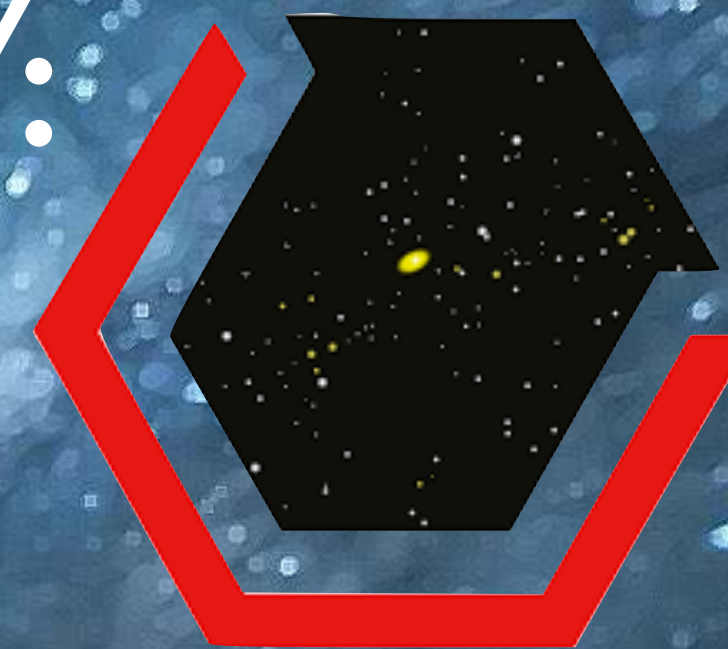


SIX YEARS OF THE DARK ENERGY SURVEY: **COSMOLOGY FROM GALAXY CLUSTERING AND WEAK LENSING**



JUDIT PRAT MARTÍ
YONDER, DARK, NIELS BOHR INSTITUTE
ADAM, MAY 2026

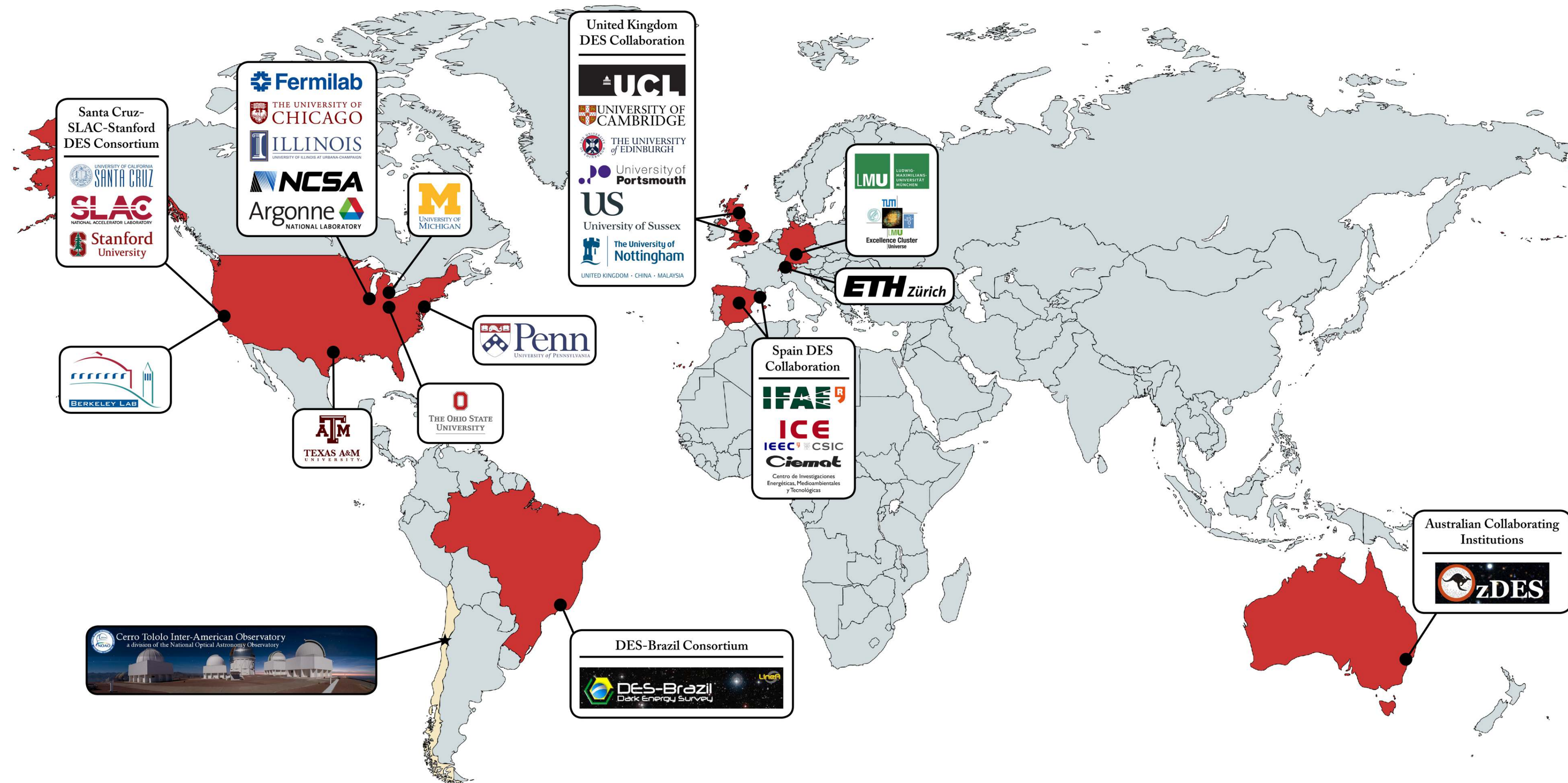
Yonder
Art • Science Niels Bohr Institute

DARK



KØBENHAVNS
UNIVERSITET

DARK ENERGY SURVEY COLLABORATION

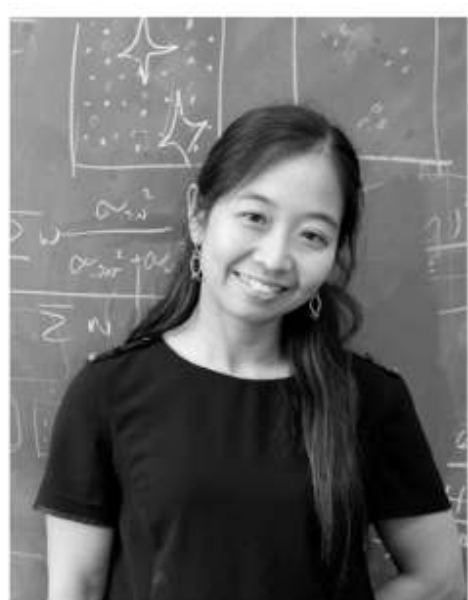


Authors of this Analysis

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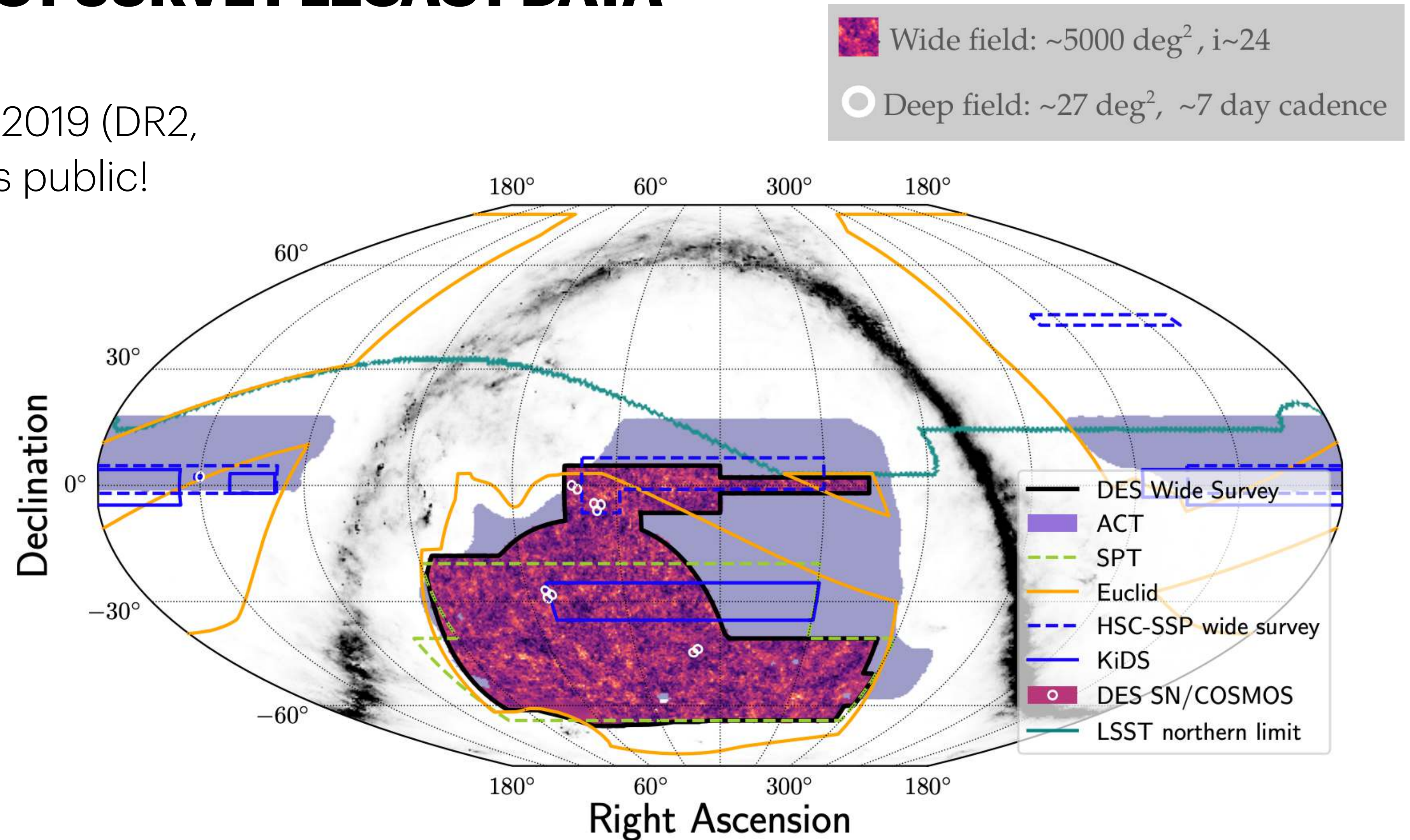
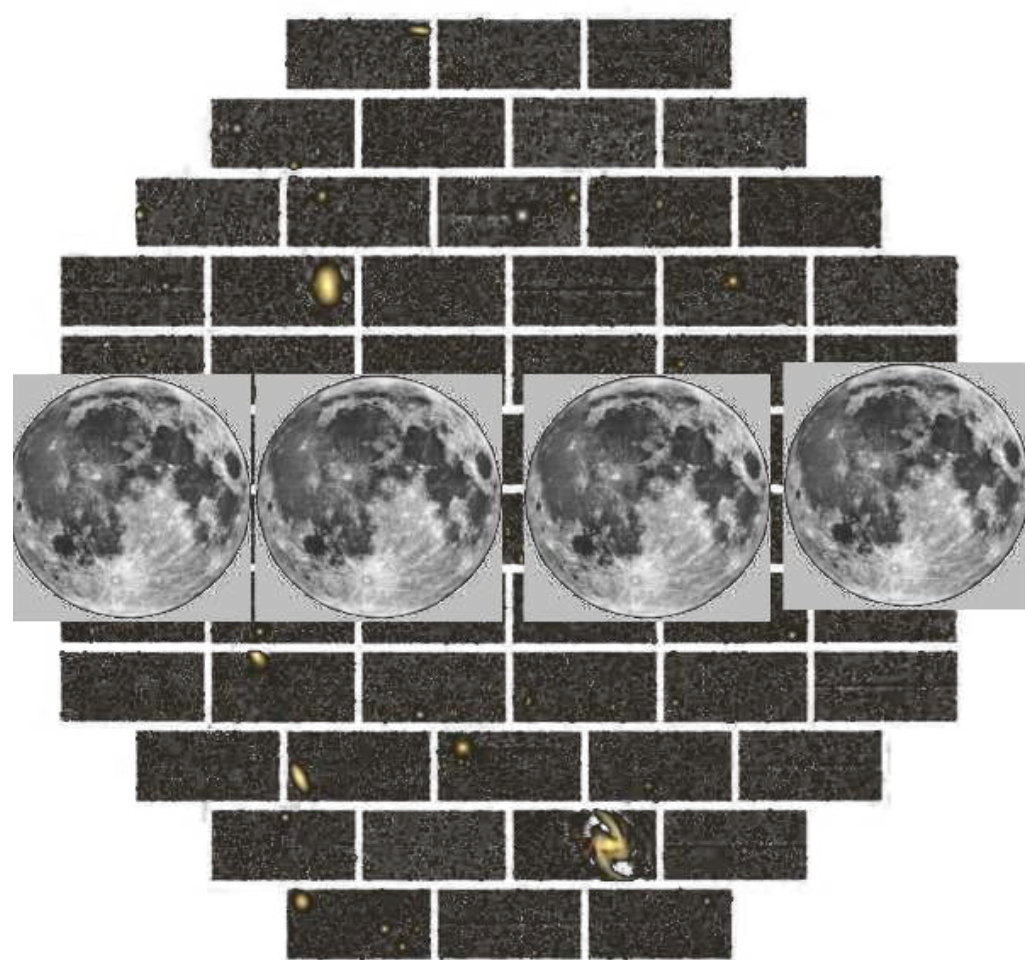
bold: early career scientists

blue: mid-career scientists (at least partially) trained in DES

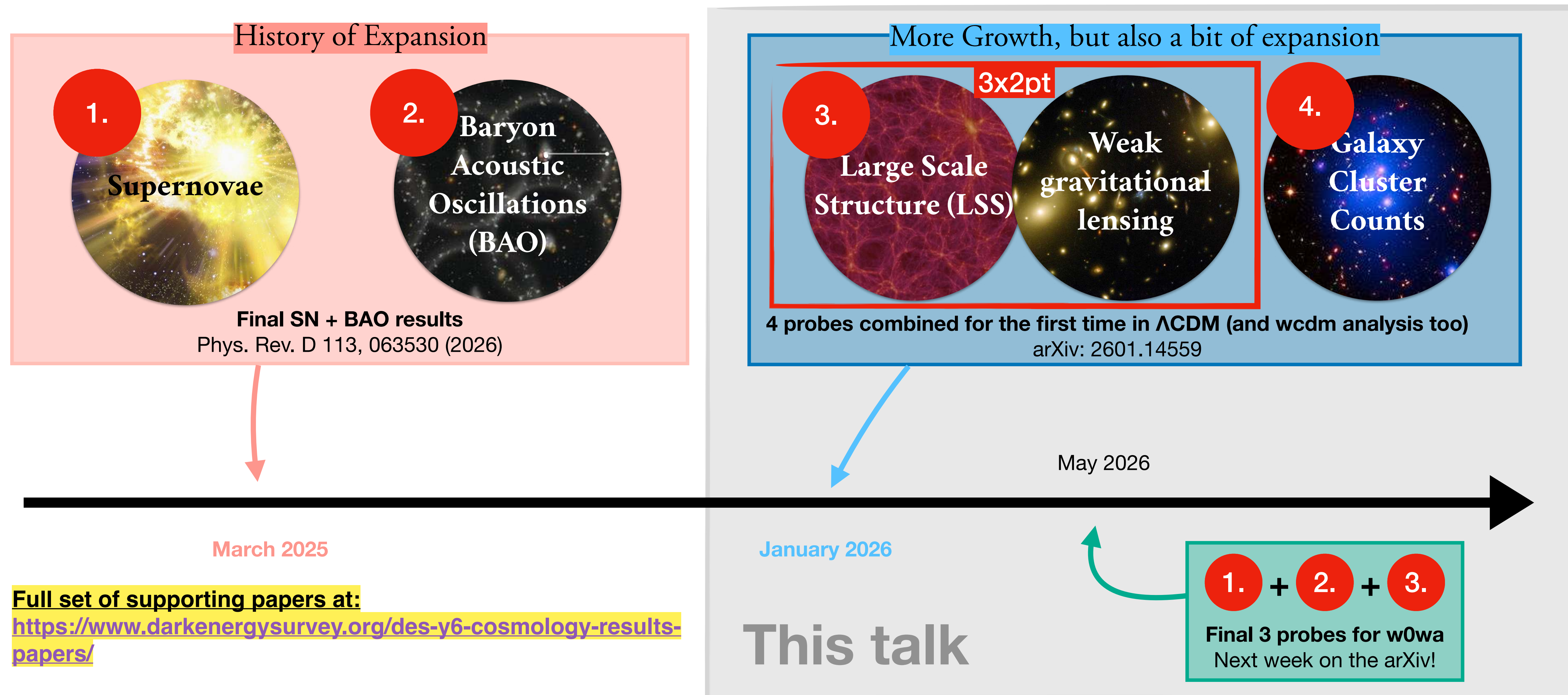


THE DARK ENERGY SURVEY LEGACY DATA

6 years of data: 2013 - 2019 (DR2,
DES et al. 2021). Data is public!

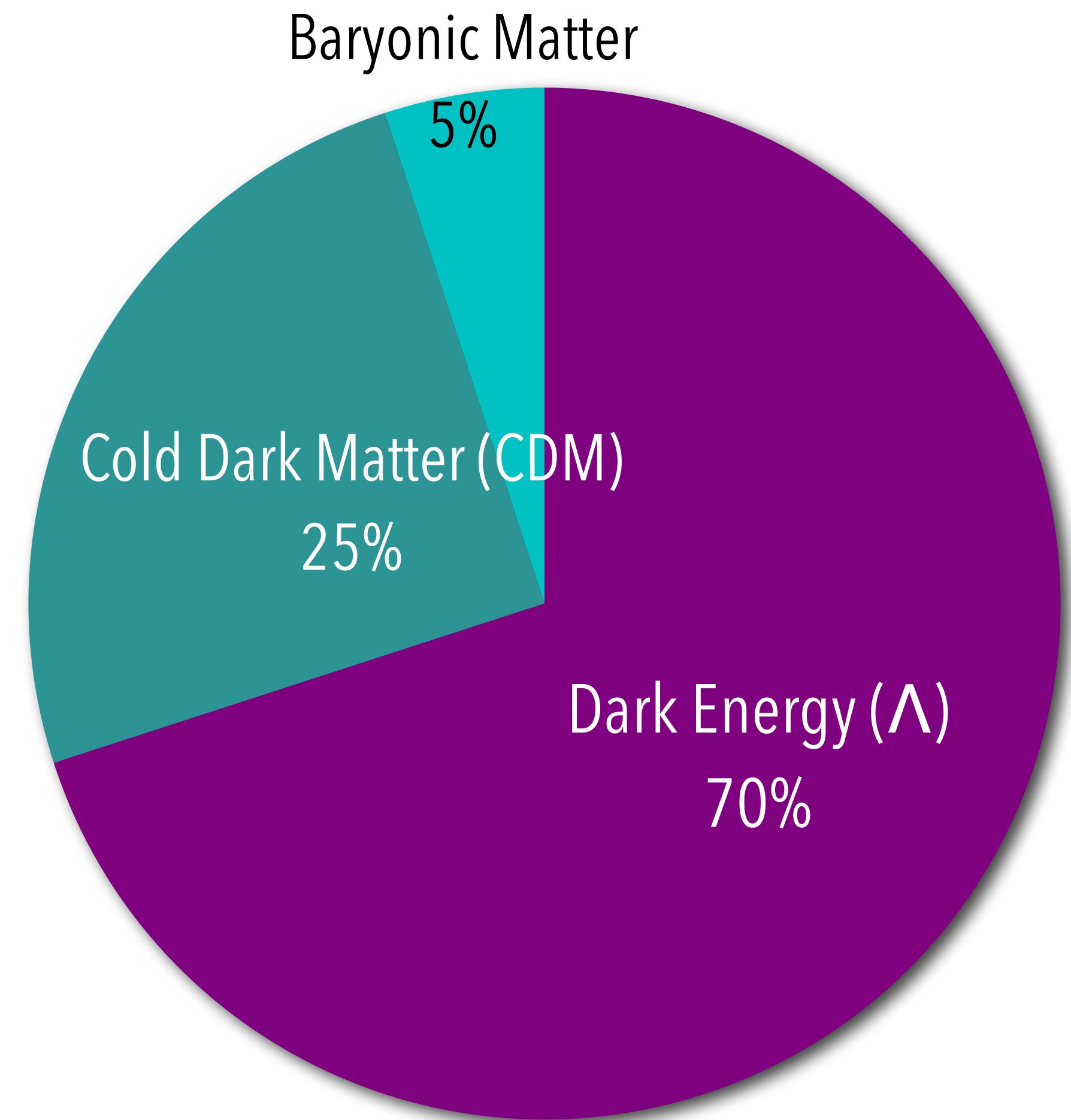
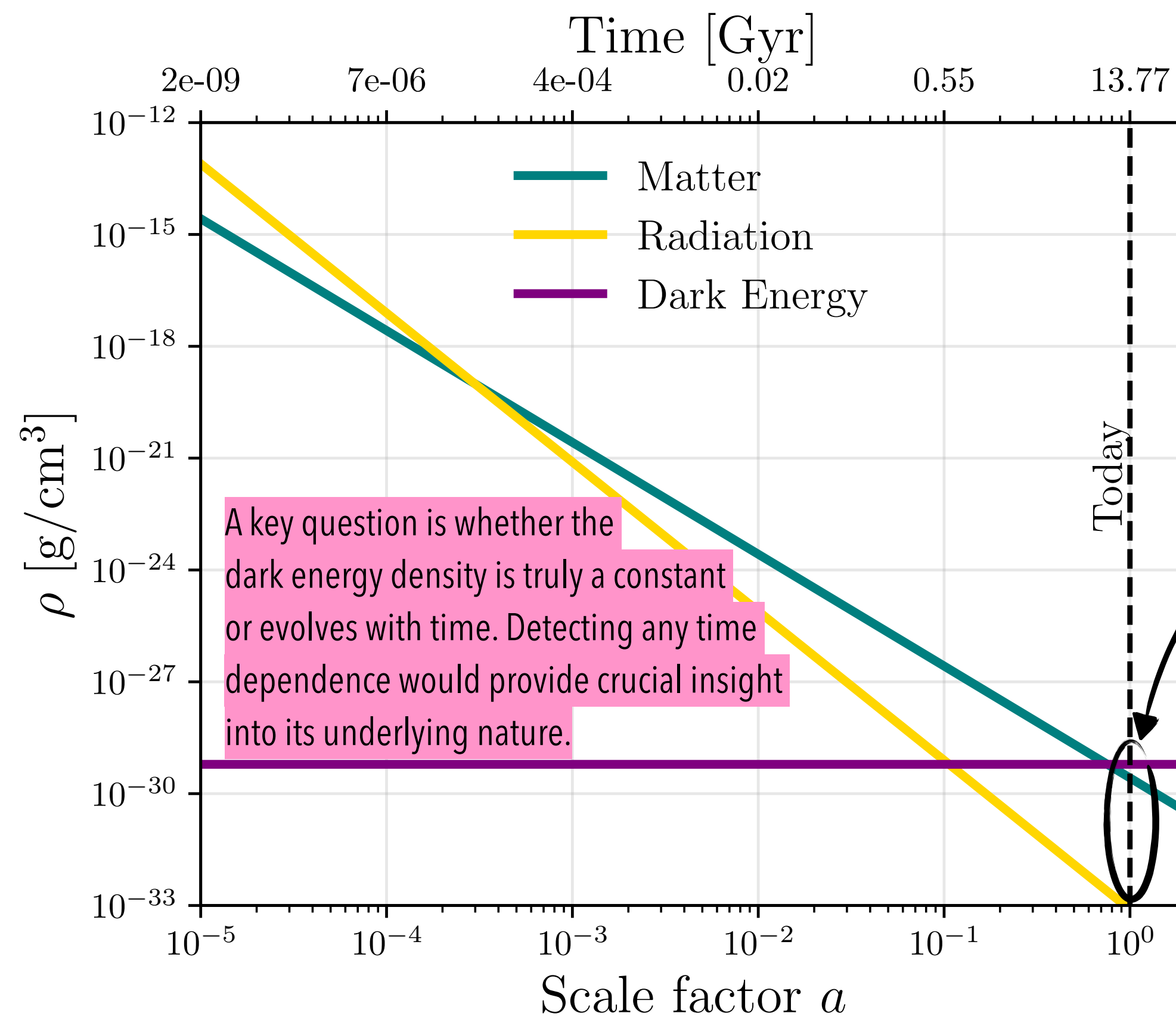


THE DARK ENERGY SURVEY WAS DESIGNED TO COMBINE **4 COSMOLOGICAL PROBES**:



THE STANDARD MODEL OF COSMOLOGY: Λ CDM

Flat Universe with Dark Energy in the form of a cosmological constant Λ + Cold Dark Matter, assuming General Relativity.

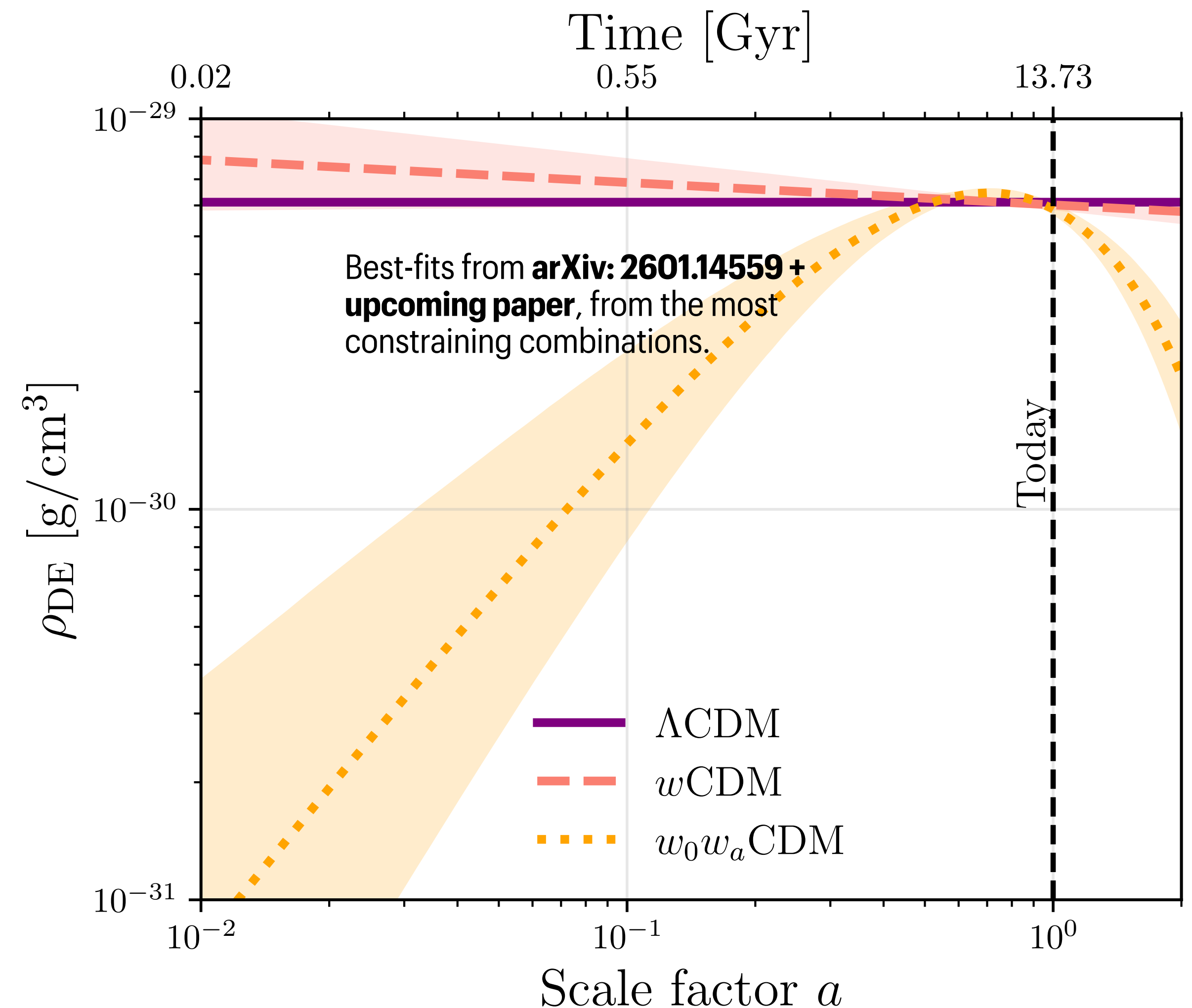


TWO FIRST EXTENSIONS FOR EVOLVING DARK ENERGY

Equation of state of dark energy: $w \equiv \frac{P}{\rho}$

- Λ CDM: $w = -1$.
- w CDM: w is constant but allowed to be different than -1.
- $w_0 w_a$ CDM (CPL: Chevallier-Polarski-Linder):

$$w(a) = w_0 + (1 - a)w_a$$

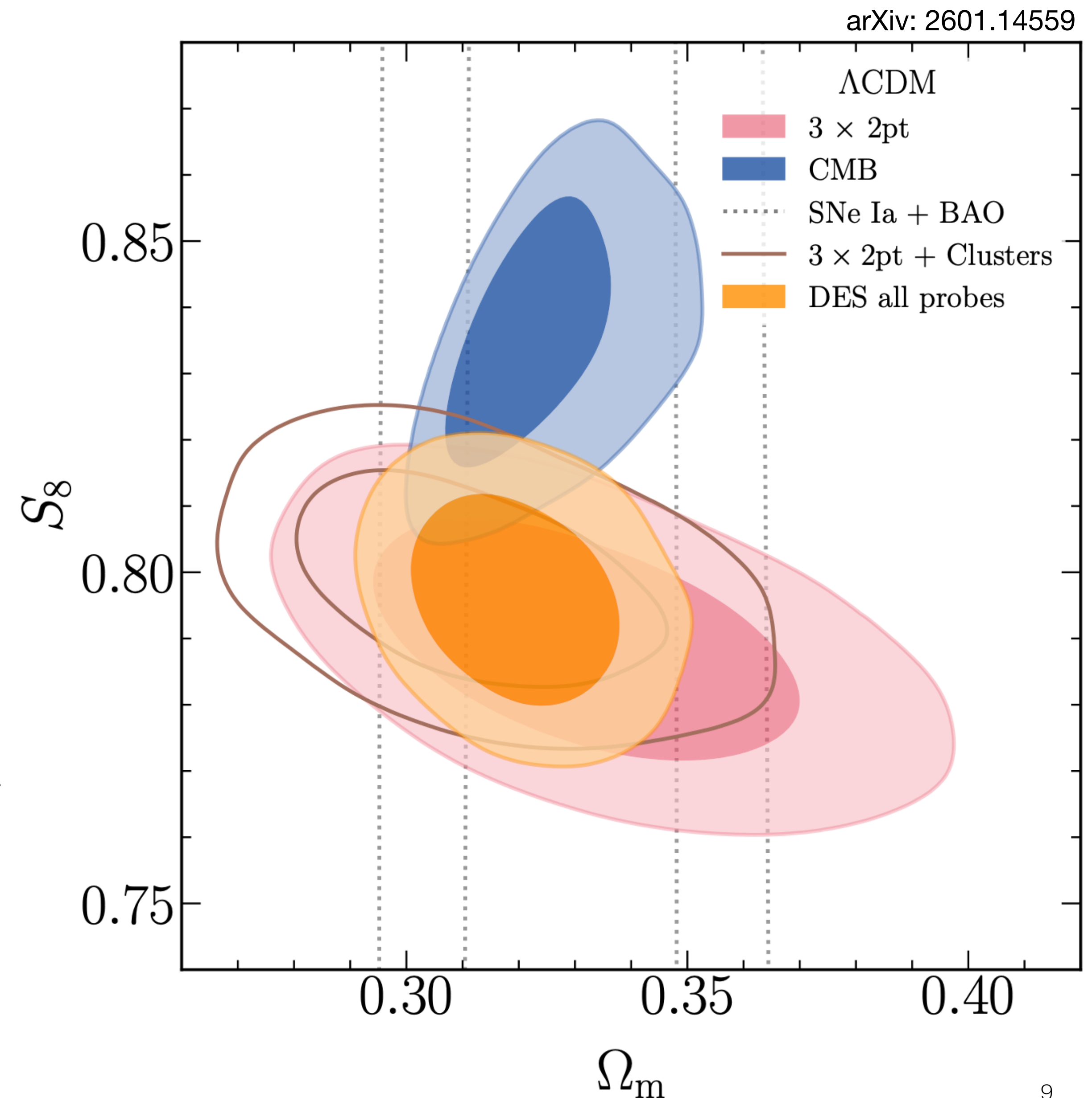


Λ CDM RESULTS

DES DARK ENERGY PROBES COMBINED: 3X2PT, BAO, SN, CLUSTERS

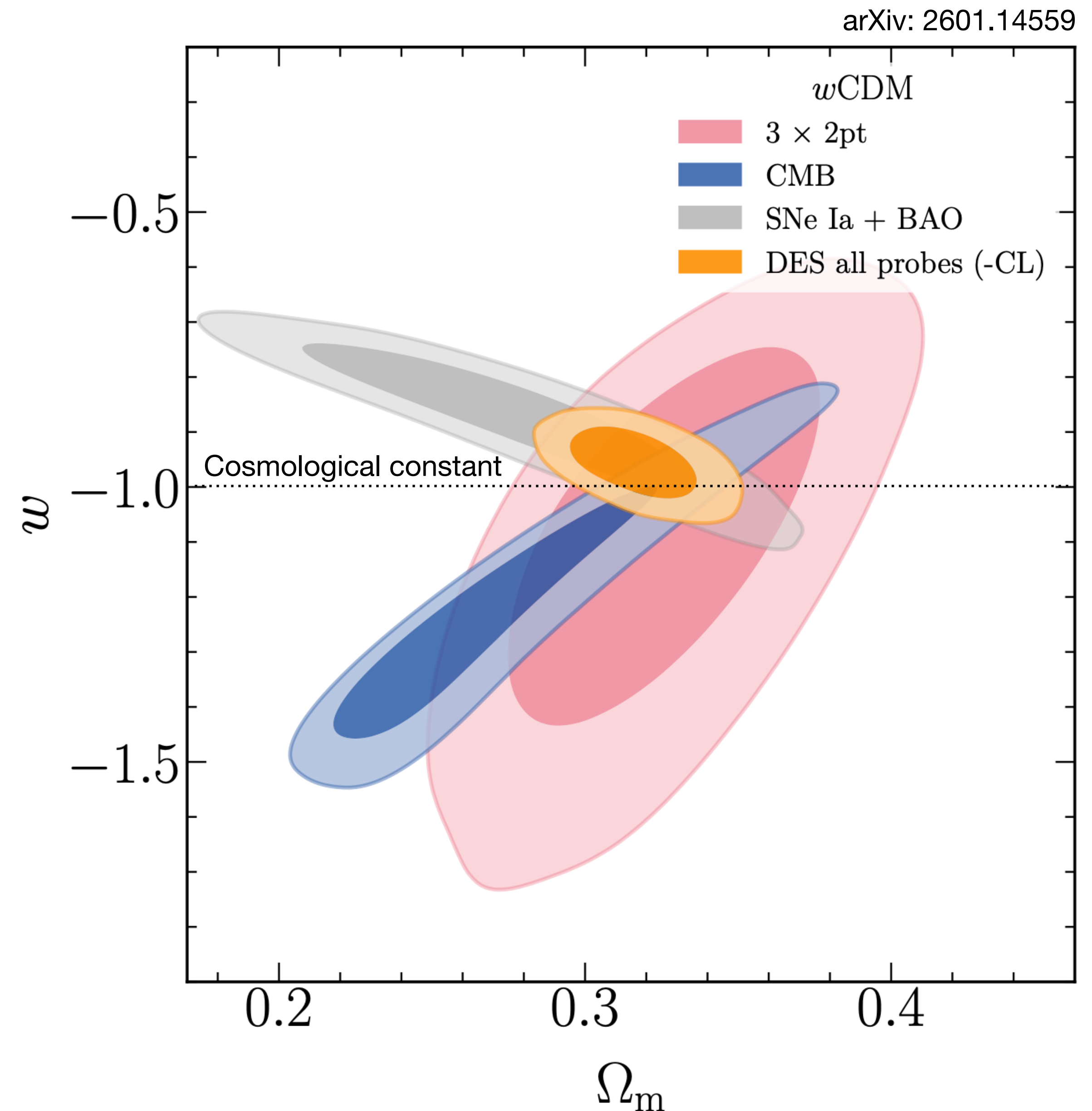
This plot is exciting for us because:

- All four probes are consistent! 🎉
- We've combined all four probes in a single survey for the first time. 💪
- DES all-probes has similar constraining power as CMB (Planck+SPT+ACT) in S_8 & Ω_m !
- In Λ CDM, DES all-probes is 2.8σ from the CMB.



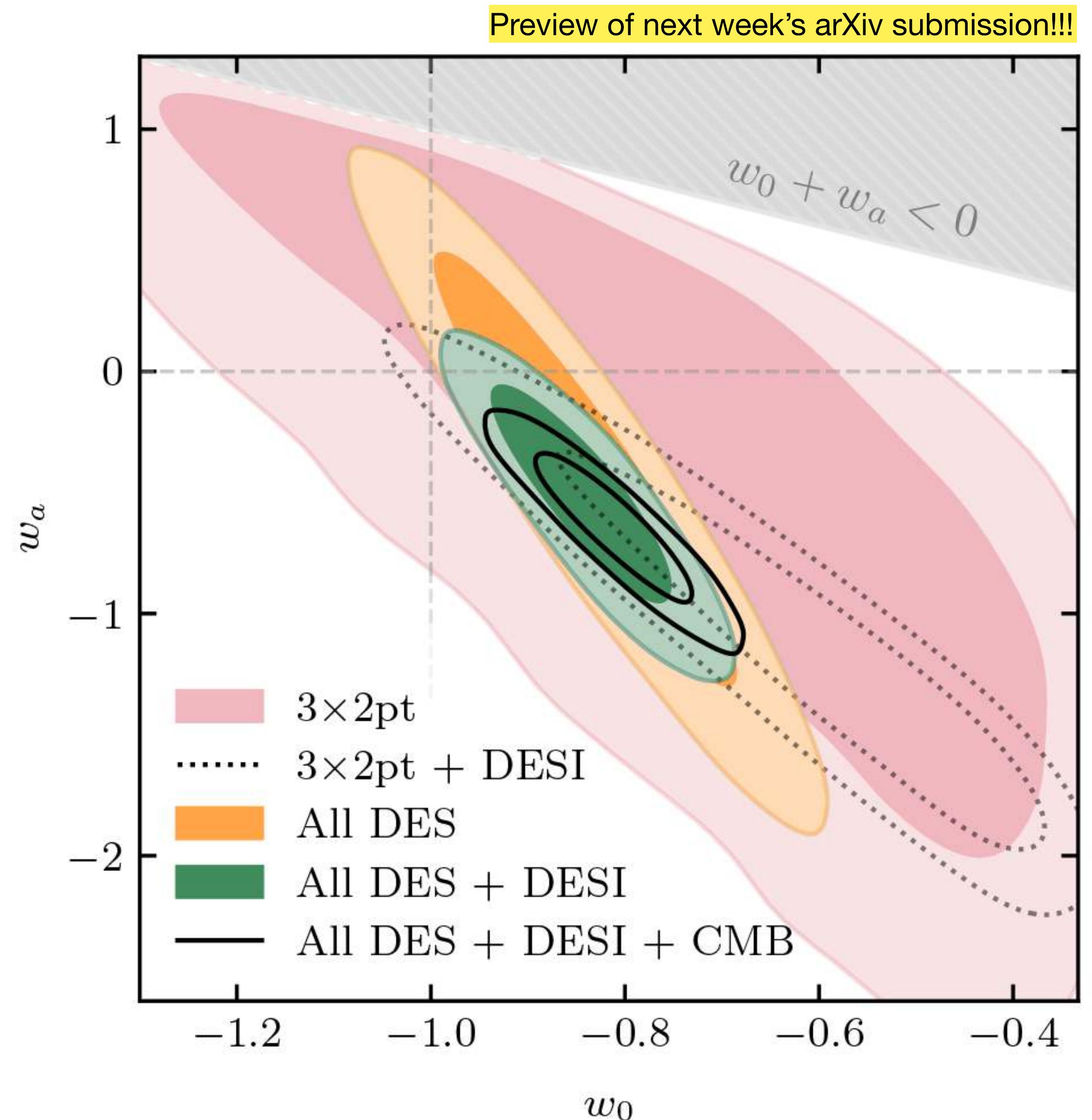
w CDM RESULTS

- We constrain the equation of state parameter to $\sim 4\%$, and find no evidence for departure from a cosmological constant of $w = -1$.
- We find no significant preference of w CDM over Λ CDM when doing model comparison via $\Delta\chi^2$.
- The full parameter difference with the CMB is 2.5σ (similar to the Λ CDM case).



w_0w_a CDM RESULTS

- First multi probe results from a single survey in this model, what DES was set out to do!
- **All DES results** (3×2pt + SN + DES BAO) are 2.2σ away from Λ CDM. **Best low-redshift only** constrain (All DES + DESI BAO, CMB independent), are **2.2σ away from Λ CDM**. Most constraining combination (+CMB) is 3σ from Λ CDM.
- Leave-out tests find the deviation ranges from 2.3 to 3.2σ , with best-fit parameters always $w_0 > -1$ and $w_a < 0$.
- We find the residual S_8 parameter difference between the early Universe and late-Universe probes to be unaffected by the assumption of dynamical dark energy.



Thank you!

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