

CNRS-JSPS-JST CELEBRATION EVENT FOR THE 50TH  
ANNIVERSARY OF FRANCE-JAPAN SCIENTIFIC COOPERATION

# COSMOLOGY FROM THE HYPER SUPRIME CAM (HSC)

Jessica Cowell



UNIVERSITY OF  
OXFORD

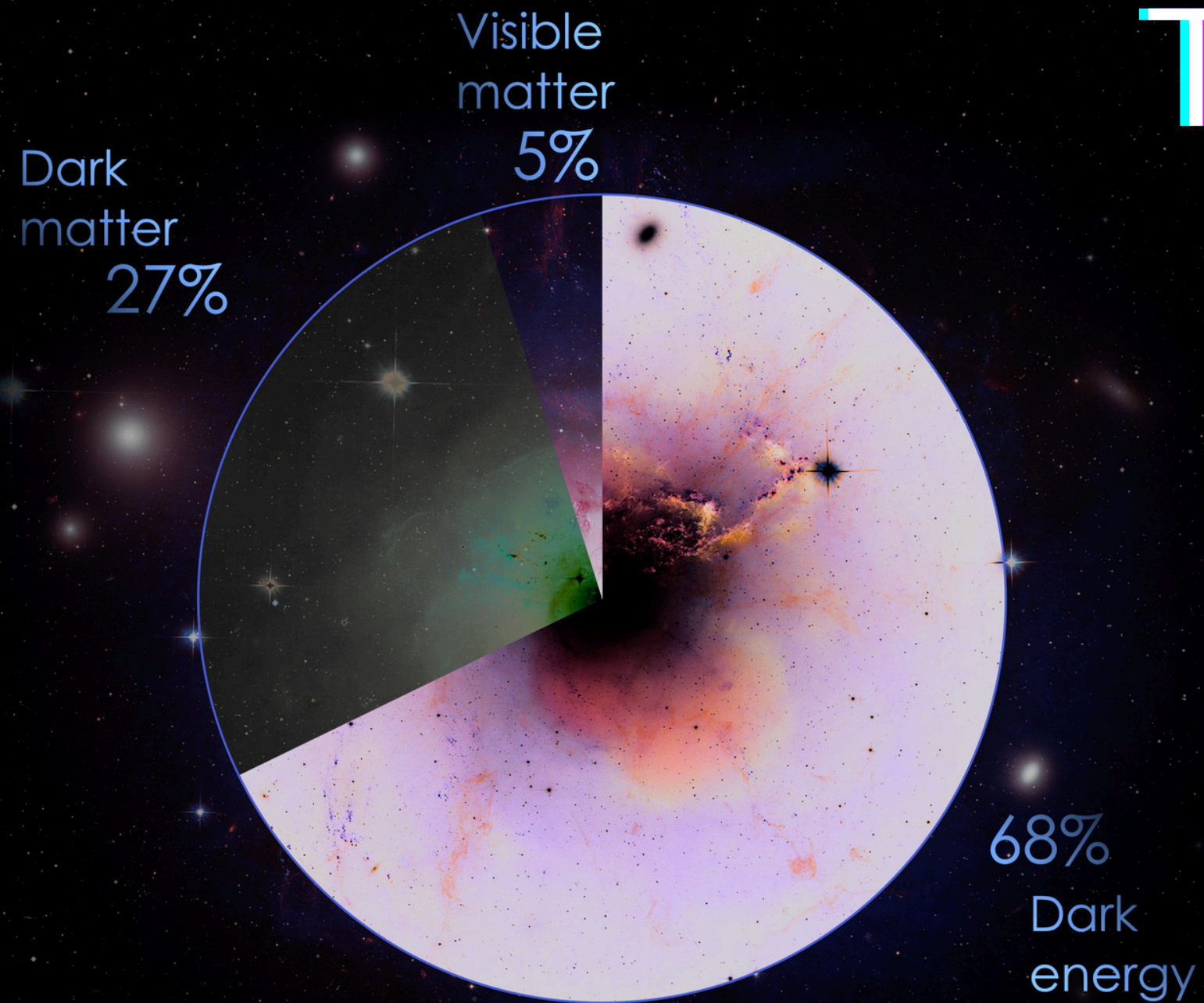
KAVLI  
IPMU INSTITUTE FOR THE PHYSICS AND  
MATHEMATICS OF THE UNIVERSE



東京大学  
THE UNIVERSITY OF TOKYO



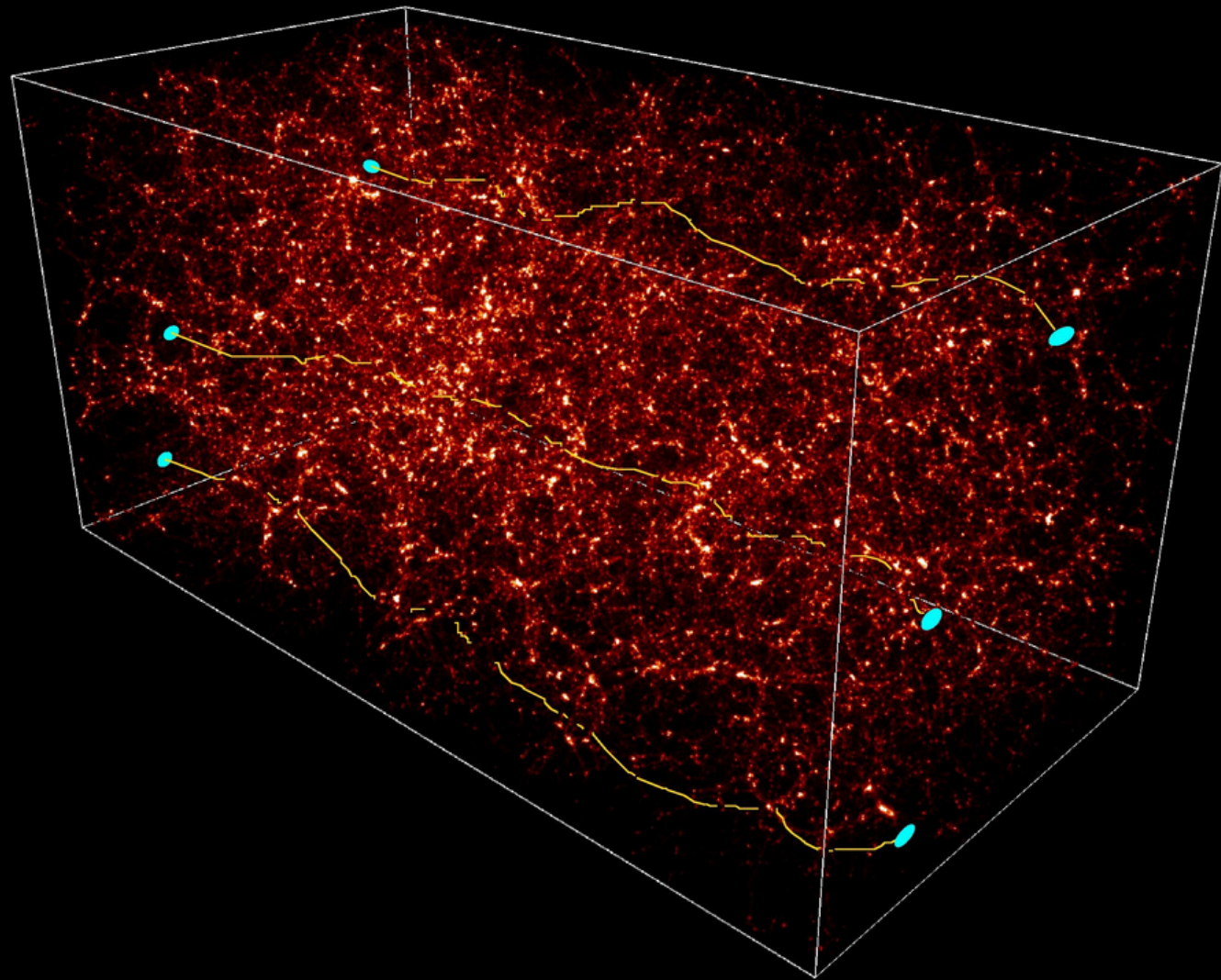
# THE STRUCTURE OF THE UNIVERSE





# WEAK LENSING

DEFLECTION OF LIGHT RAYS CROSSING THE UNIVERSE, EMITTED BY DISTANT GALAXIES

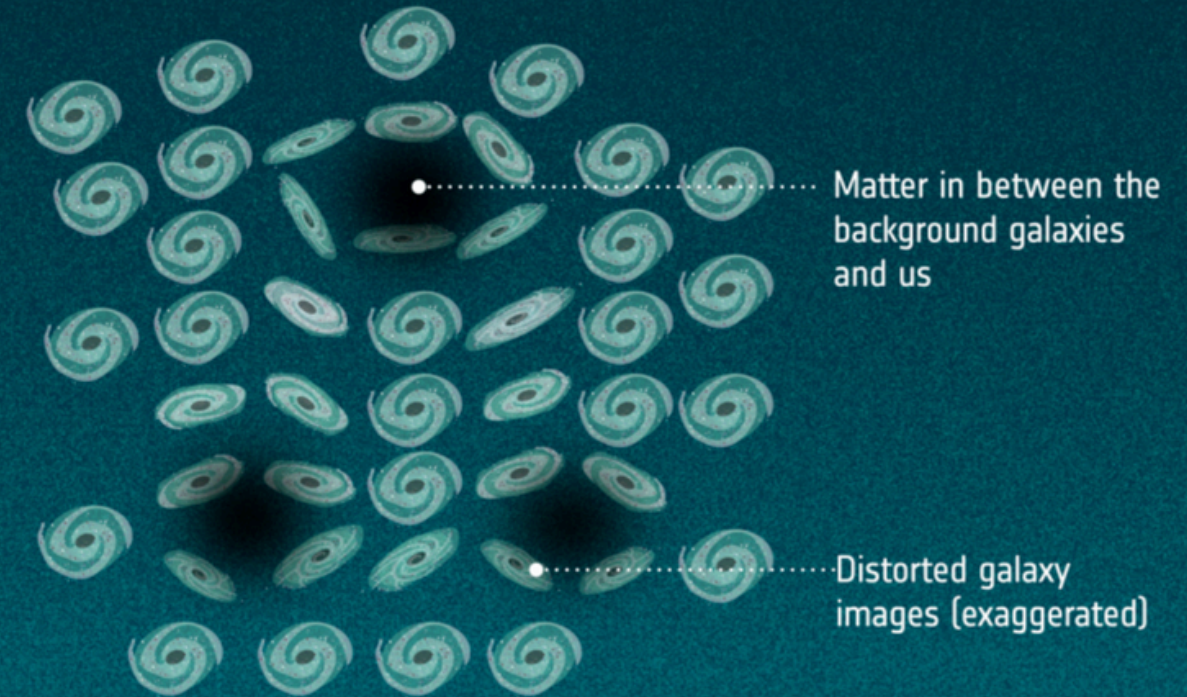


SIMULATION: COURTESY NIC GROUP, S. COLOMBI, IAP.

Unlensed sources



Weak lensing



CREDIT: EUCLID

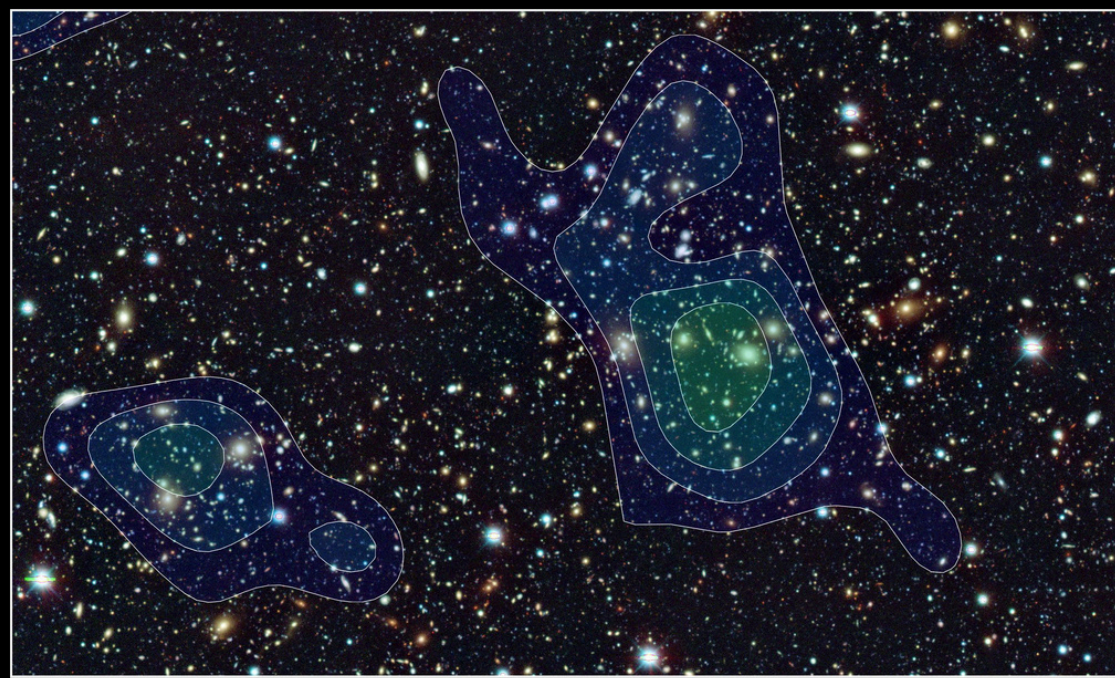
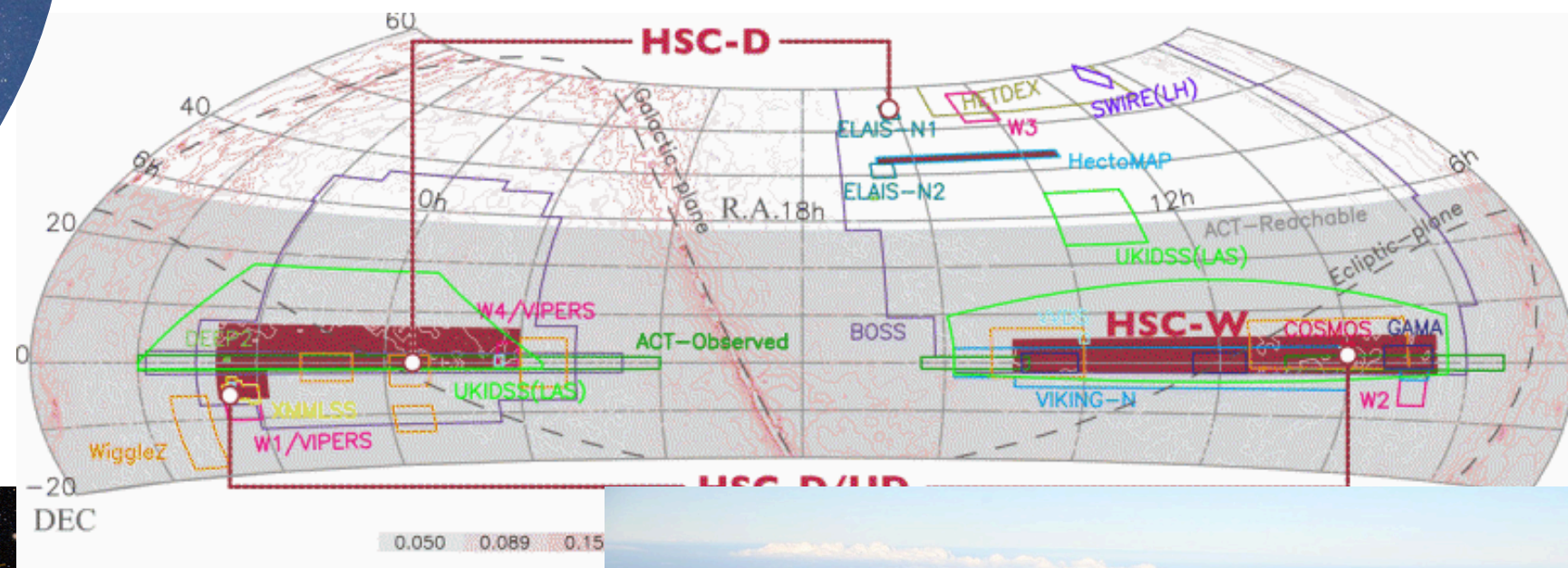
S. COLOMBI (IAP), CFHT  
TEAM



# HYPERSUPRIME CAM



- Subaru Telescope, Mauna Kea, Hawaii
- Field of view of about 7 moons (BIG!)
- Built by NAOJ, collabs with Kavli IPMU, ASIAA, Princeton U.
- ~0.9G pixel camera

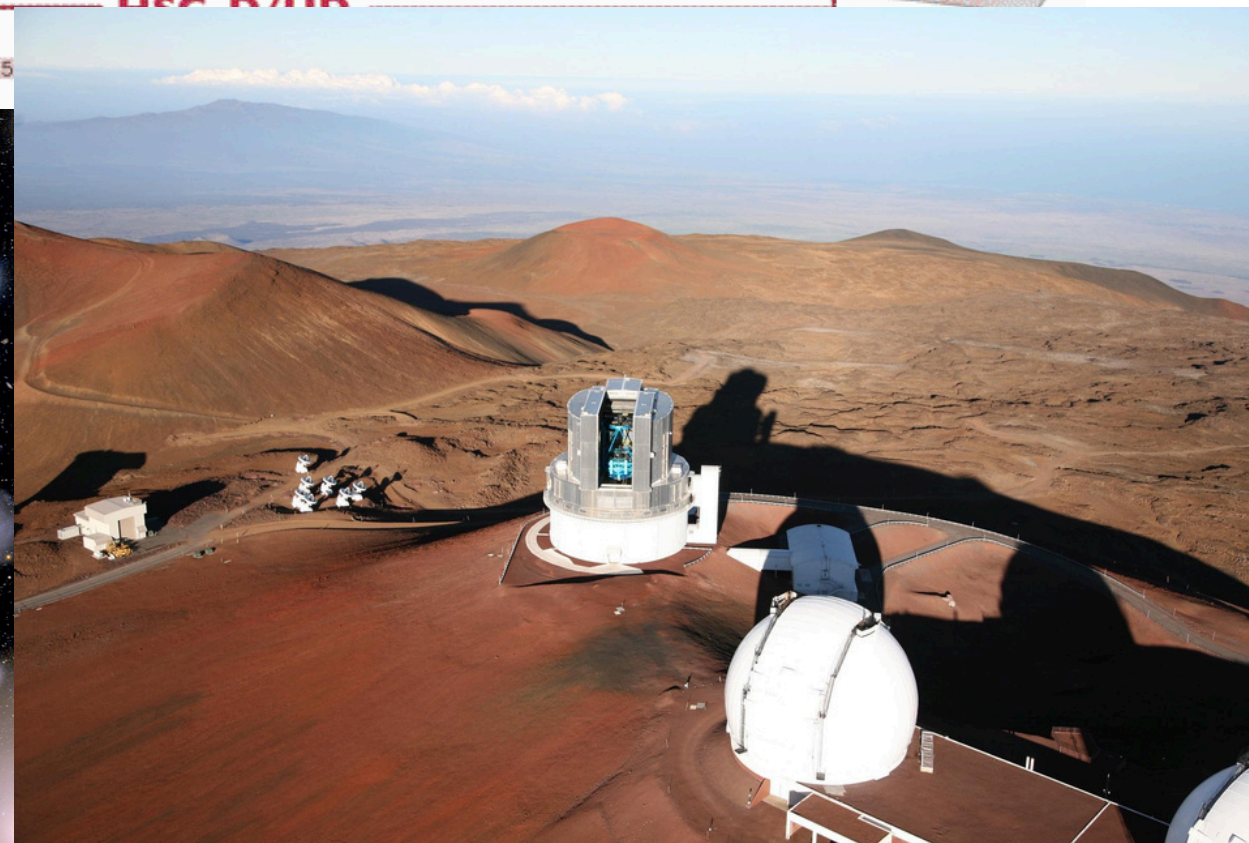


Dark Matter Map by Hyper Suprime-Cam

Hyper Suprime-Cam (i)  
2013 February 4



Subaru Telescope, National Astronomical Observatory of Japan  
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# HYPER SUPRIME CAM

**FUN FACT: HAS TO BE REMOVED AND INSTALLED EVERY 2 WEEKS!**



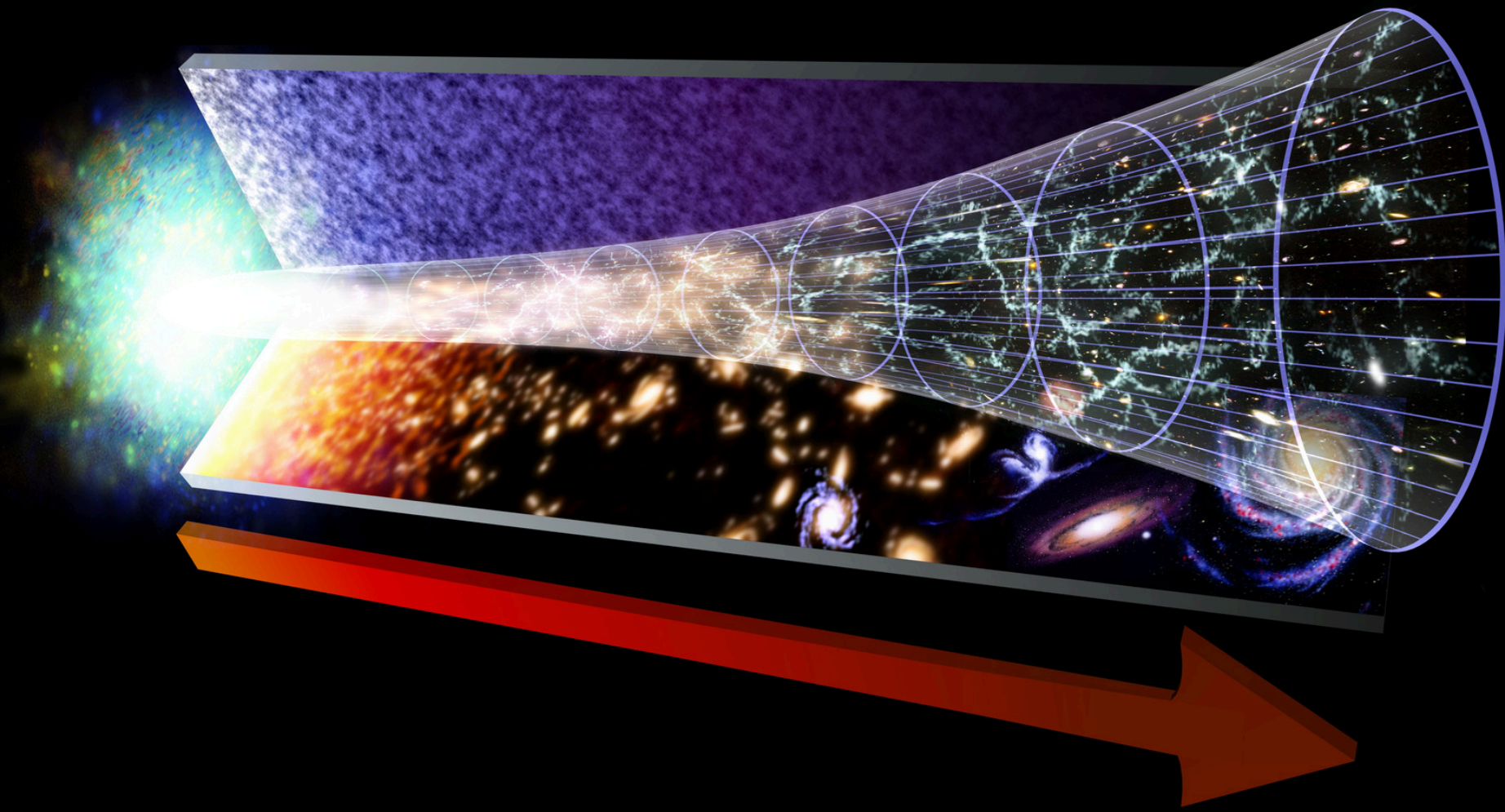
aceton U.  
s, studying  
mology.





# S8 TENSION

•  $S_8 \rightarrow$  'clumpiness' of the universe



EARLY TIMES

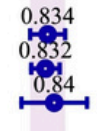
LATE TIMES  
(LARGE SCALE  
STRUCTURE)

\*(IF WE ASSUME  $\Lambda$ CDM MODEL IS CORRECT)

CMB

- CMB Planck TT,TE,EE+lowE
- CMB Planck TT,TE,EE+lowE+lensing
- CMB ACT+WMAP

EARLY TIMES



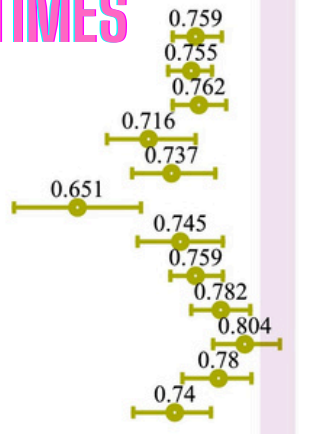
- Aghanim et al. (2020d)
- Aghanim et al. (2020d)
- Aiola et al. (2020)

Early Universe

WEEK LENSING

- WL KiDS-1000
- WL KiDS+VIKING+DES-Y1
- WL KiDS+VIKING+DES-Y1
- WL KiDS+VIKING-450
- WL KiDS+VIKING-450
- WL KiDS-450
- WL KiDS-450
- WL DES-Y3
- WL DES-Y1
- WL HSC-TPCF
- WL HSC-pseudo- $C_l$
- WL CFHTLenS

LATE TIMES

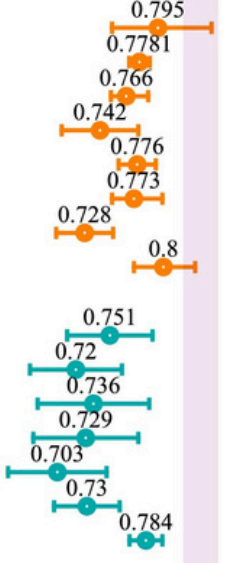


- Asgari et al. (2021)
- Asgari et al. (2020)
- Joudaki et al. (2020)
- Wright et al. (2020)
- Hildebrandt et al. (2020)
- Kohlinger et al. (2017)
- Hildebrandt et al. (2017)
- Amon et al. and Secco et al. (2021)
- Troxel et al. (2018)
- Hamana et al. (2020)
- Hikage et al. (2019)
- Joudaki et al. (2017)

Late Universe

GALAXY CLUSTERING

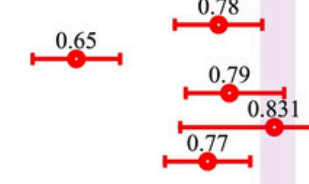
- WL+GC HSC+BOSS
- WL+GC+CMBL KiDS+DES+eBOSS+Planck
- WL+GC KiDS-1000 3x2pt
- WL+GC KiDS-450 3x2pt
- WL+GC DES-Y3 3x2pt
- WL+GC DES-Y1 3x2pt
- WL+GC KiDS+VIKING-450+BOSS
- WL+GC KiDS+GAMA 3x2pt
- GC BOSS DR12 bispectrum
- GC BOSS+eBOSS
- GC BOSS power spectra
- GC BOSS DR12
- GC BOSS galaxy power spectrum
- GC+CMBL DELS+Planck
- GC+CMBL unWISE+Planck



- Miyatake et al. (2022)
- García-García et al. (2021)
- Heymans et al. (2021)
- Joudaki et al. (2018)
- Abbott et al. (2021)
- Abbott et al. (2018d)
- Tröster et al. (2020)
- van Uitert et al. (2018)
- Philcox et al. (2021)
- Ivanov et al. (2021)
- Chen et al. (2021)
- Tröster et al. (2020)
- Ivanov et al. (2020)
- White et al. (2022)
- Krolewski et al. (2021)

CLUSTER COUNTS

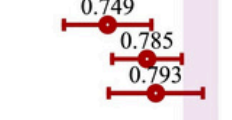
- CC AMICO KiDS-DR3
- CC DES-Y1
- CC SDSS-DR8
- CC XMM-XXL
- CC ROSAT (WtG)



- Lesci et al. (2021)
- Abbott et al. (2020d)
- Costanzi et al. (2019)
- Pacaud et al. (2018)
- Mantz et al. (2015)

REDSHIFT SPACE DISTORTION

- CC SPT tSZ
- CC Planck tSZ
- CC Planck tSZ



- Bocquet et al. (2019)
- Salvati et al. (2018)
- Ade et al. (2016d)

- RSD
- RSD



- Benisty (2021)
- Kazantzidis and Perivolaropoulos (2018)

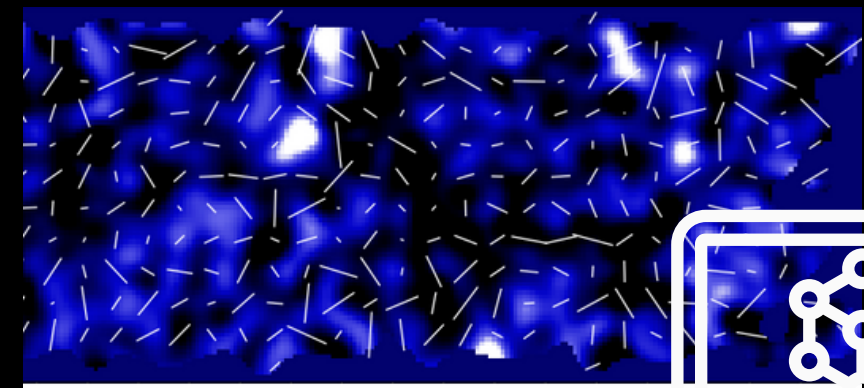
0.2 0.4 0.6 0.8 1.0 1.2

$$S_8 \equiv \sigma_8 \sqrt{\Omega_m / 0.3}$$



# HSC Y1 NON-GAUSSIAN RESULTS

Hikage, Oguri+ 18

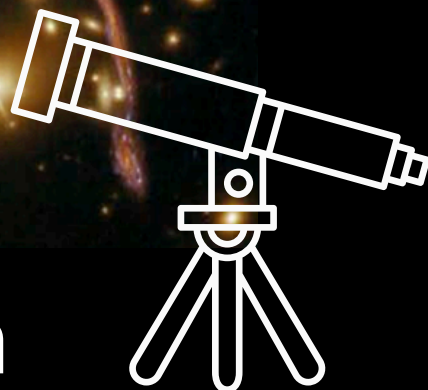
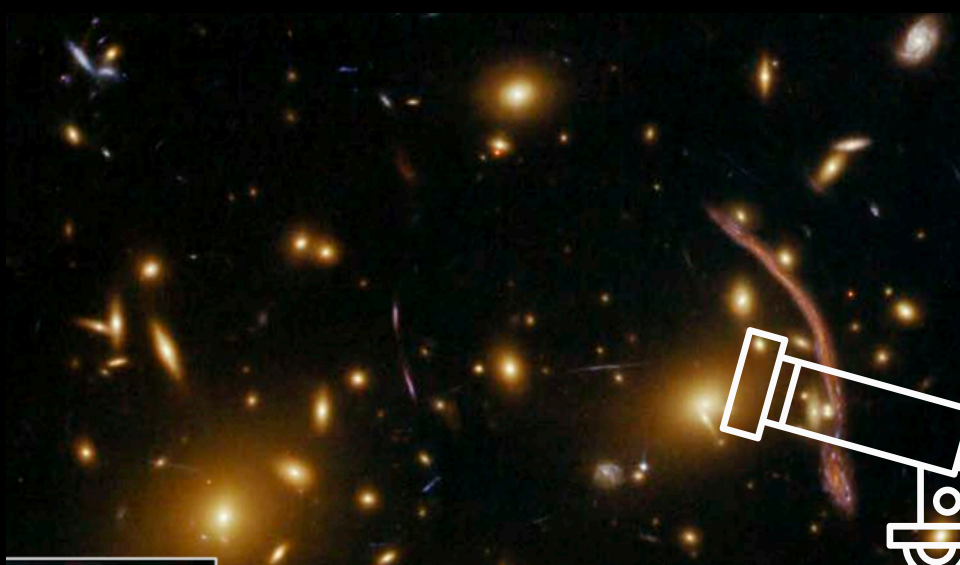


simulation

+



S8  
constraint



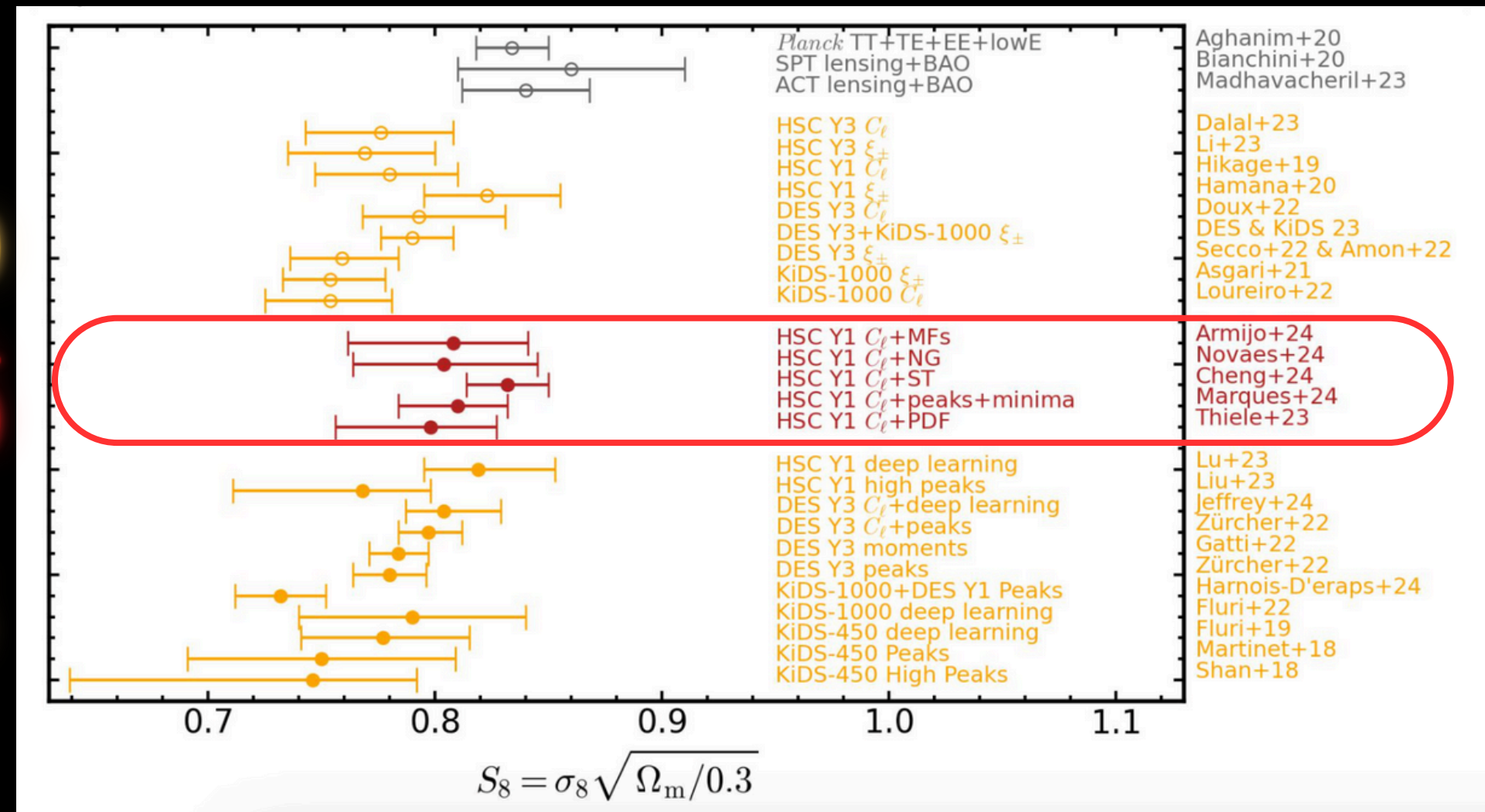
observation

CMB

LSS  
(GALAXIES)

HSC (NON-  
GAUSSIAN)

LSS (NON-  
GAUSSIAN)



+ marked power spectra Cowell++ coming soon..

Improvement from NG stats ~40% for S8





**Thank you!**

**Merci beaucoup**

**ご清聴ありがとうございました**