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The Epoch of Reionization with the Prime Focus Spectrograph

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Danmarks Grundforskningsfond
Danish National Research Foundation

DTU

UNIVERSITY OF COPENHAGEN

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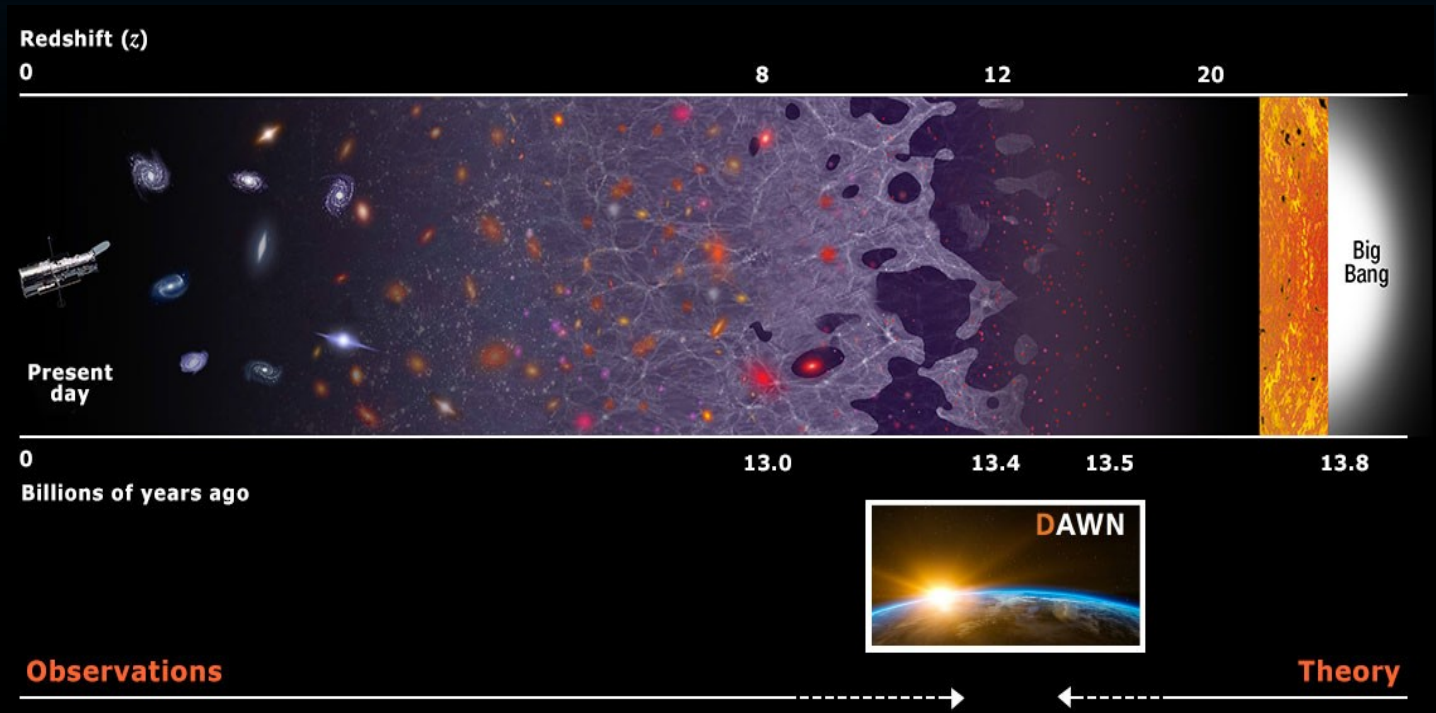
Cosmic Dawn Center (DAWN)



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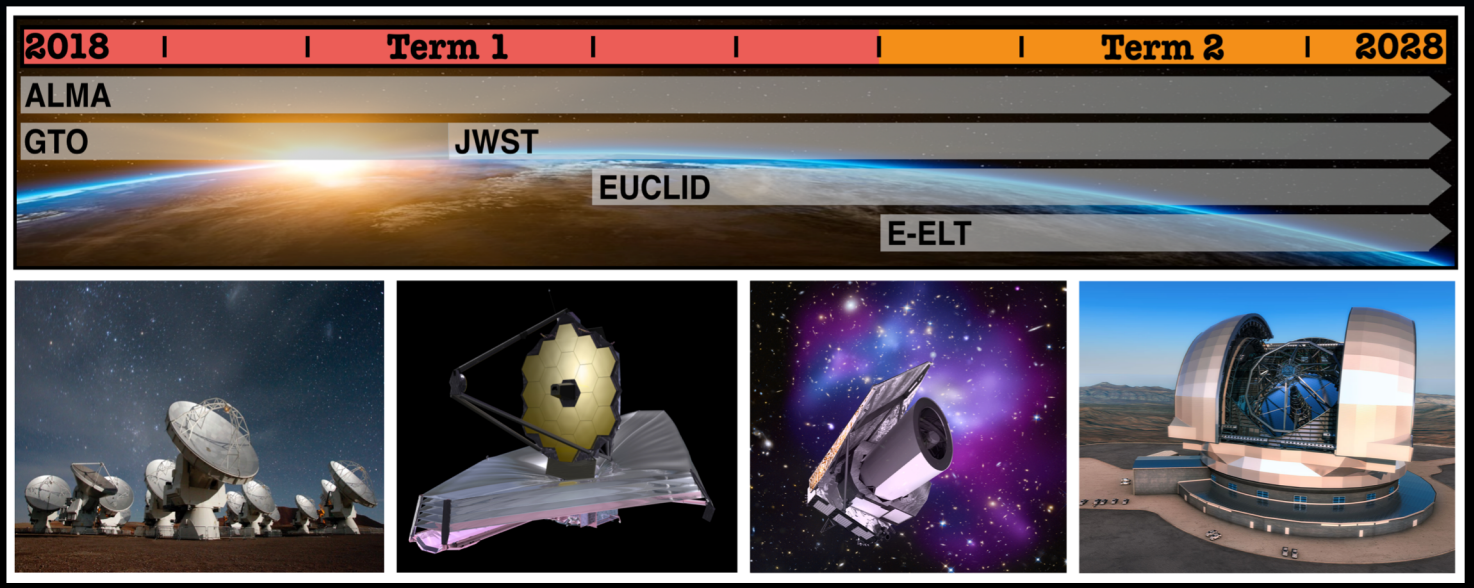
Cosmic Dawn Center (DAWN)



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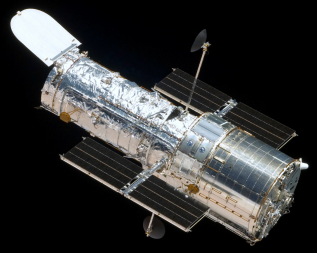
Finding the first galaxies



Pascal Oesch
(geneva

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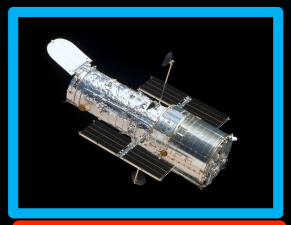
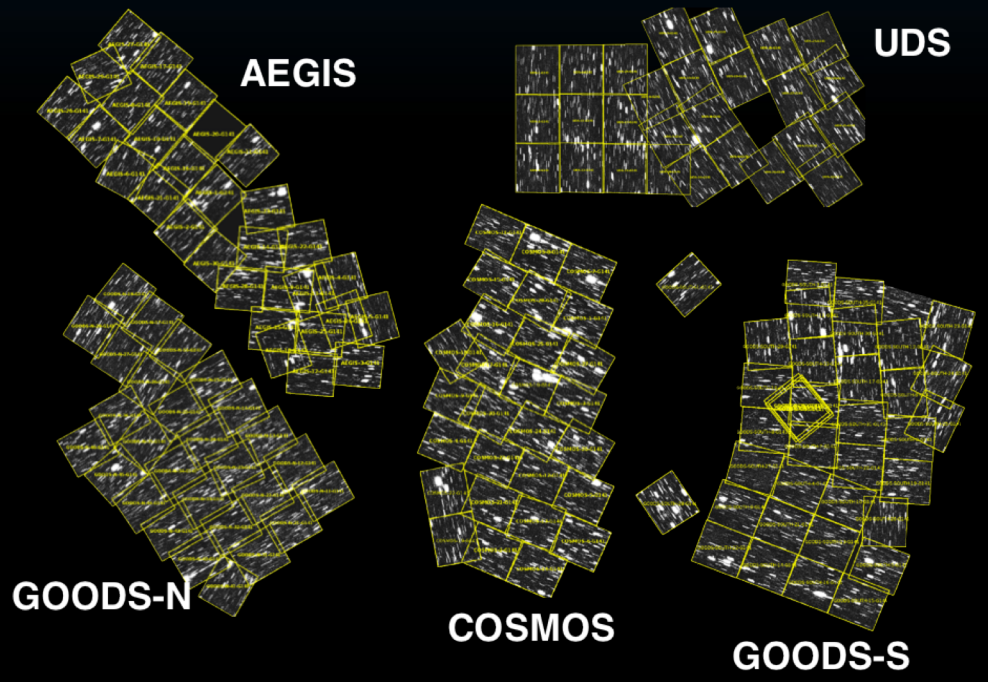
CANDELS / 3DHST



Total Area 0.25 deg^2



-Home of most known high-z galaxies

-JWST GTO fields

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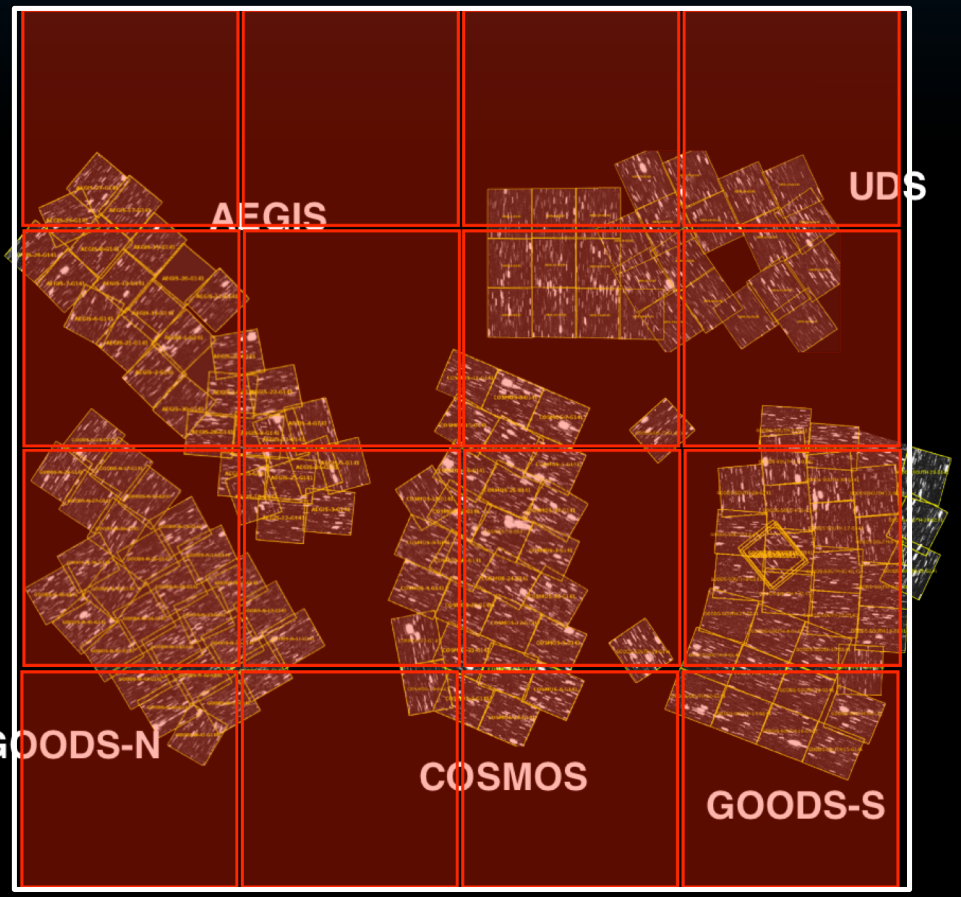
Euclid ~ Hubble with much wider field of view



euclid consortium

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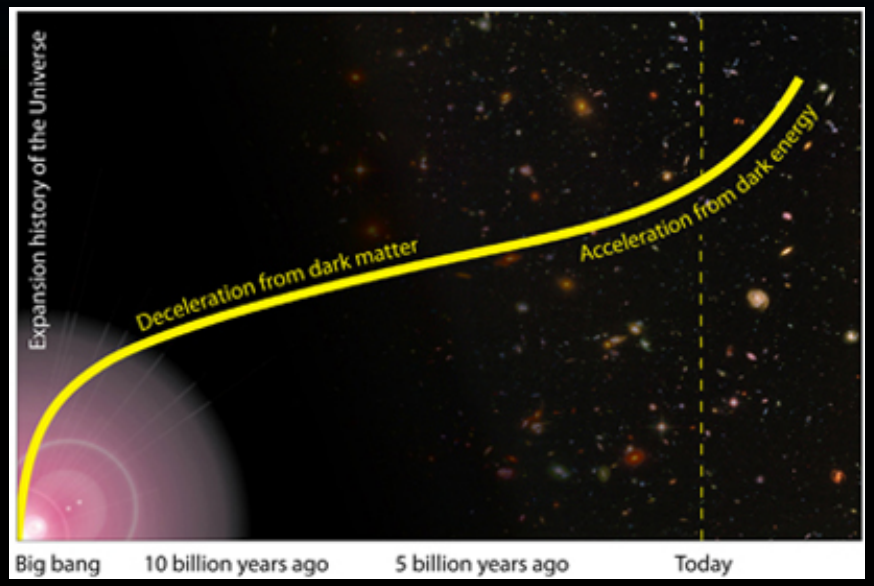
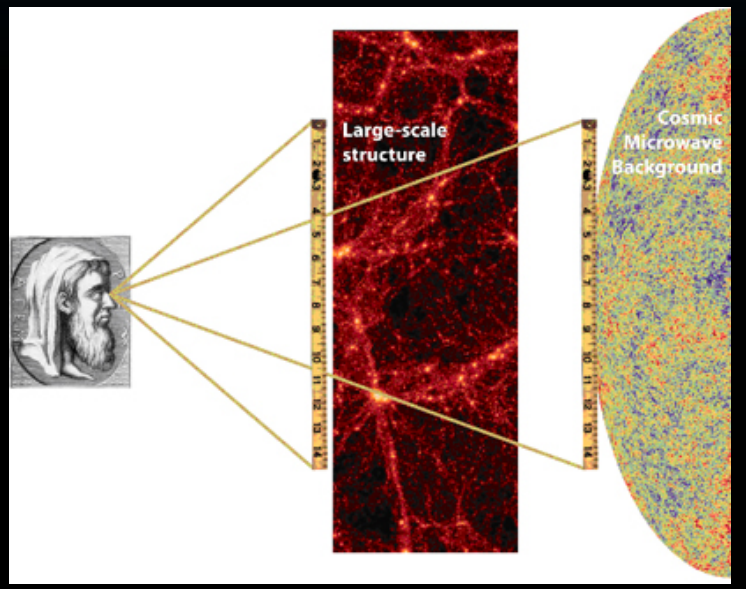
Euclid: Understanding Dark Matter and Dark Energy





Mapping the cosmic web with billions of galaxies back to Cosmic noon (z=2) will reveal nature of dark matter and dark energy through weak lensing and clustering

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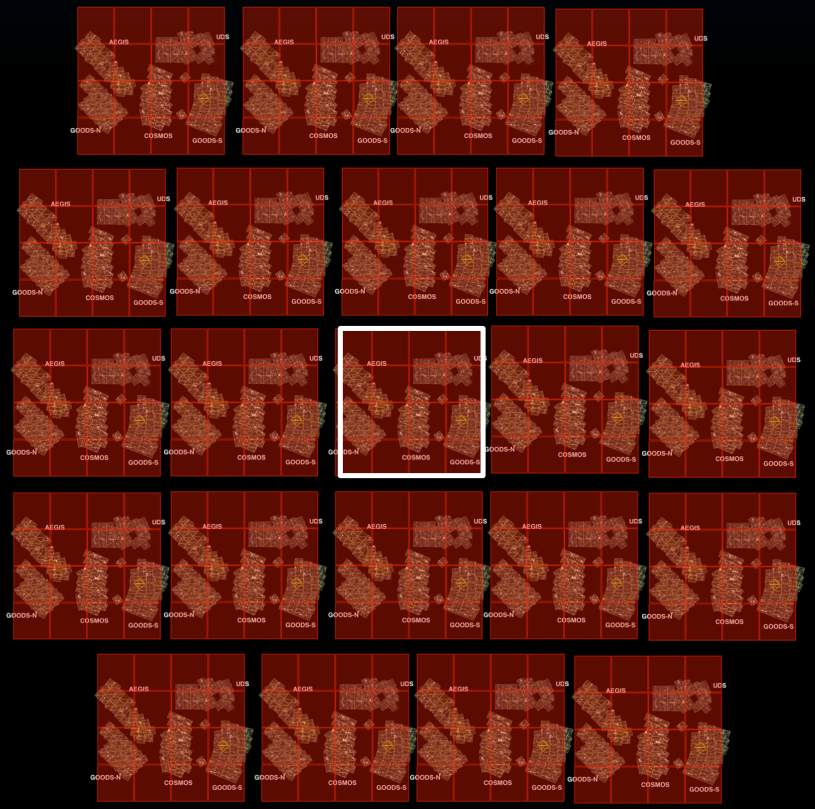
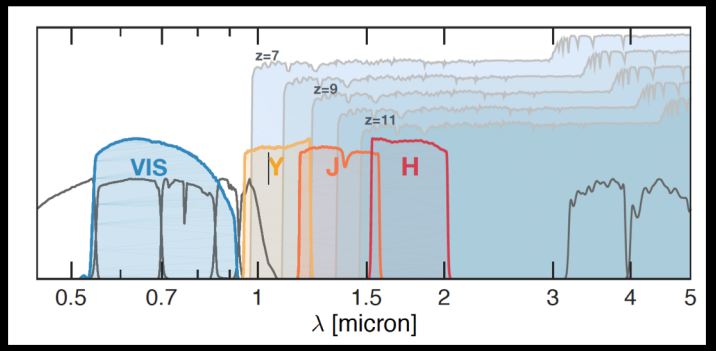
Euclid Deep Fields – 40 deg^2

4x



-North Ecliptic Pole (10 deg^2)
-Chandra Deep Field South 10 deg^2)
-Akari Deep Field South (20 deg^2, TBC)



High resolution Y+J+HK imaging to 26th mag. Essential for high redshift galaxy selection

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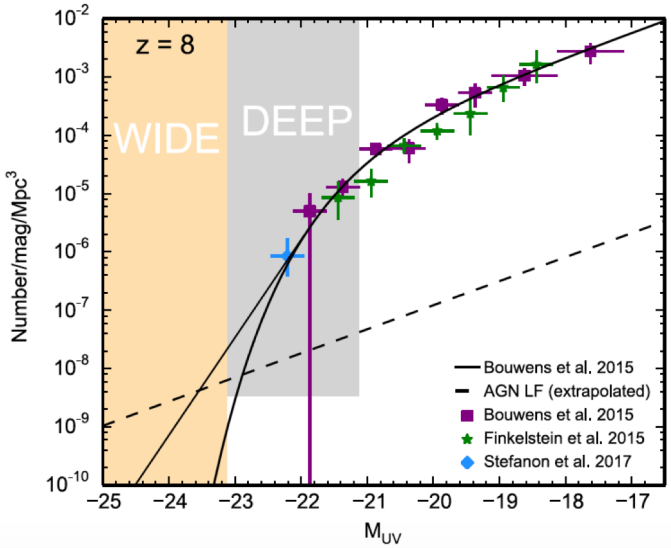
Thousands of bright z>8 Galaxies



Redshift	LBG (Schechter LF)	LBG (DPL LF)	AGN
6	46000	57000	200
7	14000	14000	48
8	2300	1900	12
9	410	630	3
10	27	220	1
11	0-100??		

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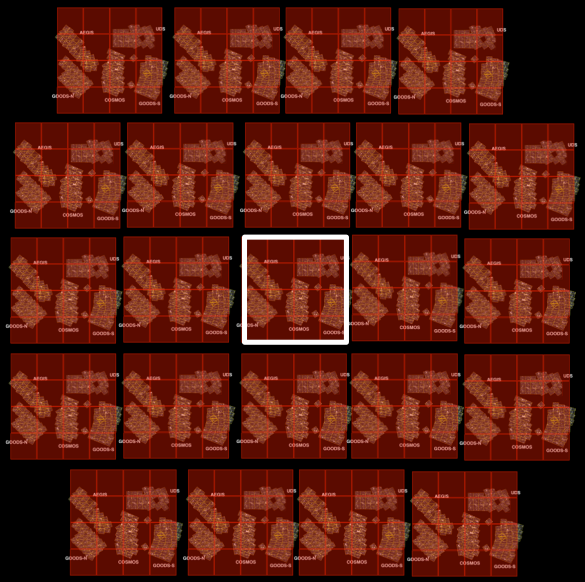
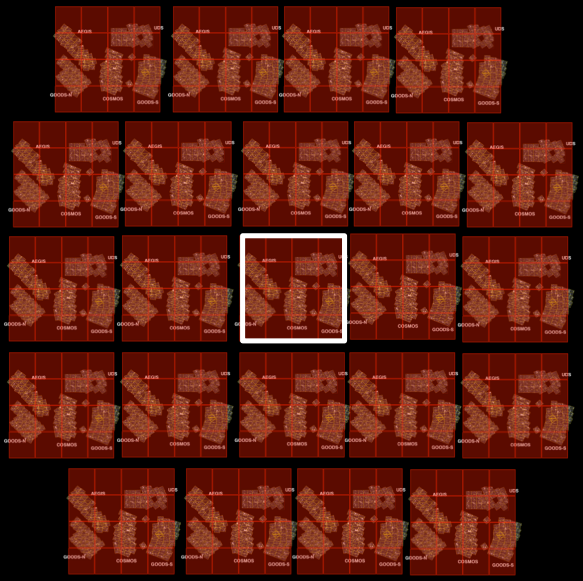
20 Square degrees observable from Hawaii (NEP,CDFS)

North Ecliptic Pole (10 deg^2)



Chandra Deep Field South (10 deg^2)



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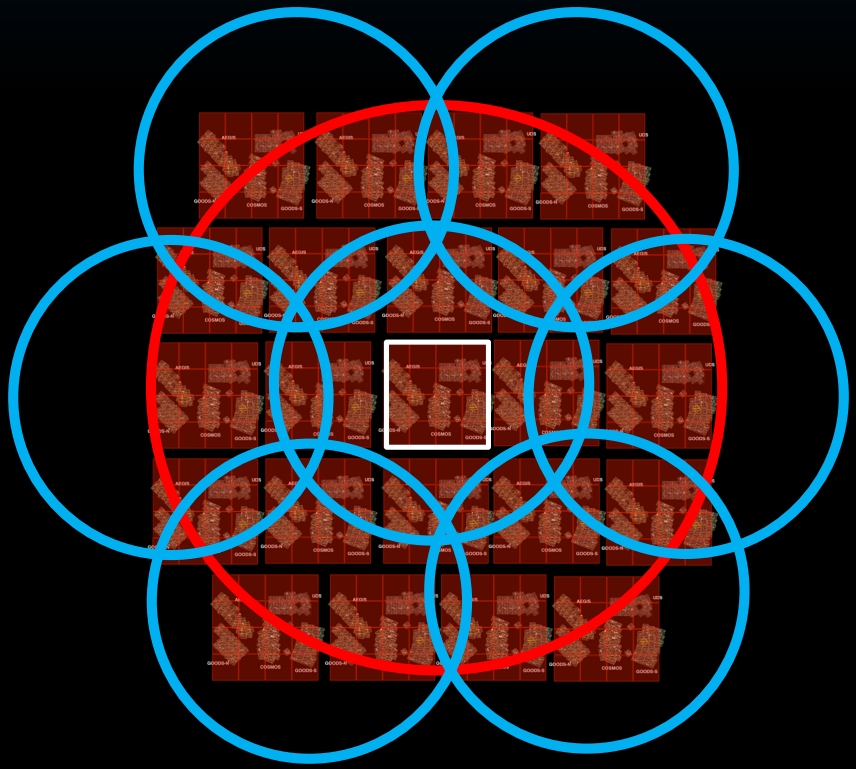
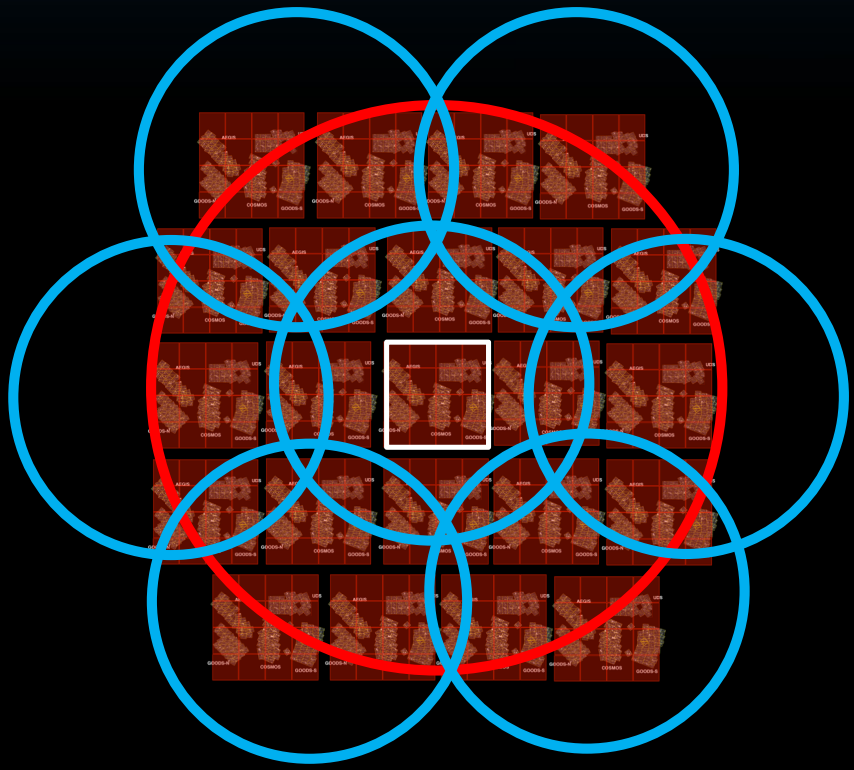
Cosmic Dawn Survey (2018-2020)

North Ecliptic Pole (10 deg^2)



Chandra Deep Field South (10 deg^2)



Subaru/HSC (30n, PI:Sanders)

Spitzer IRAC (6000h, PI:Capak)

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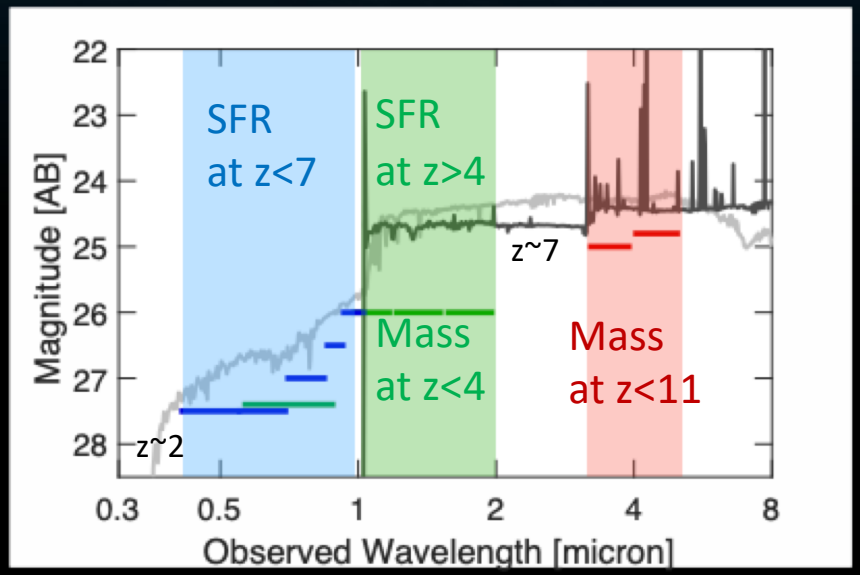
Cosmic Dawn Survey of Euclid Deep Fields (2019-2021)



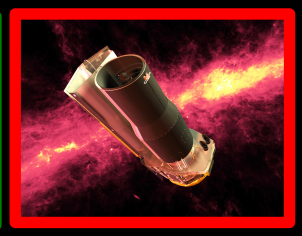
Cosmic Dawn Survey will be 100 times larger than existing HST+Spitzer extragalactic surveys (CANDELS)

Unbiased sample with reliable photo-z, Stellar mass, SFR for all M>M* galaxies to z=8, and brighter galaxies to z>10

Full picture of large scale structure over 95% of the history of the Universe

Hawaii-Two-0
HSC (30n)
Keck (10n)

Euclid deep



Spitzer WFIRST
Euclid Legacy
survey (6000h)

LMT – LSS survey
1.1, 1.4, 2.1 mm
0.25 mJy RMS

5500 7<z<8
1000 8<z<9
200 9<z<10

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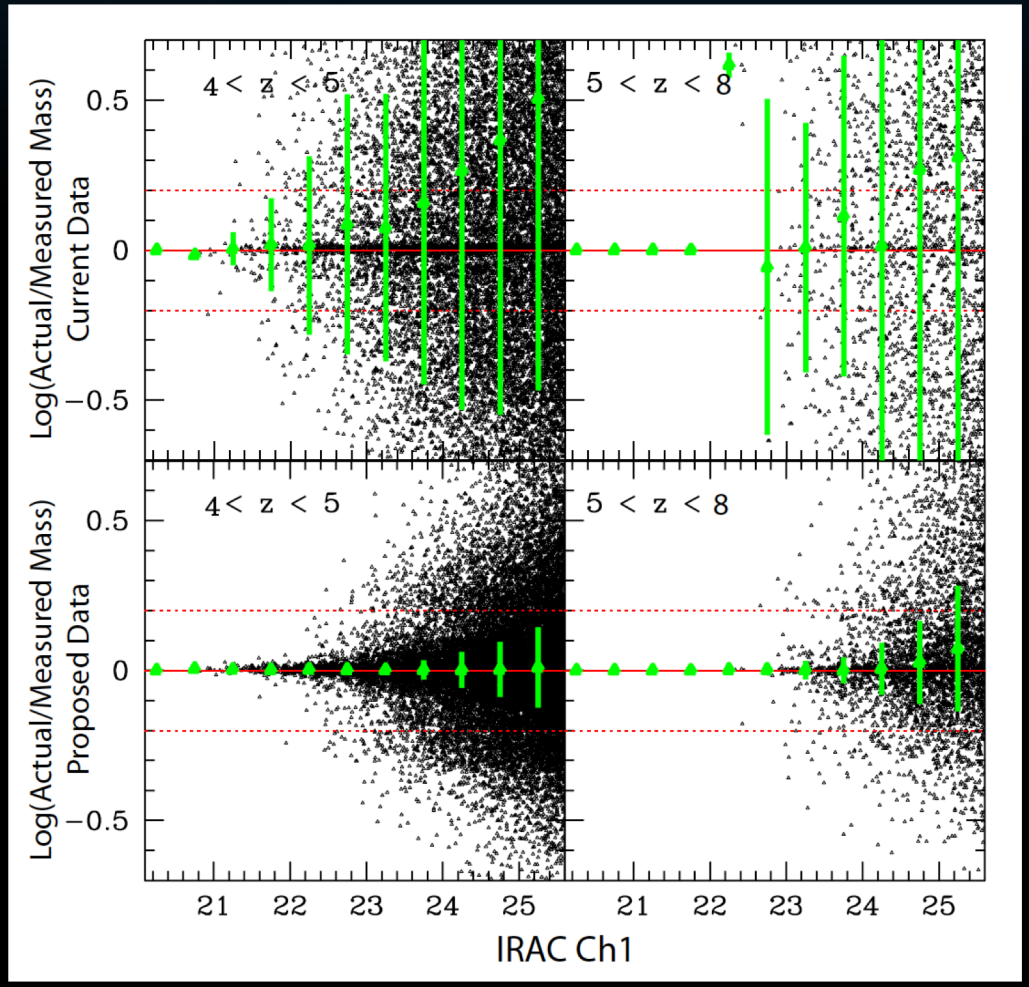
Importance of Spitzer for stellar masses at z>4



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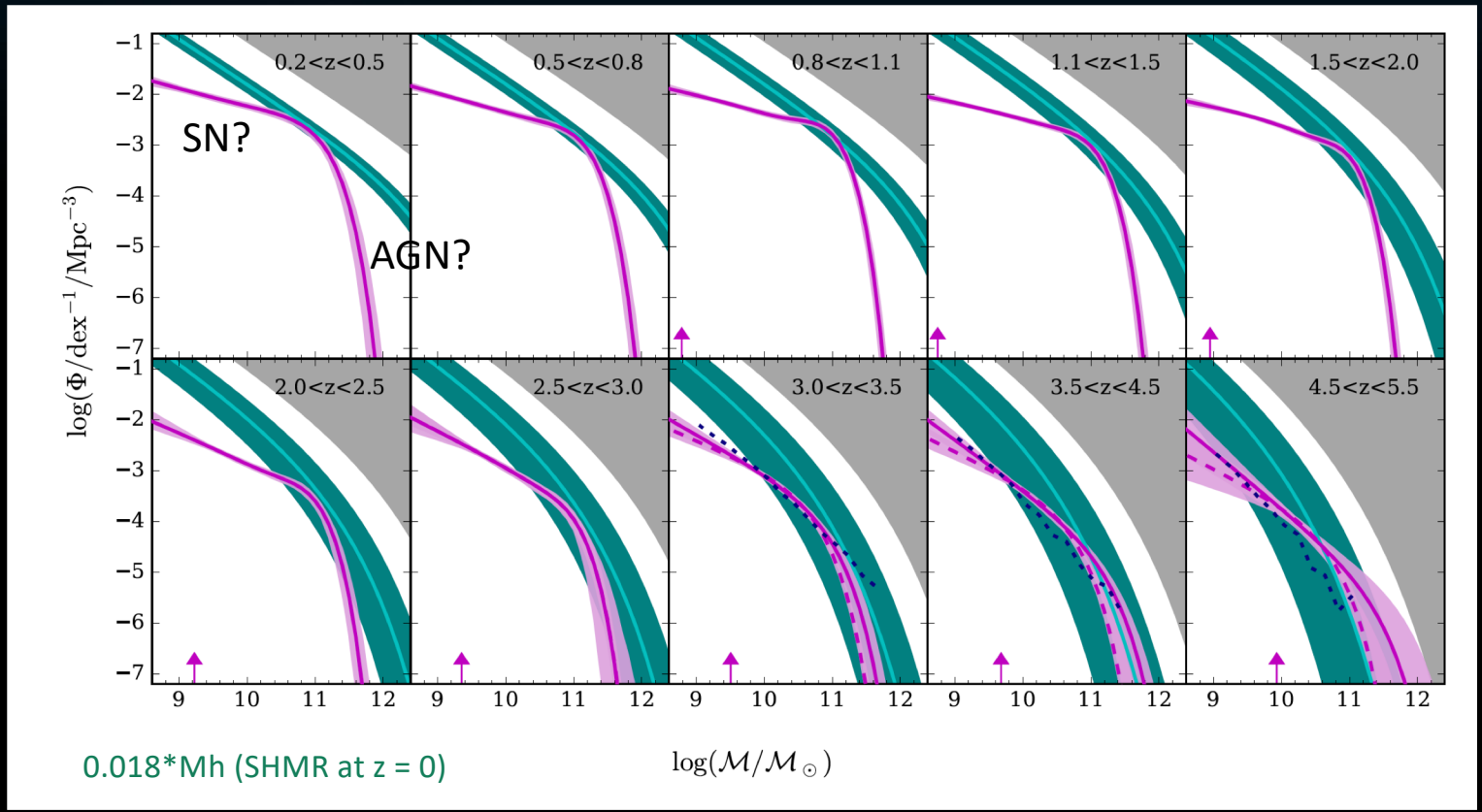
Probing the onset of Feedback Mechanisms



0.018*Mh (SHMR at z = 0)

(Davidzon+2017)

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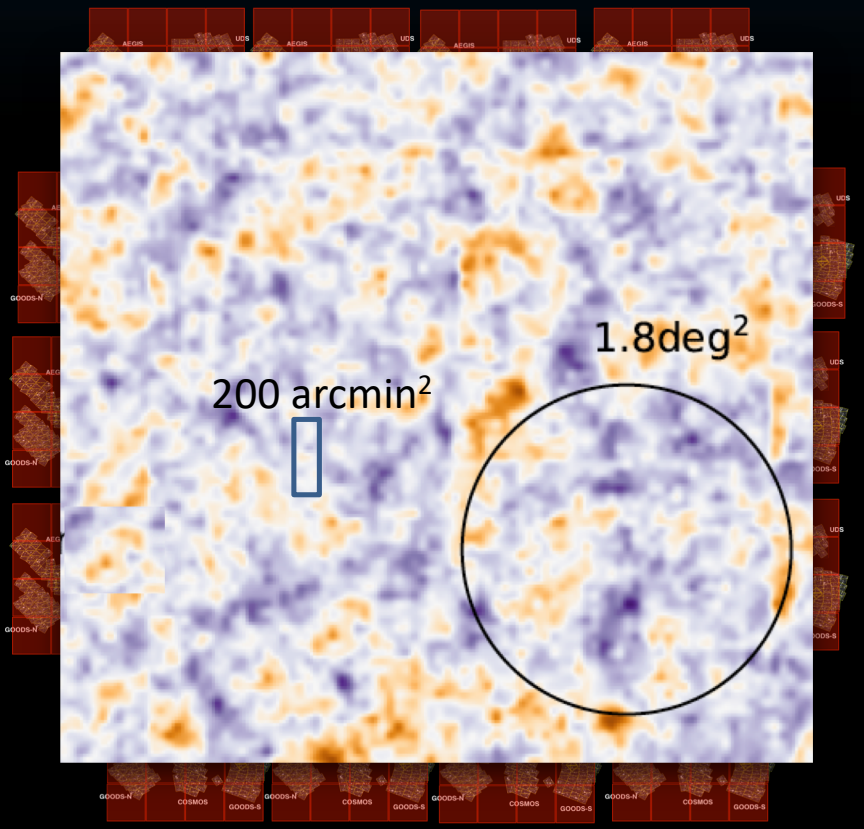
Characterize large scale structure at Cosmic Dawn

z=5 dark matter density map (Springel+ 2005)

Large area needed to map out large scale structure to find and characterize highest density peaks of the Universe during Cosmic Dawn

These pinpoints the formation sites of the first galaxies



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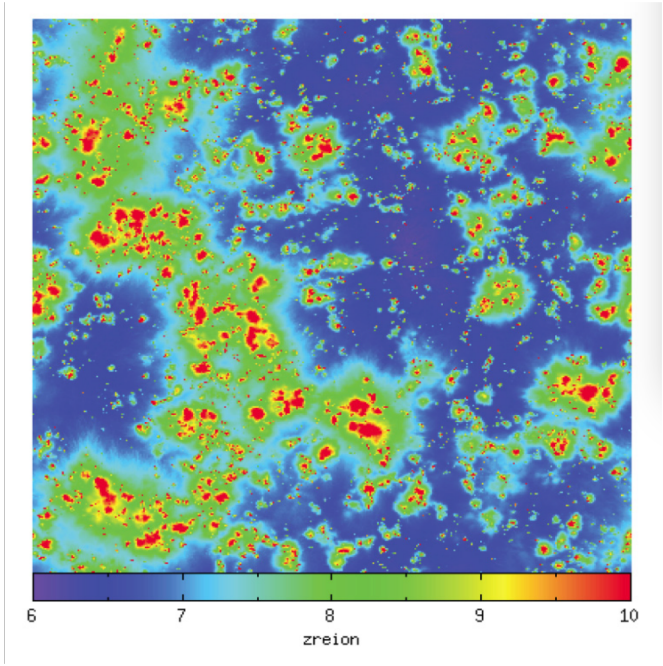
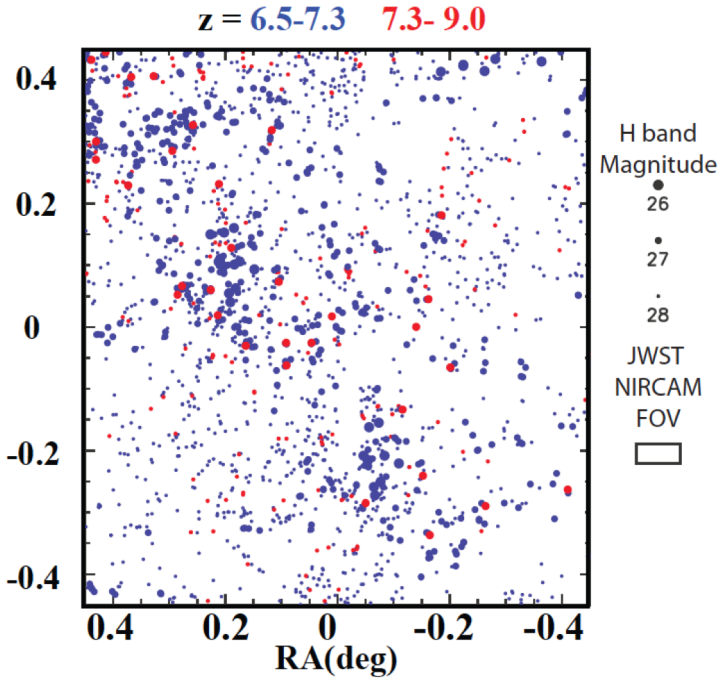
How did Reionization start and Proceed?





- Simulations suggest it happens on degree scales (Trac+2008)
- Starts at z>10 in bubbles around the highest density peaks, traced well by the brightest galaxies

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ORIGINS – European Research Council Synergy Grant


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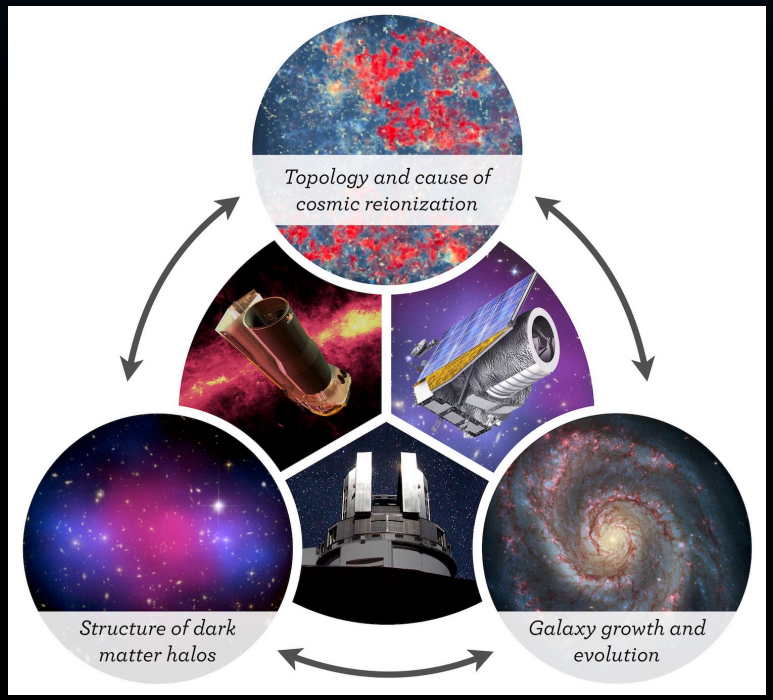

Proposed partnership between Japan, Hawaii and Europe to extend the PFS survey deep into Epoch of Reionization

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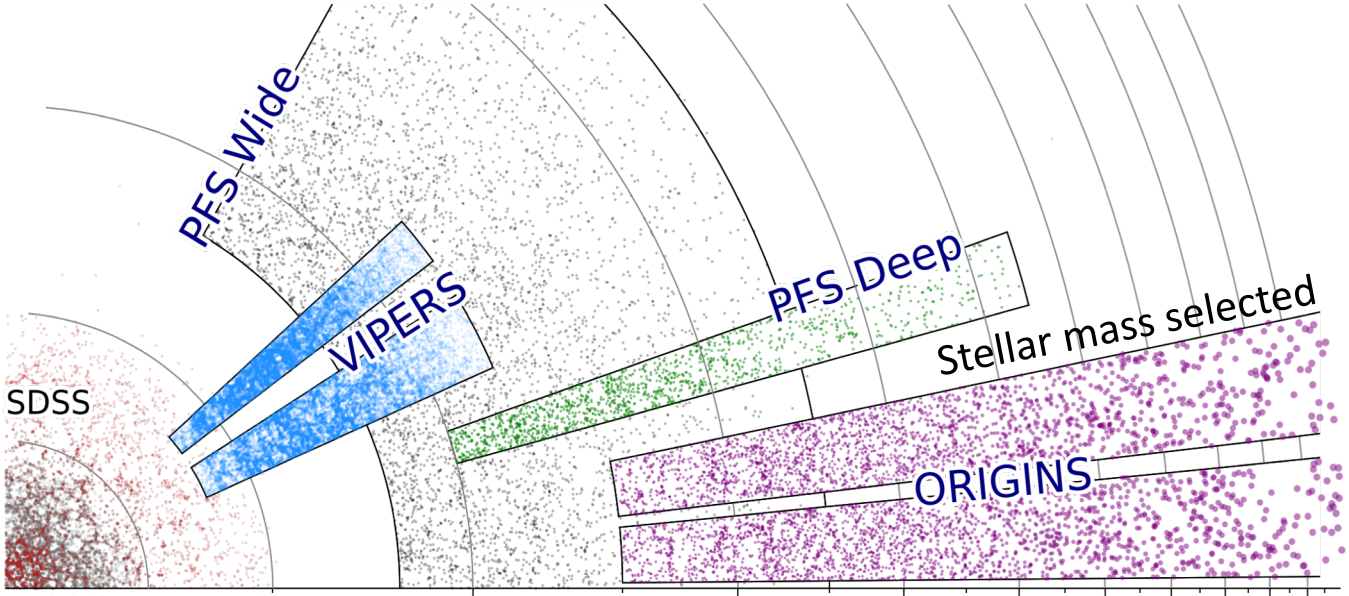
Expand PFS survey to map LSS through EoR



Spectra [deg^{-2}]	10000	2000	600
Exposure time [hours]	2	6	16
Allocation [nights]	40	20	20

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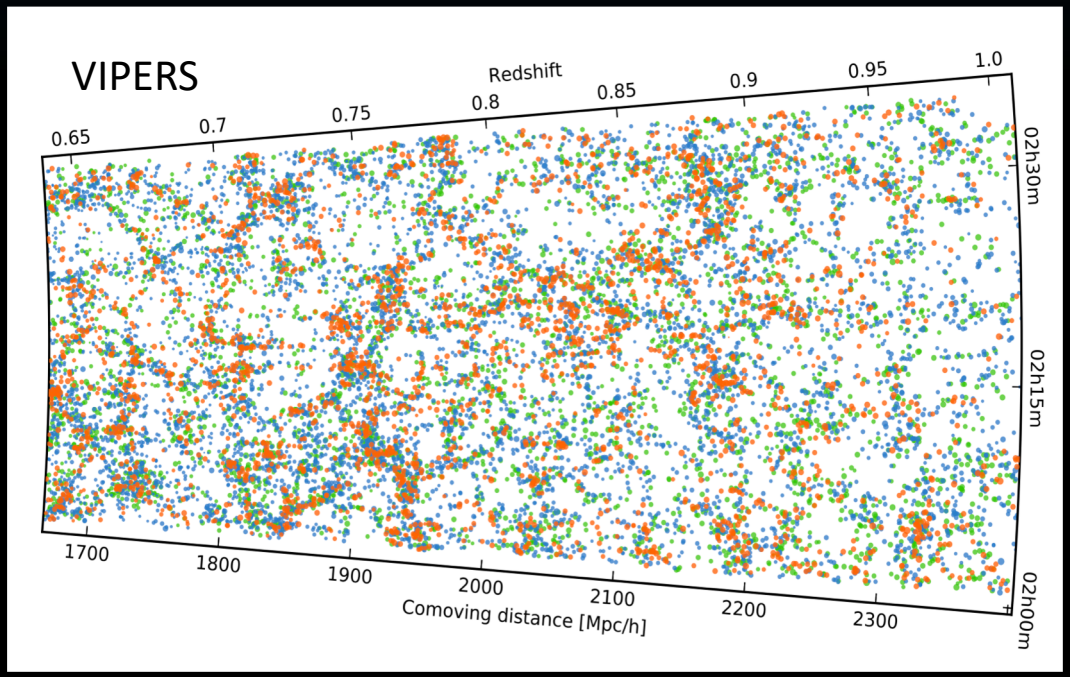
Characterize large scale structure through EoR



- Test of gravity and Cosmology to z=4 (clustering + Redshift space distortions)
- Co-evolution of Dark matter and galaxies to z=10 (clustering and abundance matching)

Unleash strong synergy between major Cosmology and galaxy evolution surveys of the next decade

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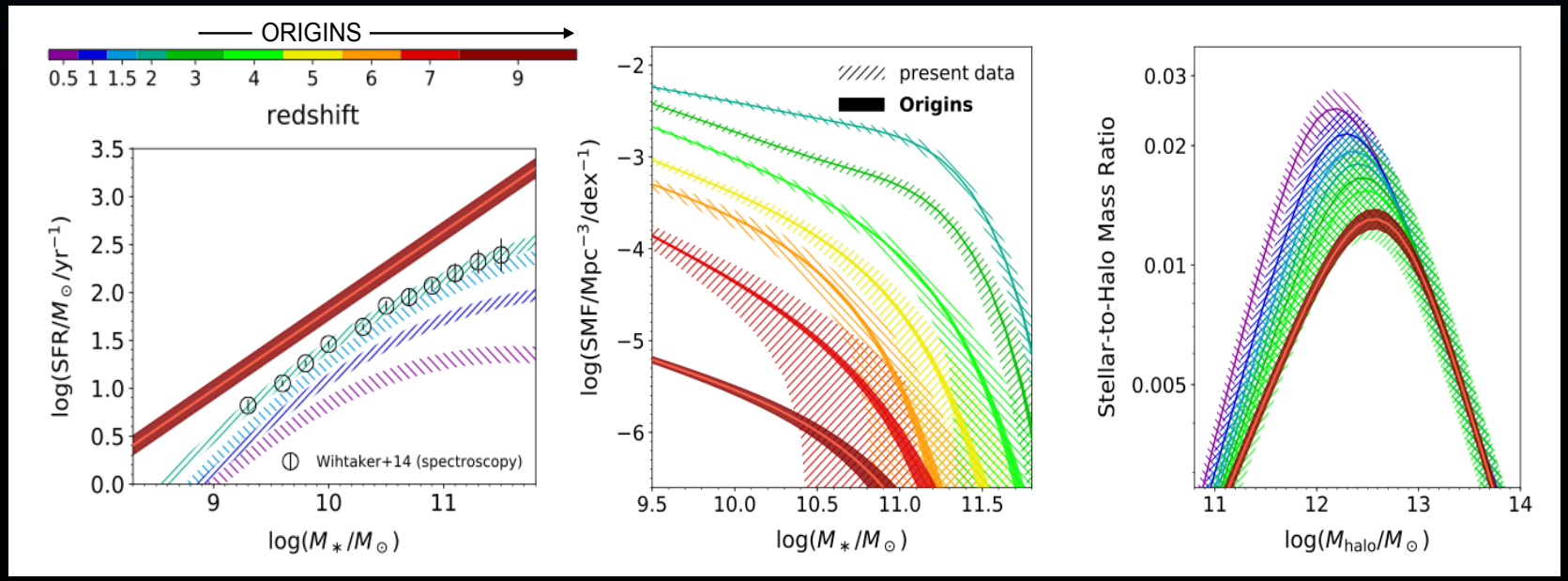
Main sequence, stellar to halo mass function to z=10



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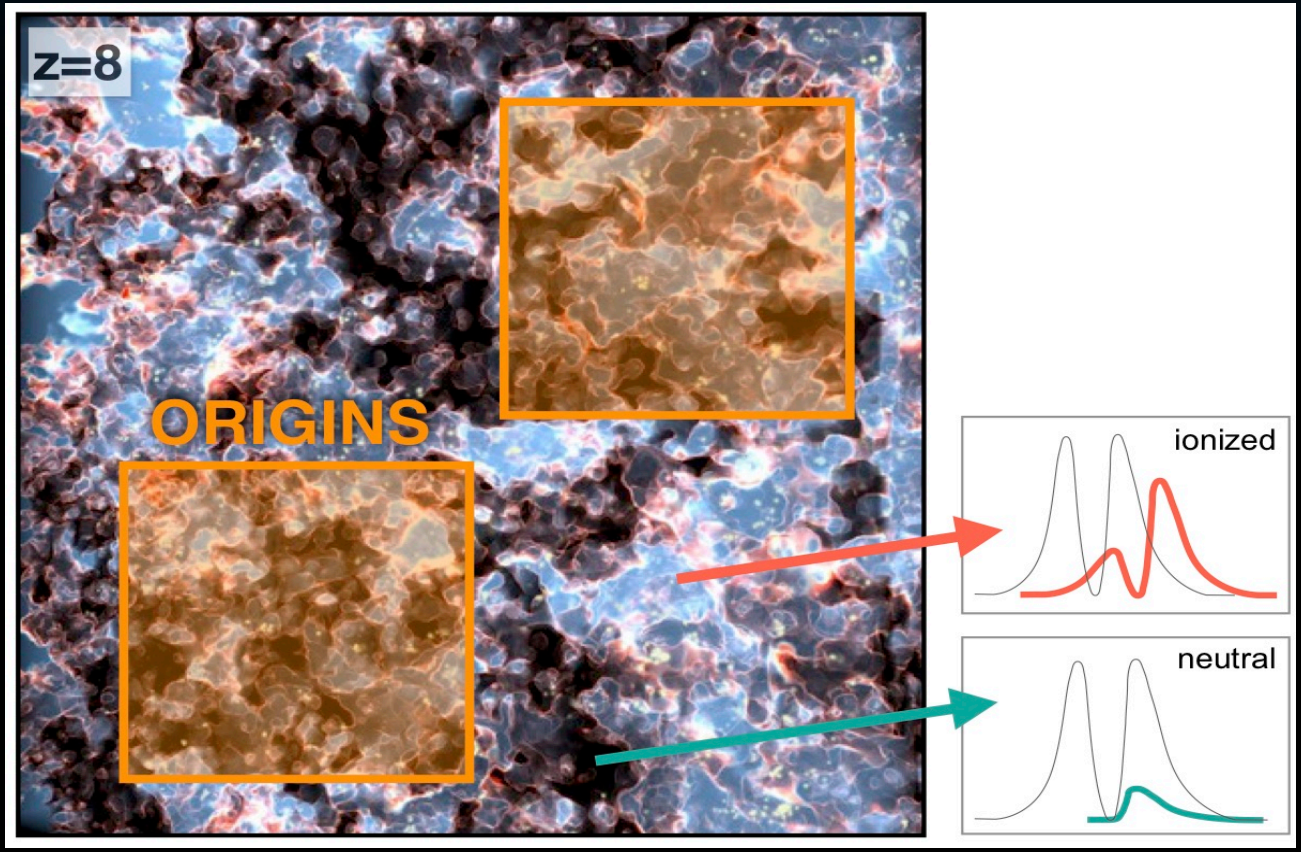
Topology and sources of Cosmic Reionization



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Thank you