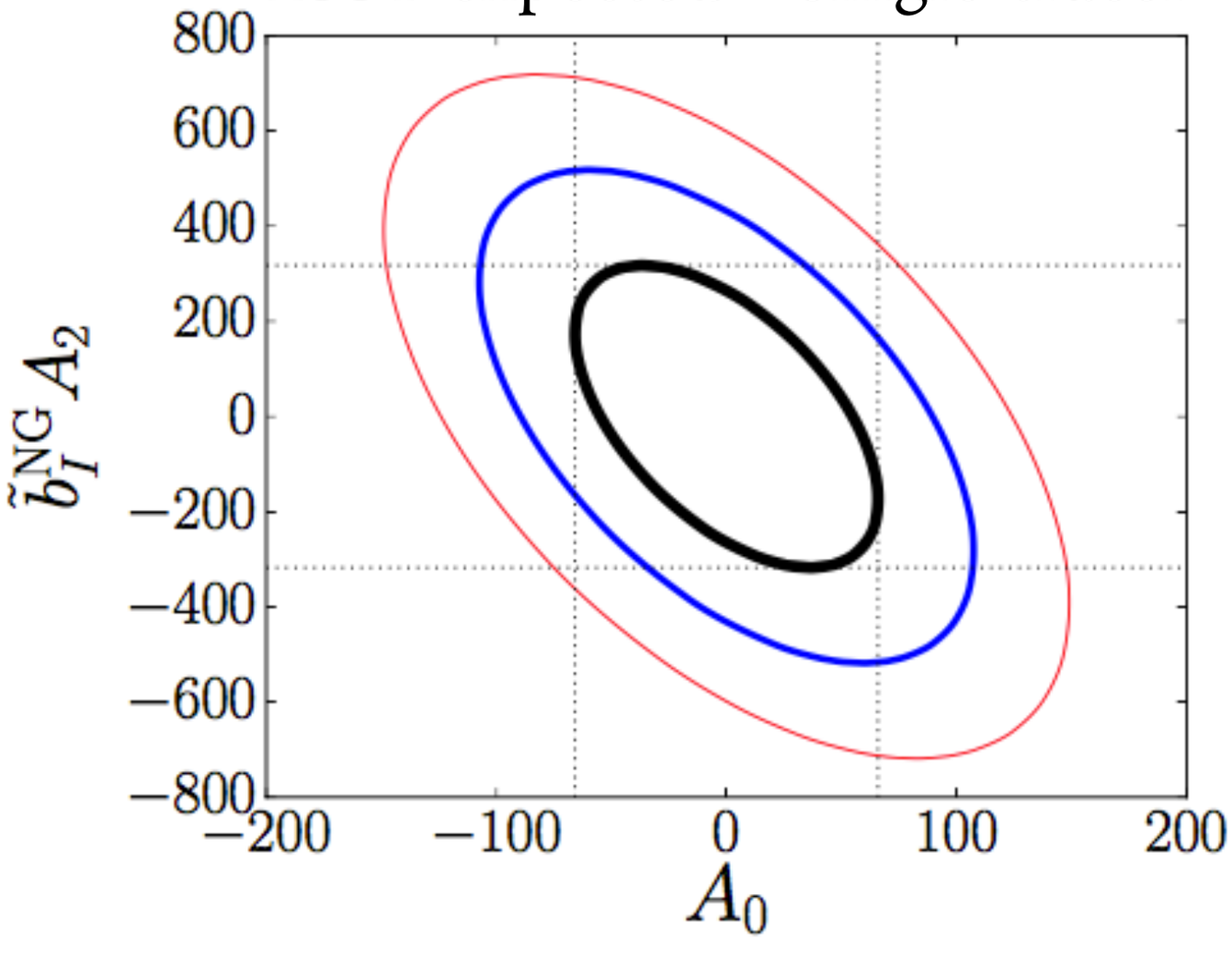
BARYONS ACOUSTIC OSCILLATIONS

EC & Dvorkin (2013)

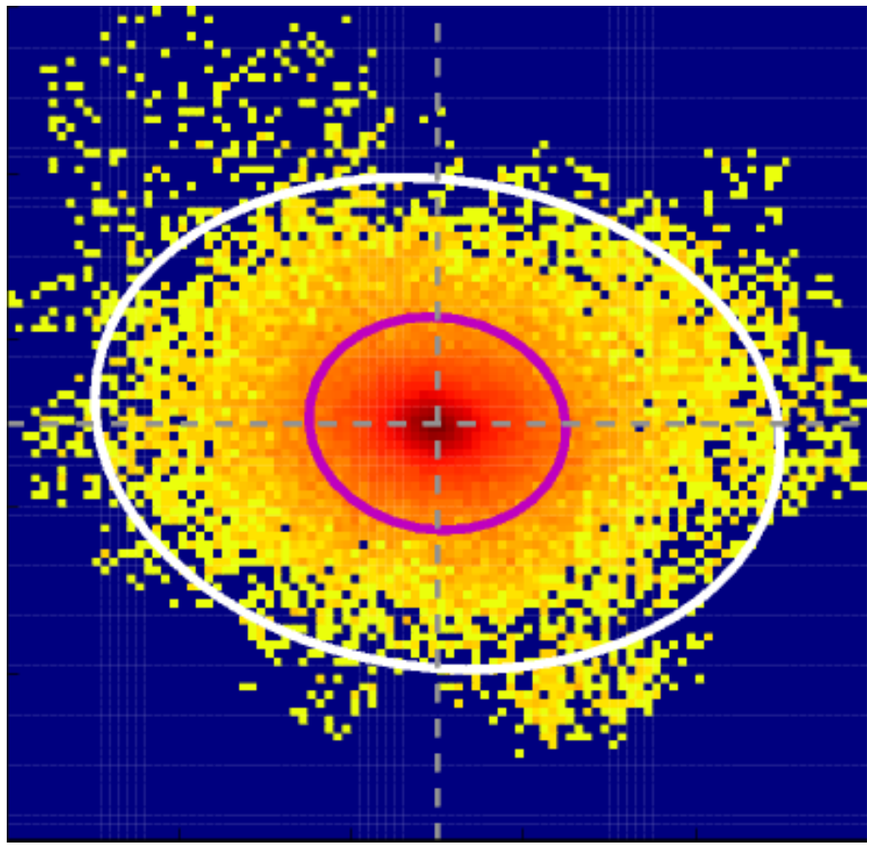
COSMOLOGY WITH INTRINSIC ALIGNMENTS

$\tilde{b}^I_{\rm NG} A_2$	*Scale-dependent bias of intrinsic shapes*
A_0	*Scale-dependent clustering bias*

LSST expected – single-tracer



Multi-tracer approach



EC+ (2016)

Schmidt, EC & Dvorkin (2015)

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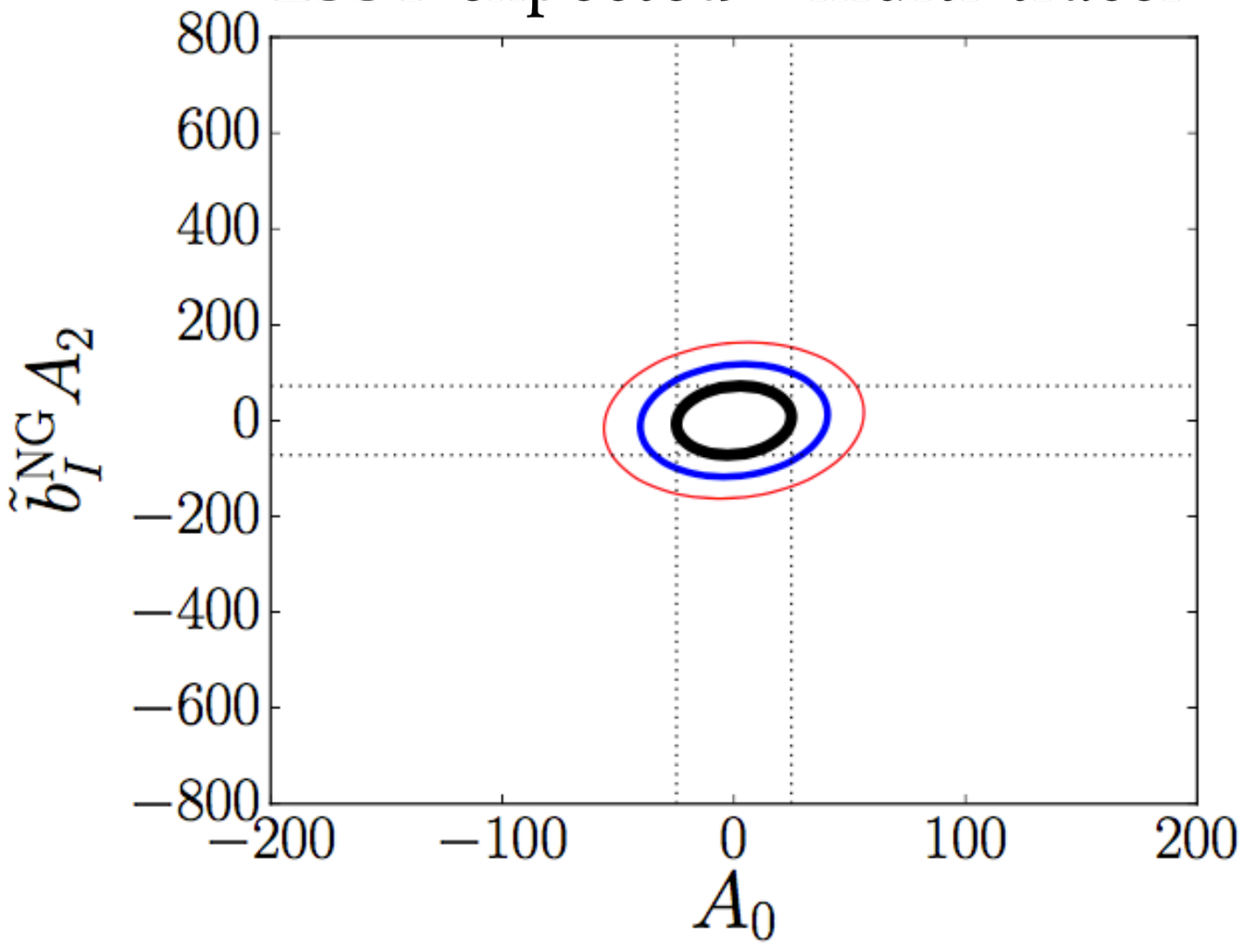

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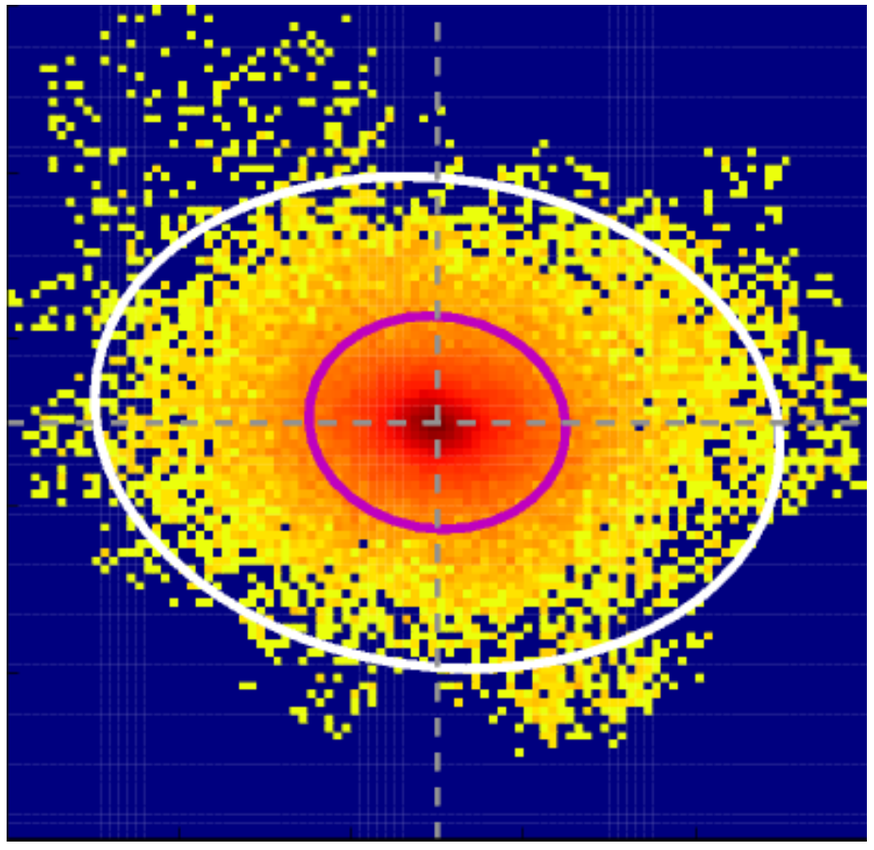


EC+ (2016)
Schmidt, EC & Dvorkin (2015)

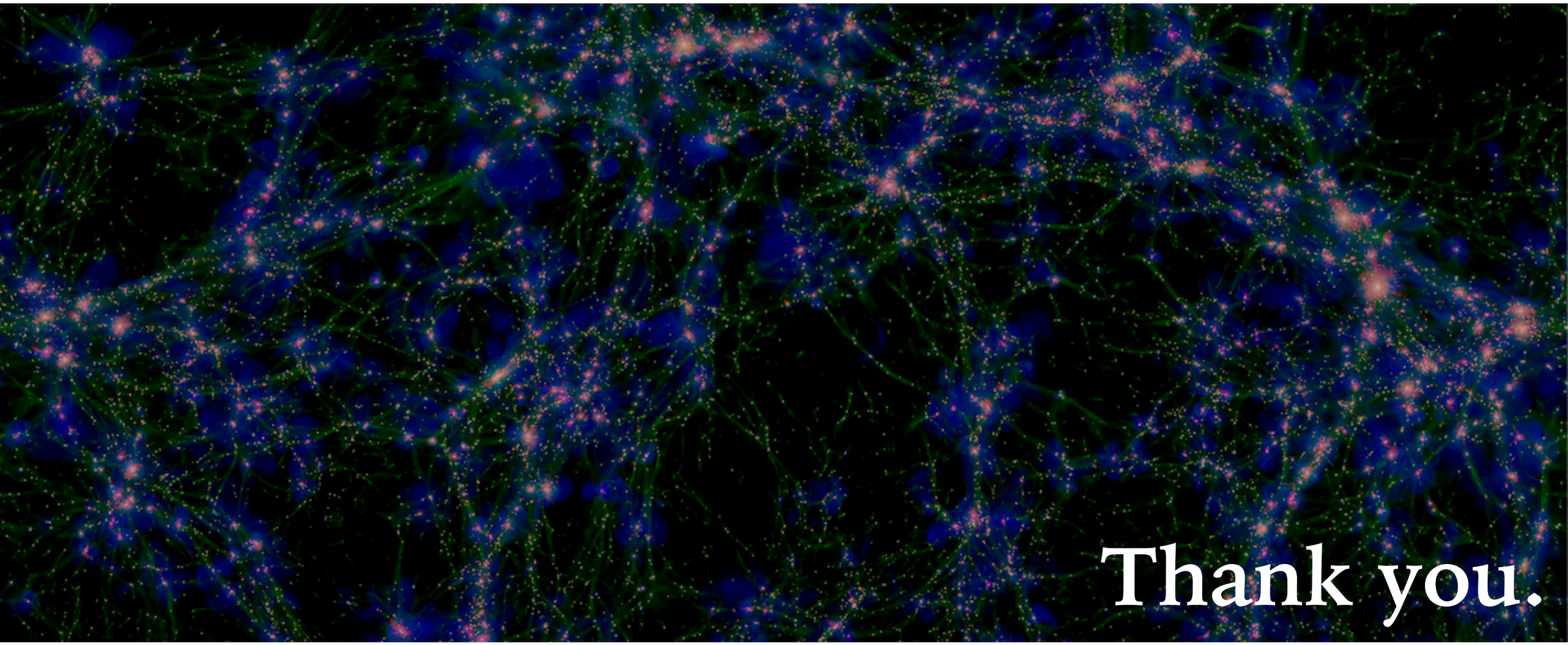
SUMMARY

Exciting prospects for *weak lensing and combined probes* come at a PRICE.

The need to understand & model astrophysical systematics:

- *the large-scale distribution of matter &*
- *intrinsic alignments.*

An opportunity to learn about the early universe & galaxy evolution.



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