

Cosmological Parameters via HII galaxies

Ricardo Chávez Murillo, IRyA, UNAM

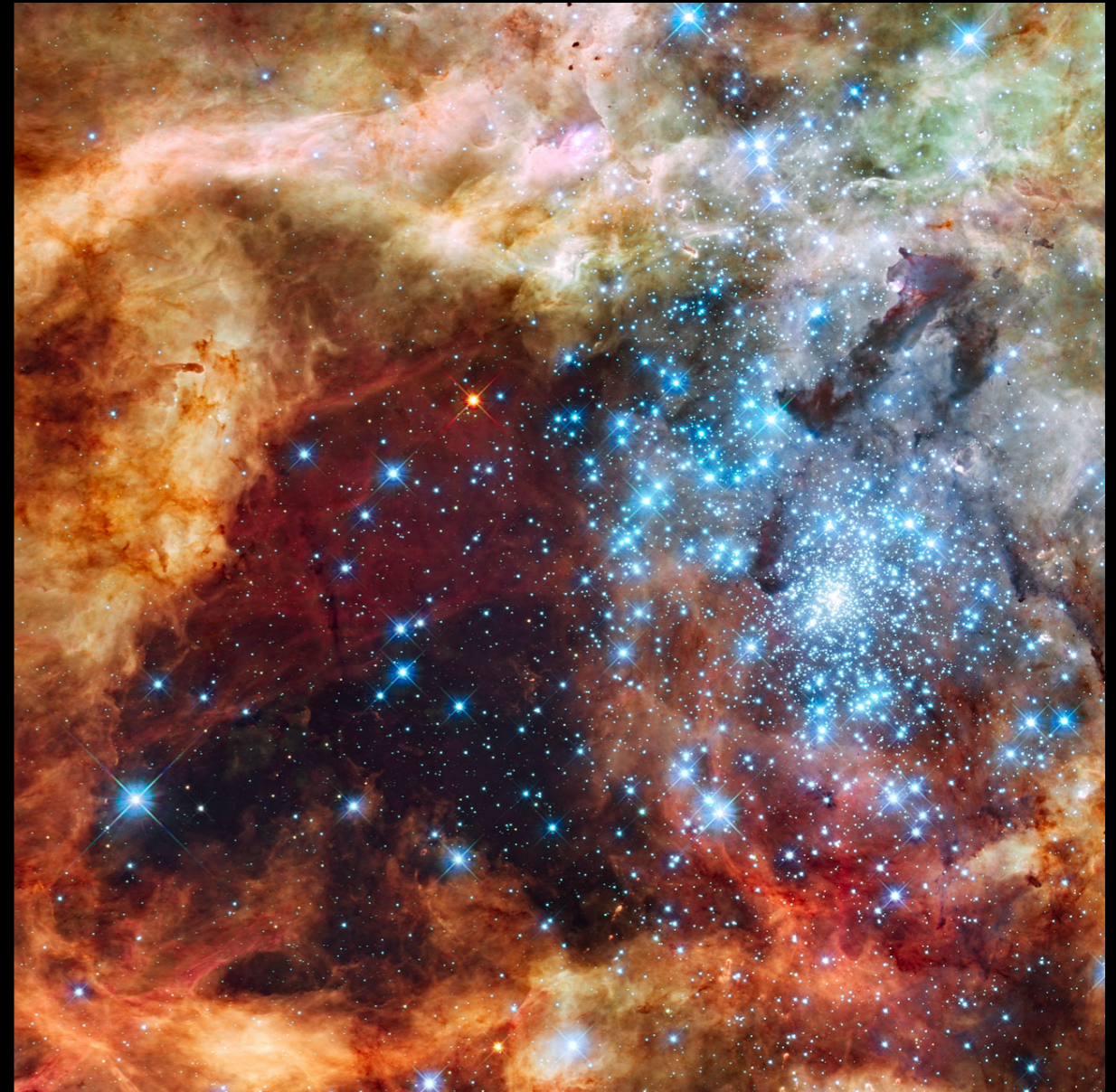
CosmoVerse, Lisbon, May 2023



Giant Extragalactic HII Regions

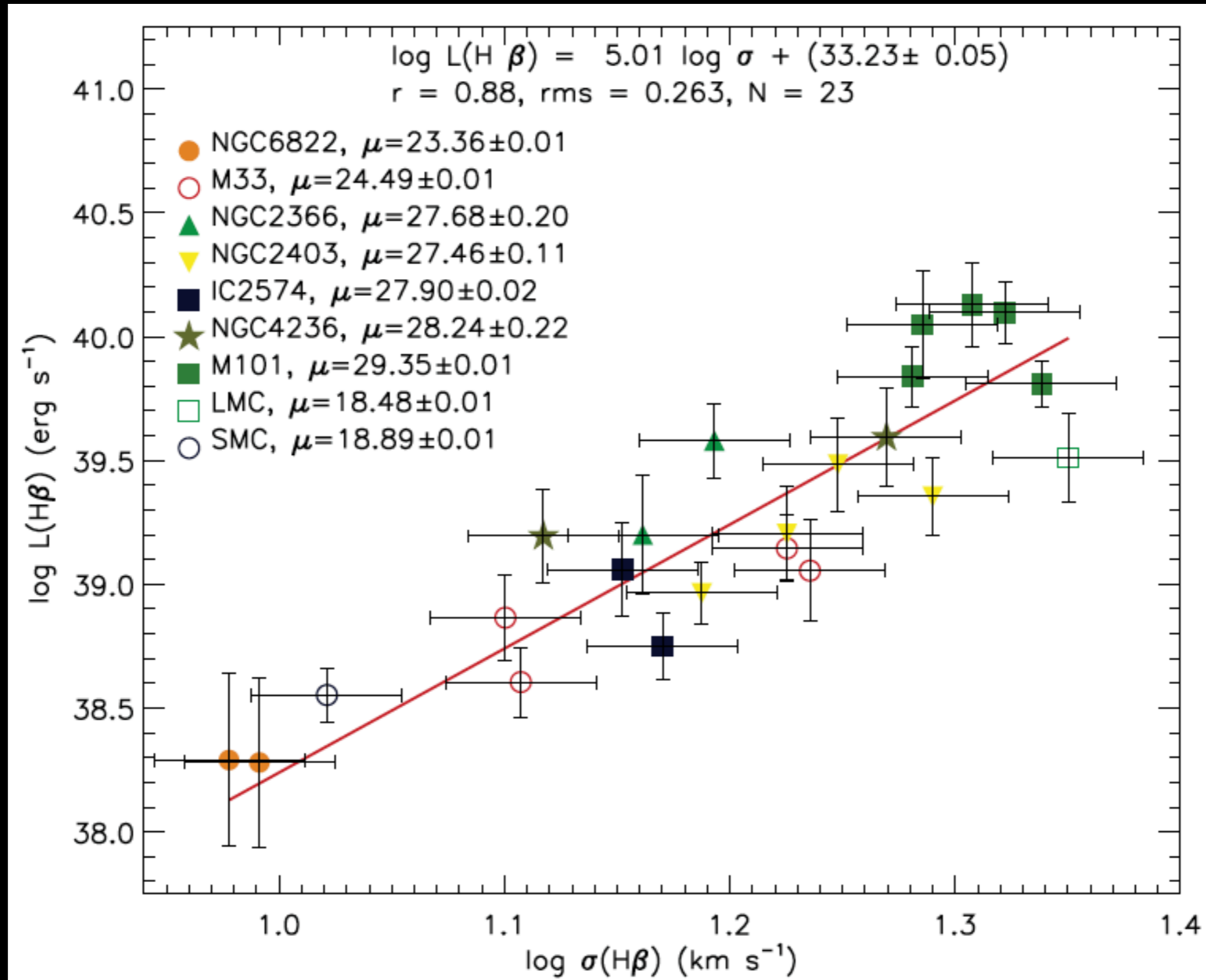


NGC 5455 @ M101



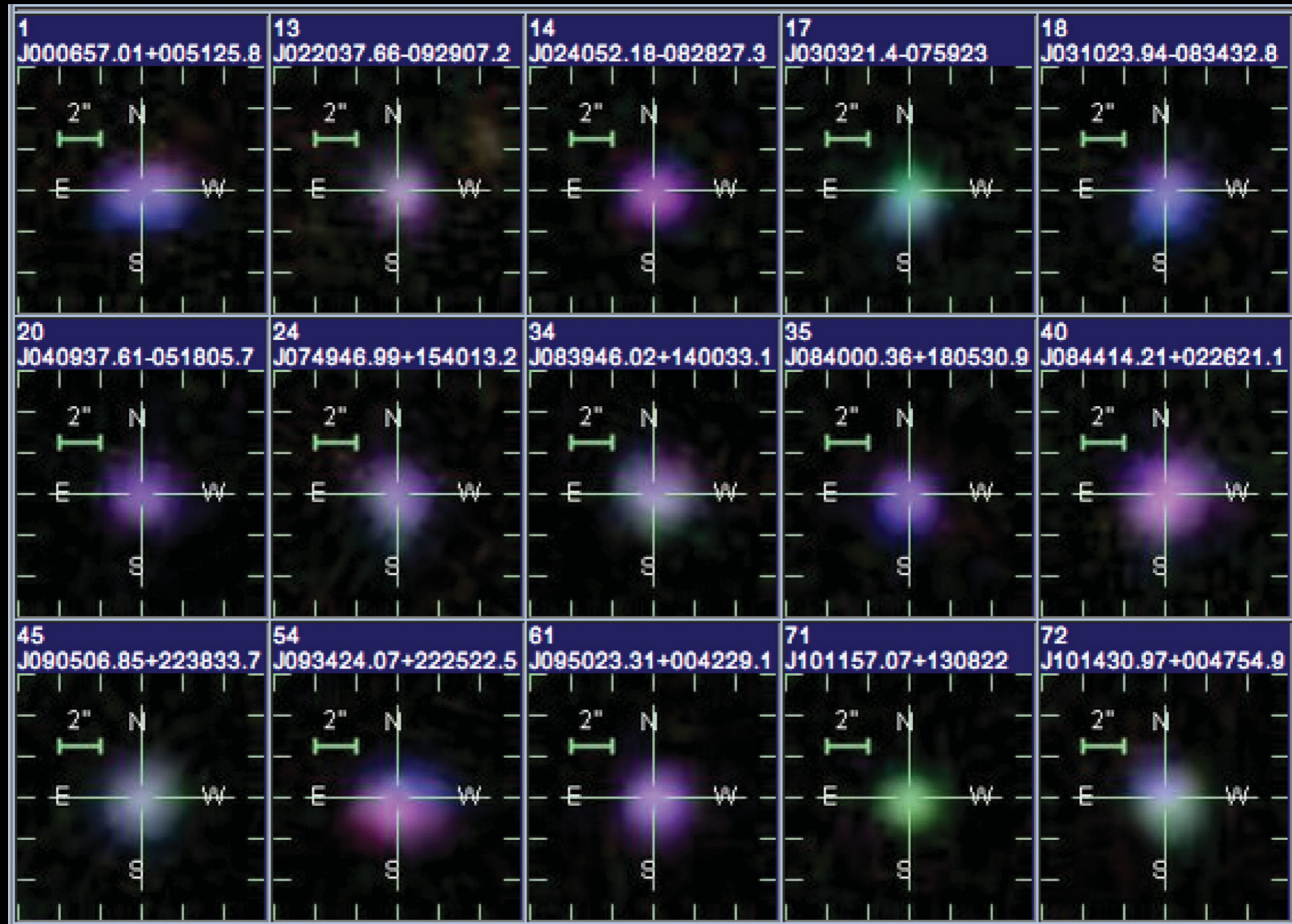
30 Dor @ LMC

The L- σ Relation of GEHR



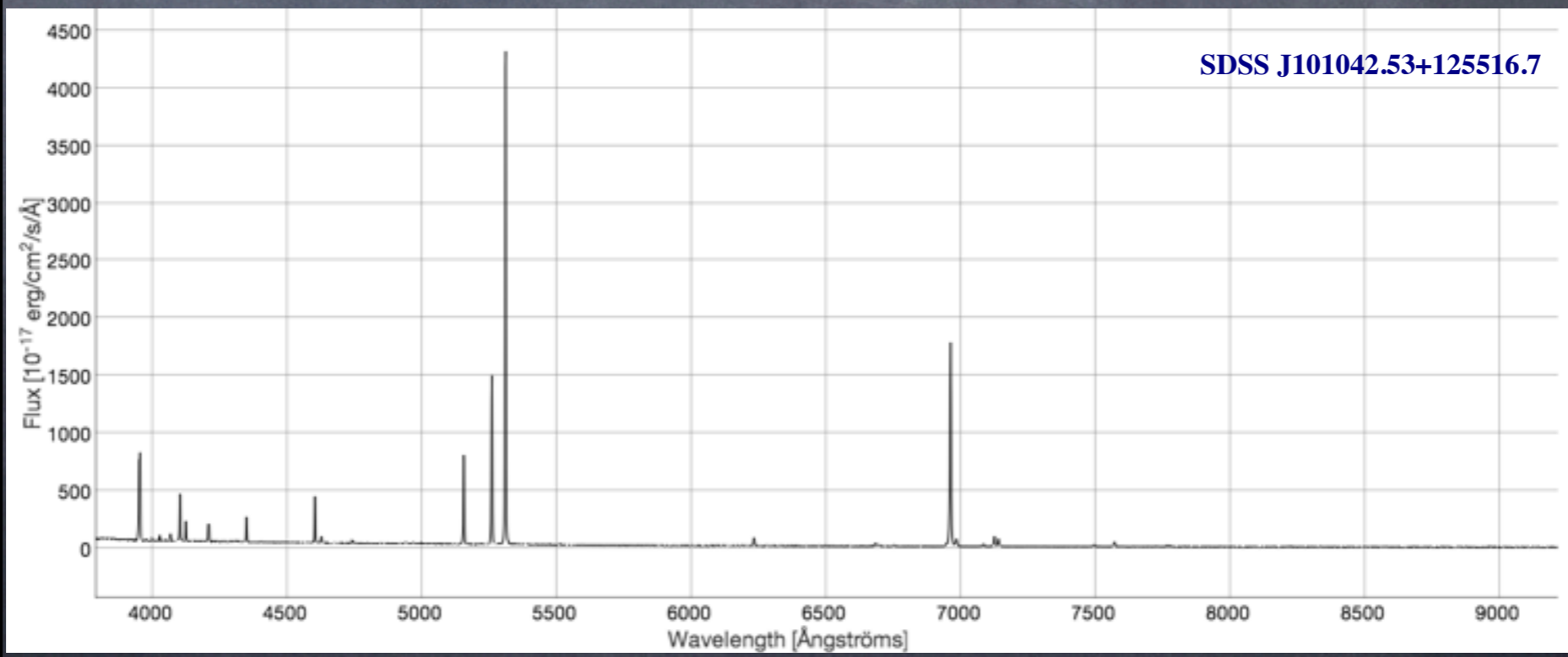
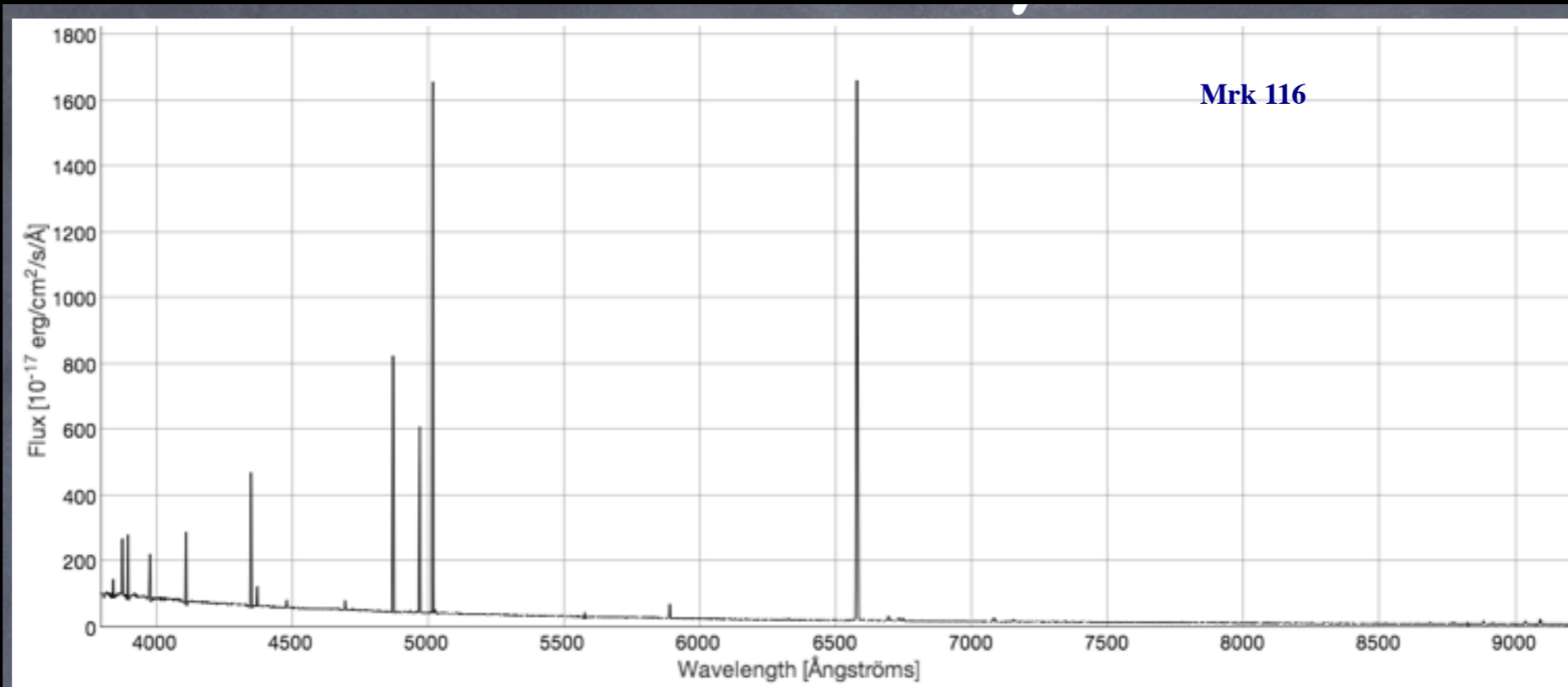
From Chávez et al. 2012

HII Galaxies

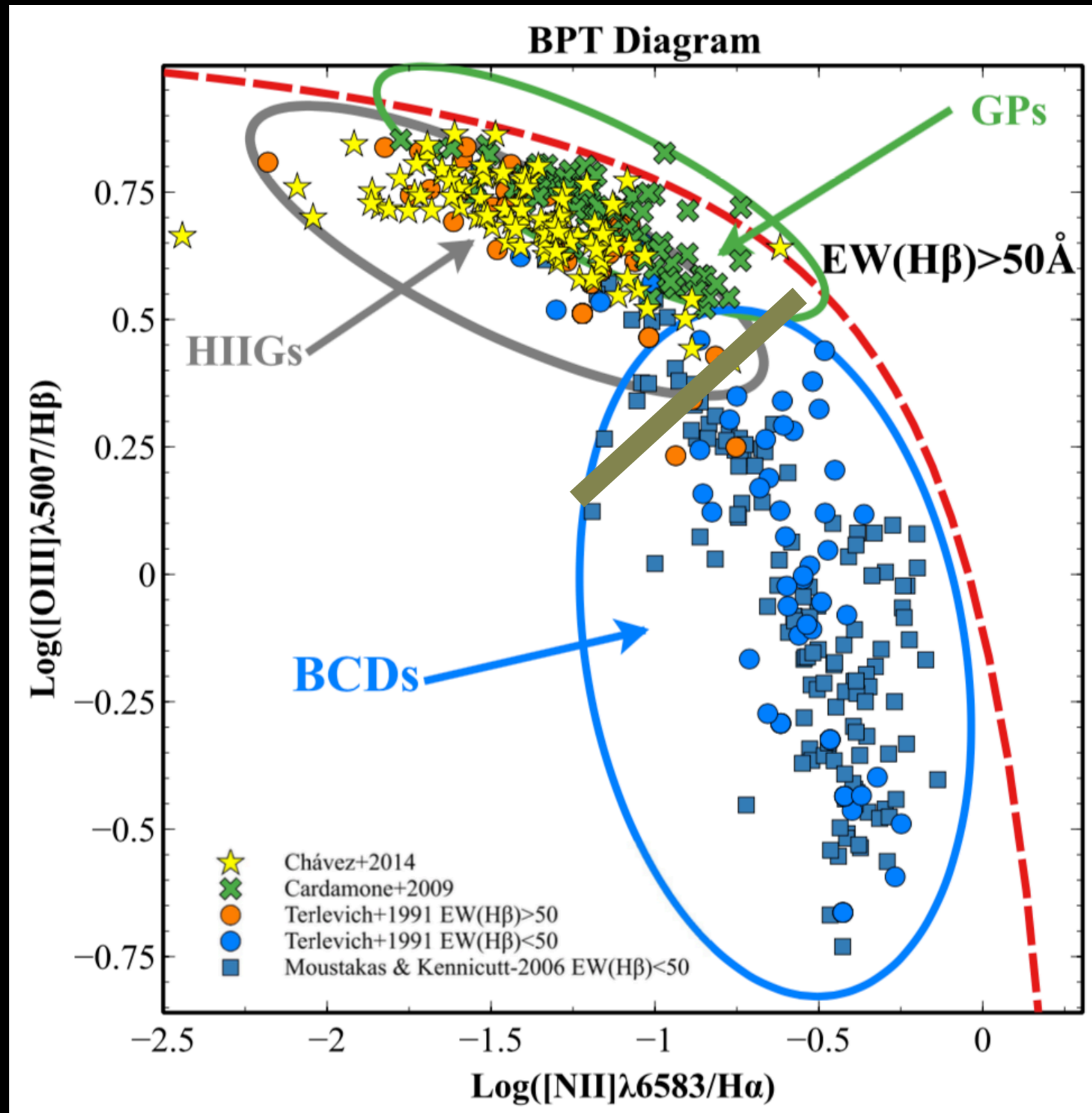


From Chávez et al. 2014

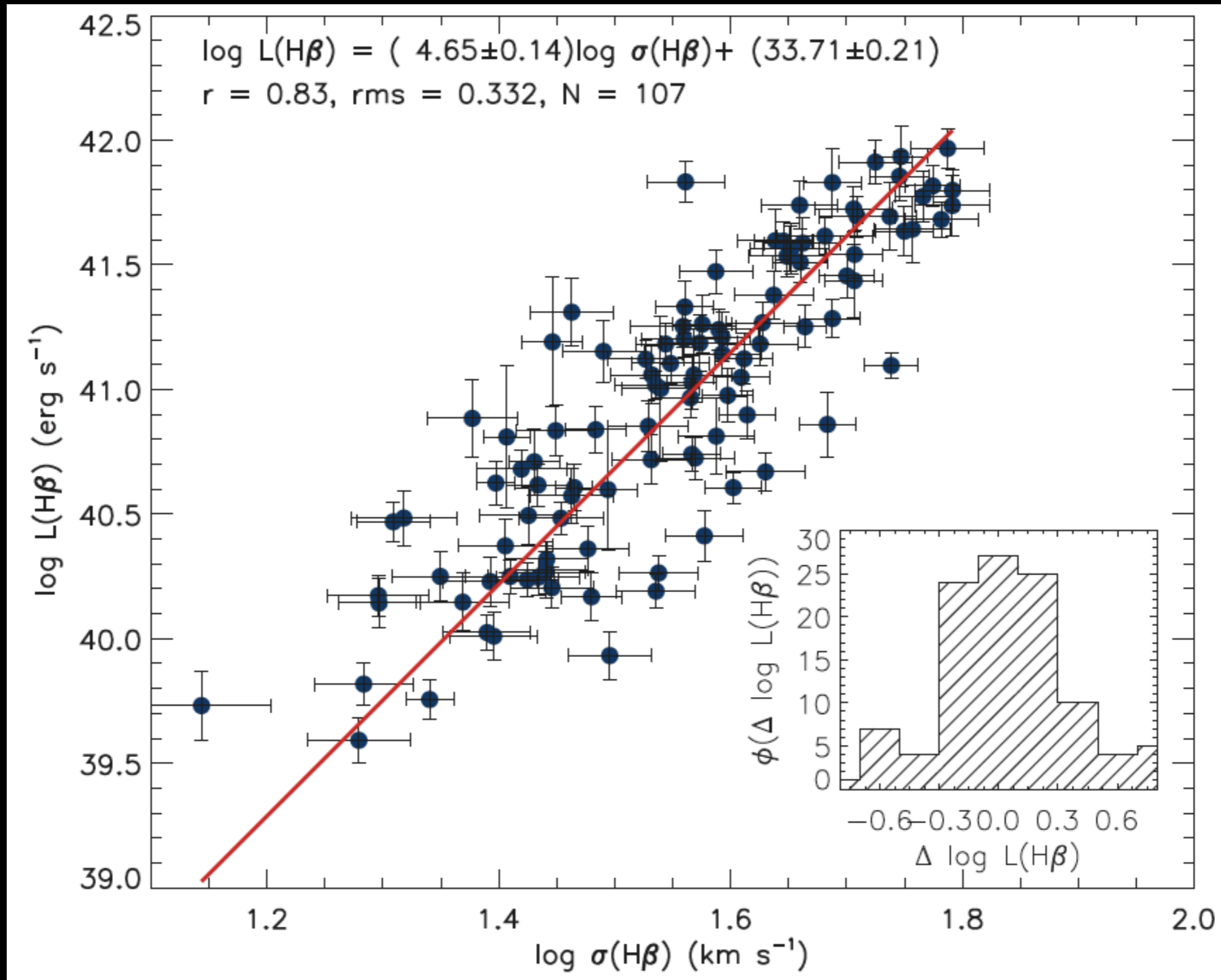
HII Galaxies: Optical Spectra



HII Galaxies Properties: BPT Diagram

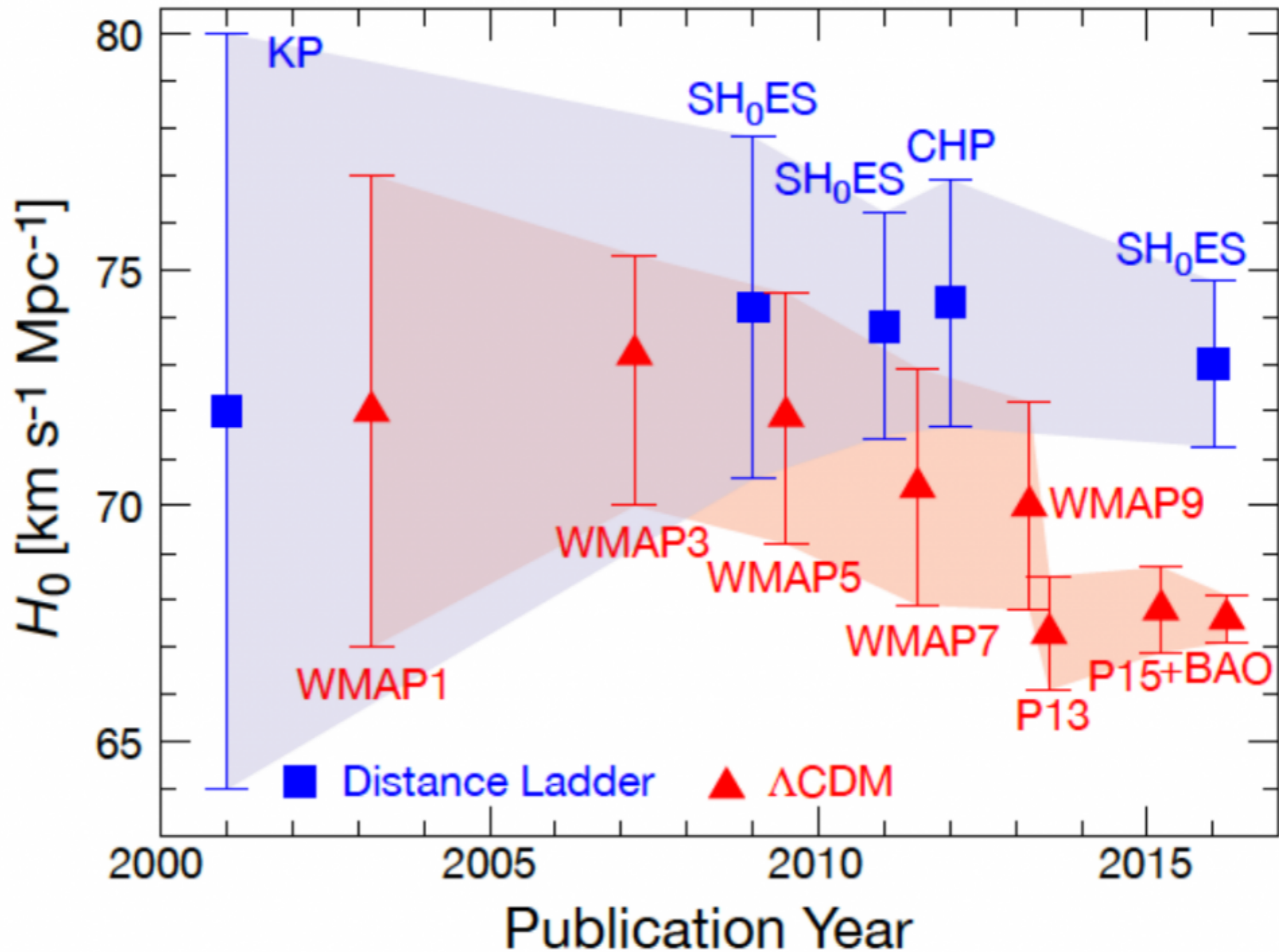


The L- σ Relation: Local HIIG

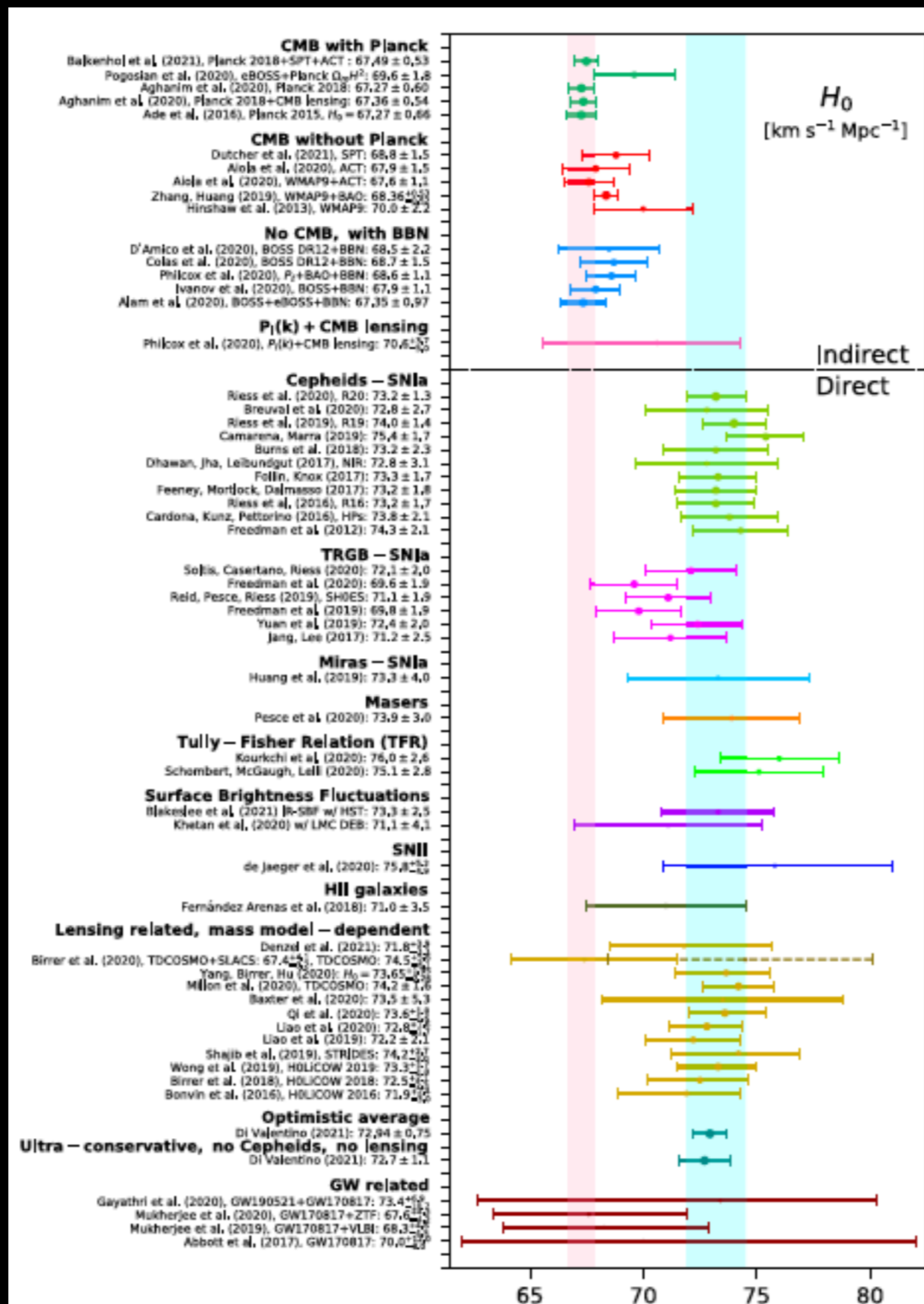


From Chávez et al. 2014

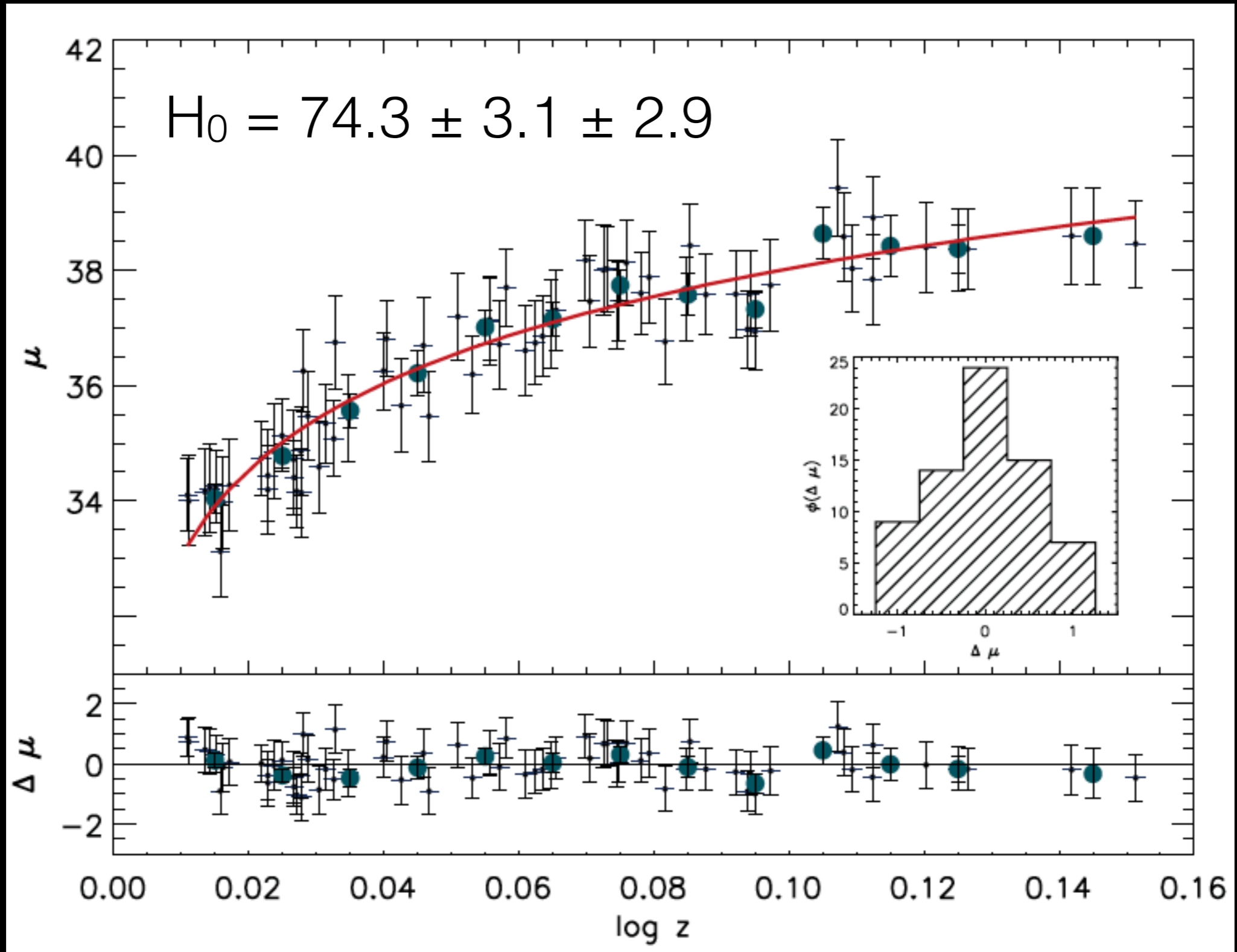
The Hubble Constant Tension



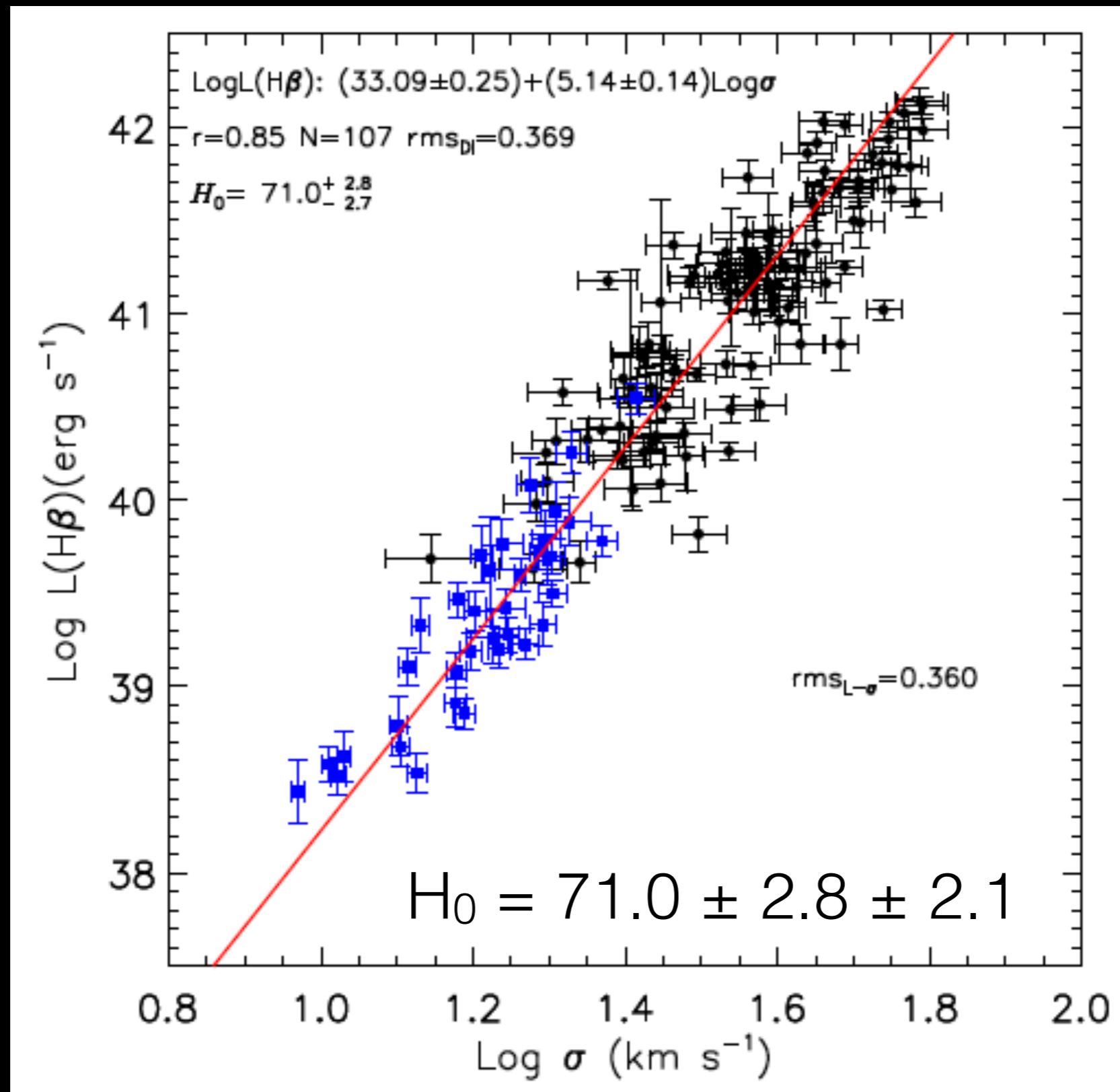
The Hubble Constant Tension



HIIG as Cosmological Probes: The Hubble Constant



HIIG as Cosmological Probes: The Hubble Constant



HIIG as Cosmological Probes: Systematics

- Size of the starburst: 0.03 mag \rightarrow 0.97 km/s/Mpc
- Age of the starburst: 0.025 mag \rightarrow 0.8 km/s/Mpc
- Spectrophotometry: 0.015 mag \rightarrow 0.48 km/s/Mpc
- Chemical abundances: 0.02 mag \rightarrow 0.6 km/s/Mpc
- Internal extinction: 0.025 mag \rightarrow 0.8 km/s/Mpc
- Total: 0.053 mag \rightarrow 1.68 km/s/Mpc

A Picture of our Universe

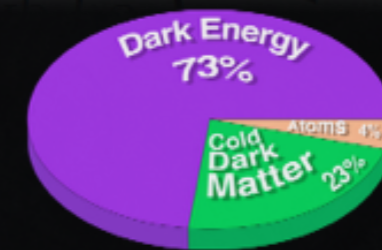
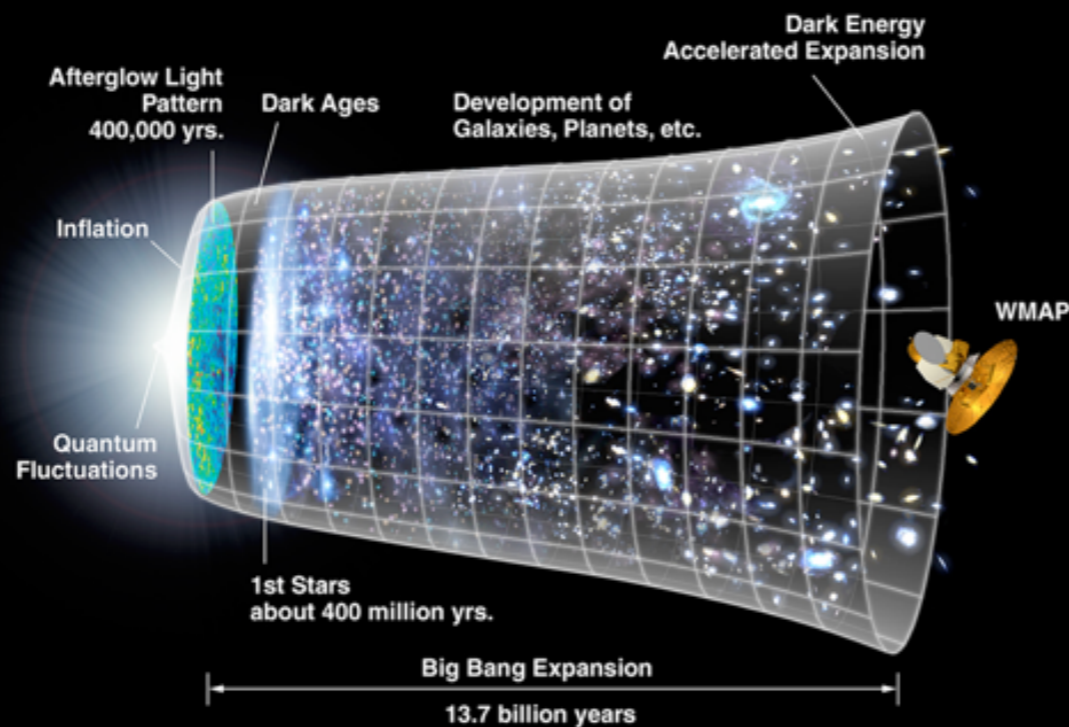
$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R + \Lambda g_{\mu\nu} = -\kappa T_{\mu\nu}$$

+

$$ds^2 = dt^2 - a^2(t) \left[\frac{dr^2}{1 - kr^2} + r^2(d\theta^2 + \sin^2\theta d\phi^2) \right]$$

↕

$$H^2(z) = H_0^2 \left[\Omega_r(1+z)^4 + \Omega_m(1+z)^3 + \Omega_k(1+z)^2 + \Omega_w \exp \left(3 \int_0^z \frac{1+w(x)}{1+x} dx \right) \right]$$



$$p_w = w(z)\rho_w$$

$$w(z) = w_0 + w_1 f(z)$$

$$f(z) = z/(1+z)$$

NASA/WMAP Science Team

Observations: High-z Sample

VLT Telescope:

2 half nights in the period 95A with KMOS

→ Visitor mode.
Lost due to rain!!!!.

16 hours in the period 97A with KMOS. Priority A, first Q

→ Service mode.
Observing period from 3/2016 to 9/2017 (extended)

39 hours in the period 98A with KMOS. Priority A, first Q

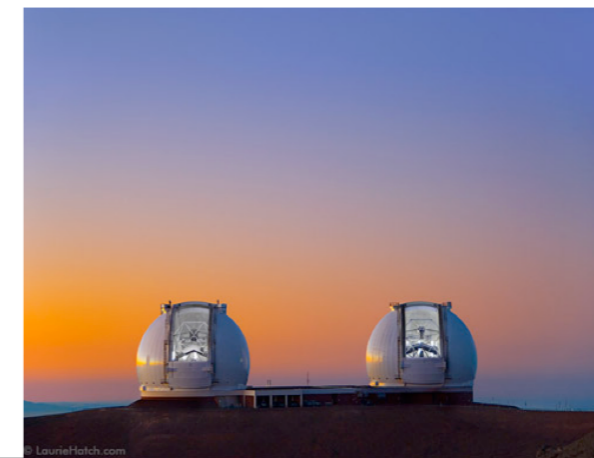
→ Service mode.
Observing period from 10/2016 to 3/2017



KECK Telescope:

1 night with MOSFIRE in January 27th, 2016.

→ Visitor mode.



Independent cosmological constraints from high- z H II galaxies: new results from VLT-KMOS data

Ana Luisa González-Morán,¹★ Ricardo Chávez^{ID},²★ Elena Terlevich,¹ Roberto Terlevich,^{1,3}
David Fernández-Arenas^{ID},⁴ Fabio Bresolin^{ID},⁵ Manolis Plionis,^{6,7} Jorge Melnick,^{8,9} Spyros Basilakos¹⁰
and Eduardo Telles⁹

¹*Instituto Nacional de Astrofísica, Óptica y Electrónica, AP 51 y 216, 72000, Puebla, México*

²*CONACYT-Instituto de Radioastronomía y Astrofísica, UNAM, Campus Morelia, C.P. 58089, Morelia, México*

³*Institute of Astronomy, University of Cambridge, Cambridge CB3 0HA, UK*

⁴*Kavli Institute for Astronomy and Astrophysics, Peking University, Beijing 100871, China*

⁵*Institute for Astronomy, University of Hawaii, 2680 Woodlawn Drive, Honolulu, HI 96822, USA*

⁶*National Observatory of Athens, P. Pendeli, 15236 Athens, Greece*

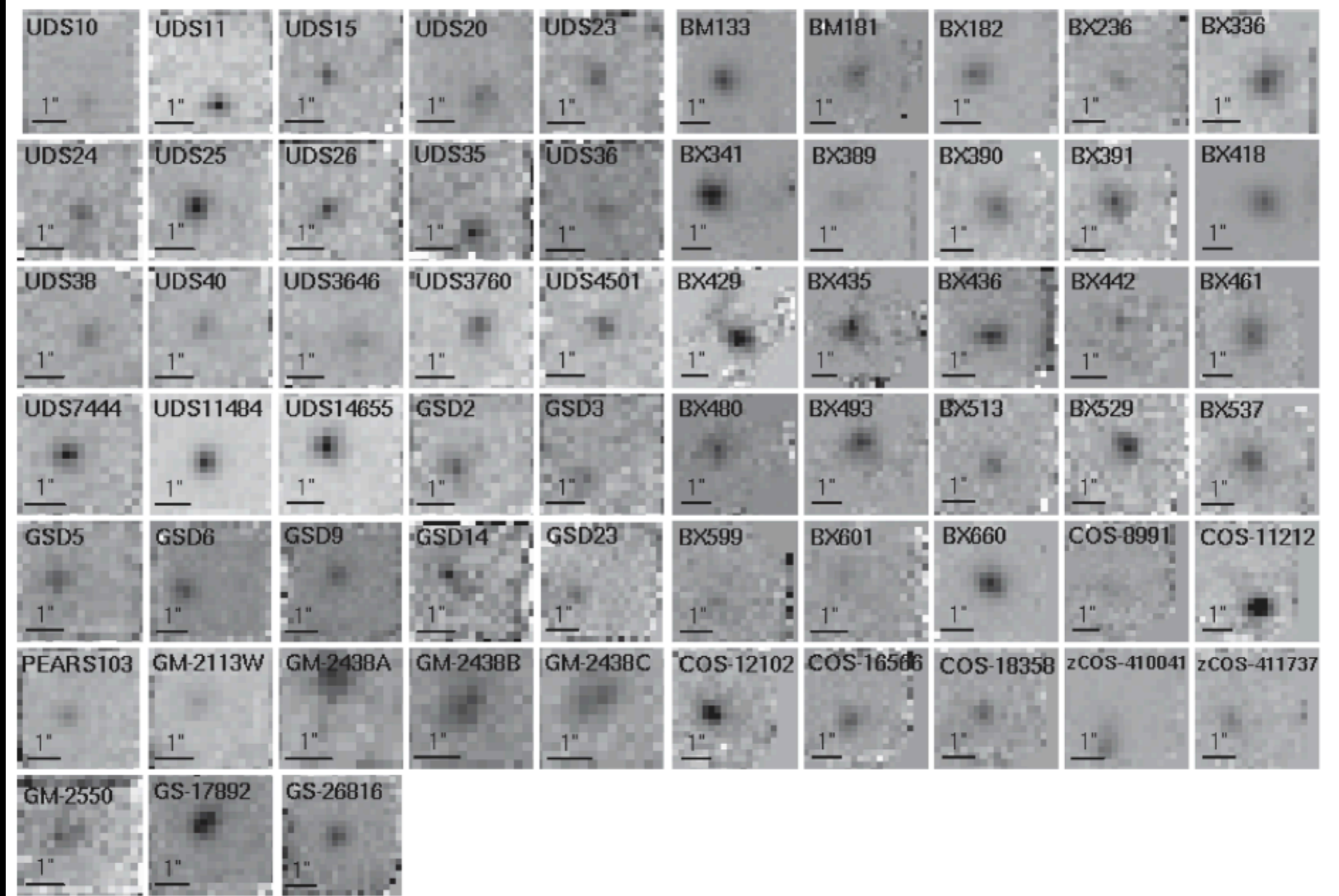
⁷*Physics Department, Aristotle University of Thessaloniki, Thessaloniki 54124, Greece*

⁸*European Southern Observatory, Av. Alonso de Cordova 3107, Santiago de Chile, Chile*

⁹*Observatorio Nacional, Rua José Cristino 77, 20921-400 Rio de Janeiro, Brasil*

¹⁰*Academy of Athens Research Center for Astronomy & Applied Mathematics, Soranou Efessiou 4, 11-527 Athens, Greece*

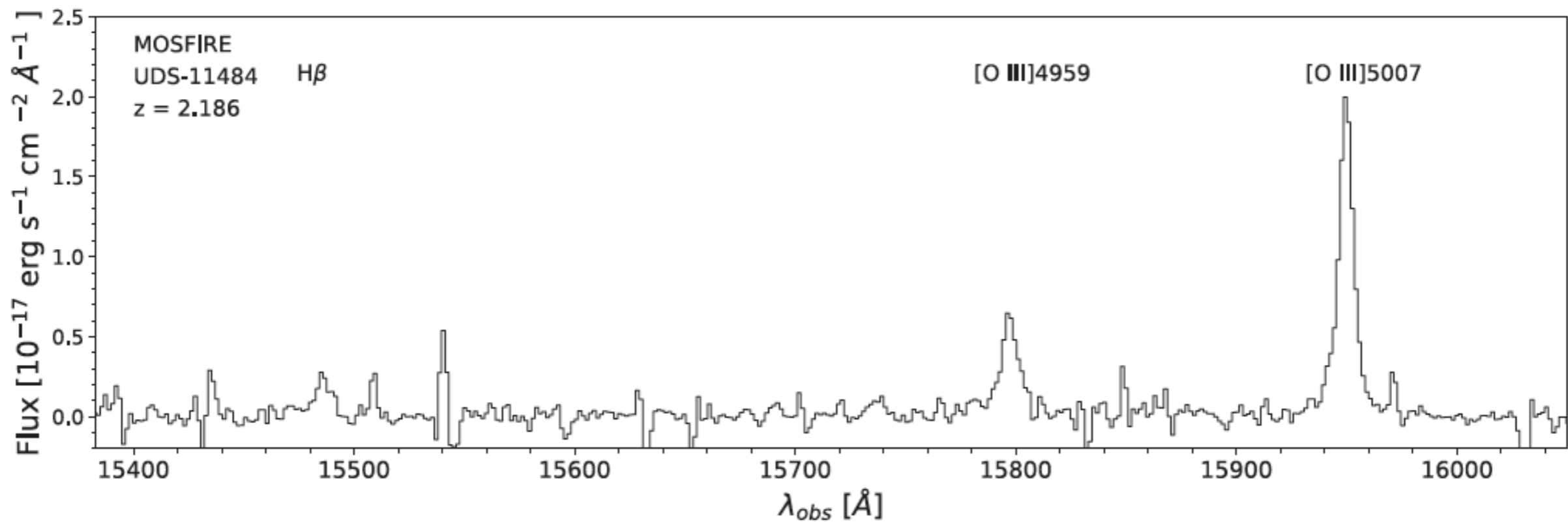
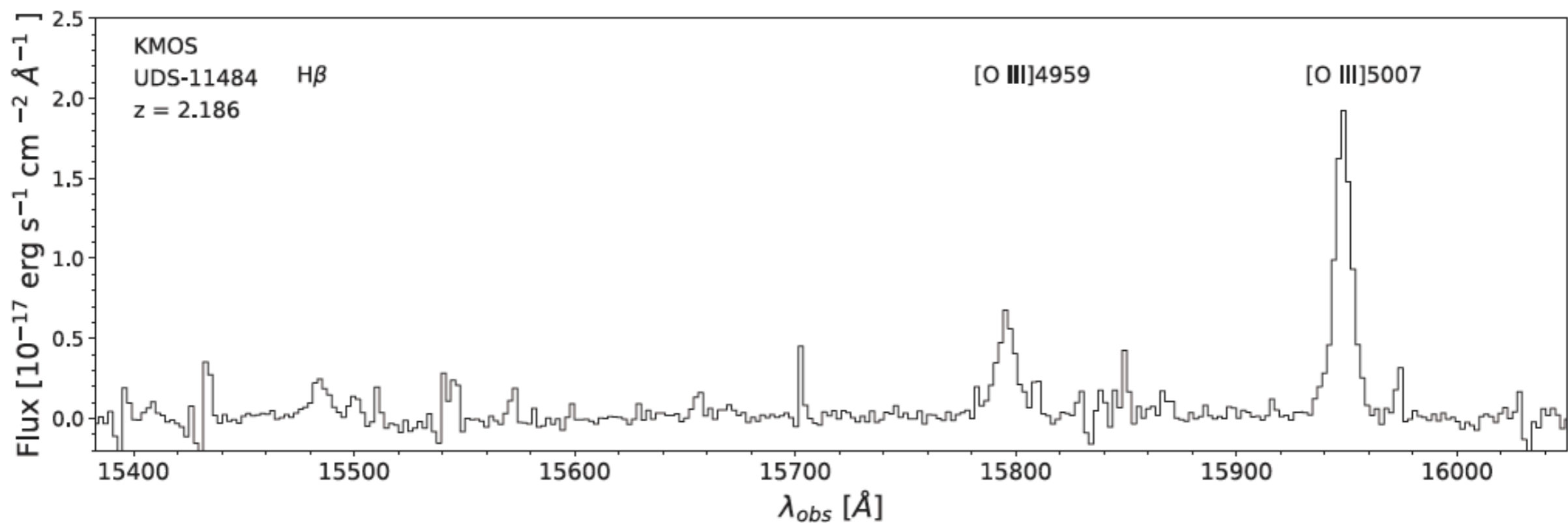
The VLT-KMOS sample



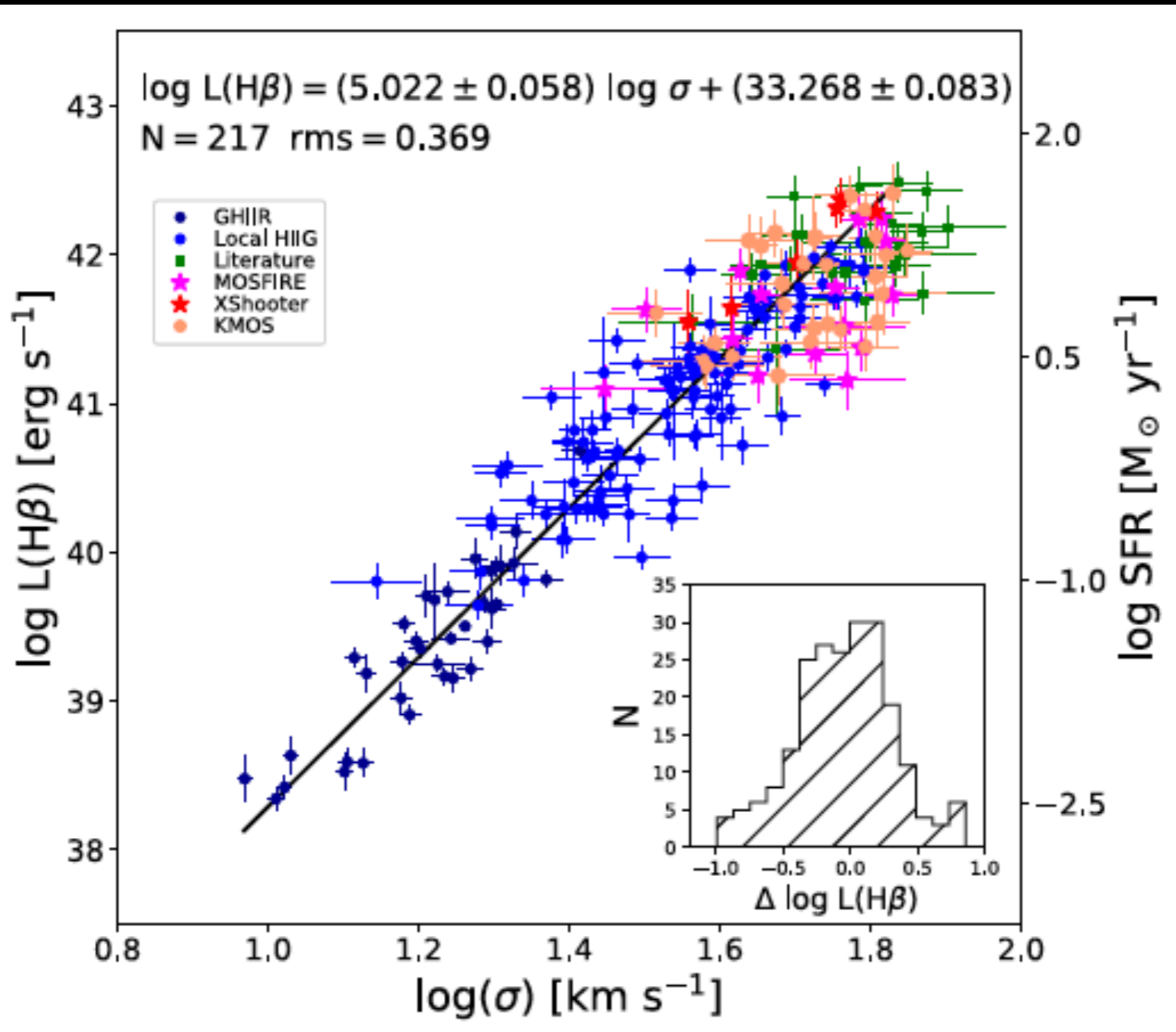
(a) UDS and GOODS-S fields

(b) Q2343 and COSMOS fields

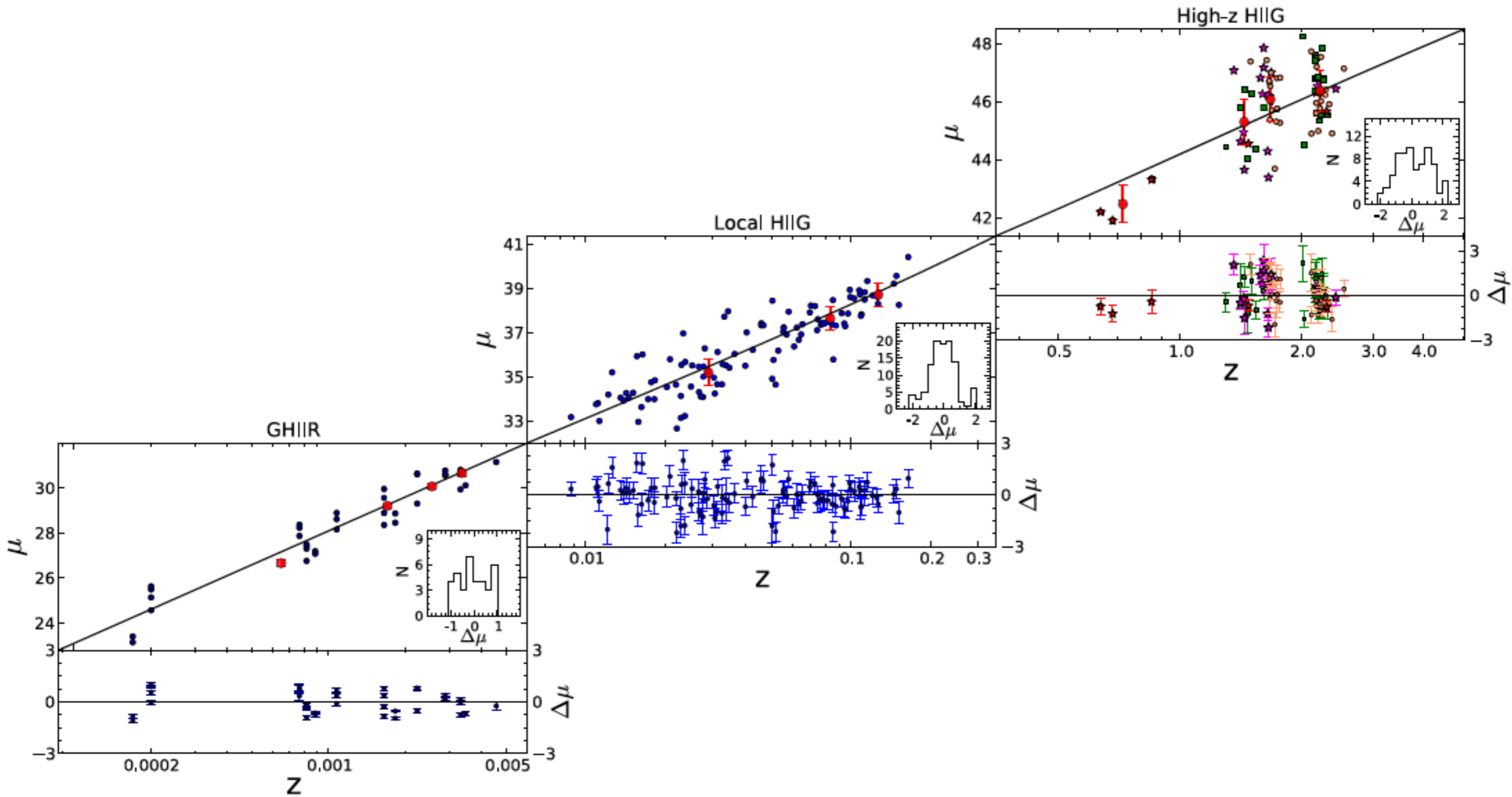
The data



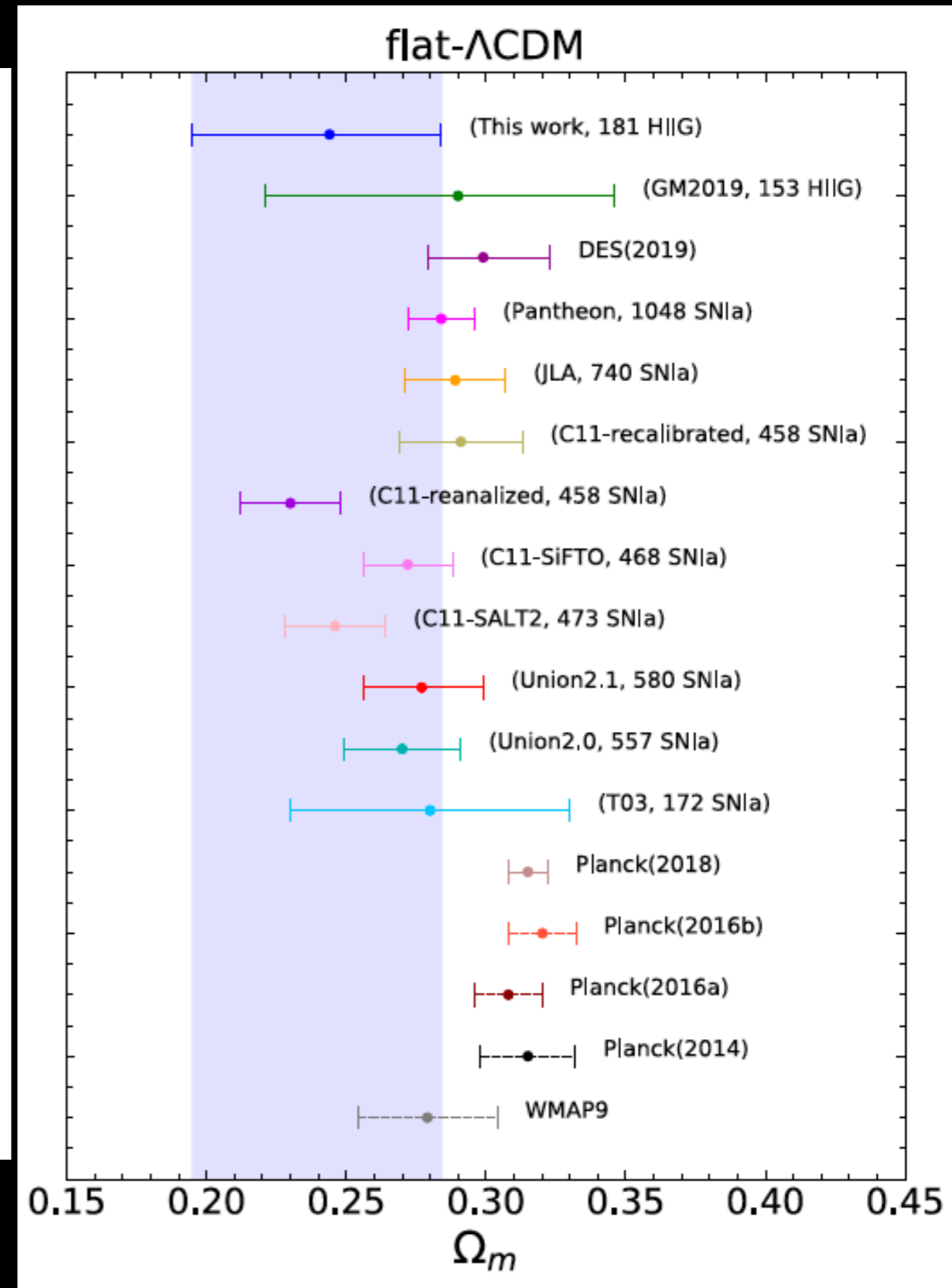
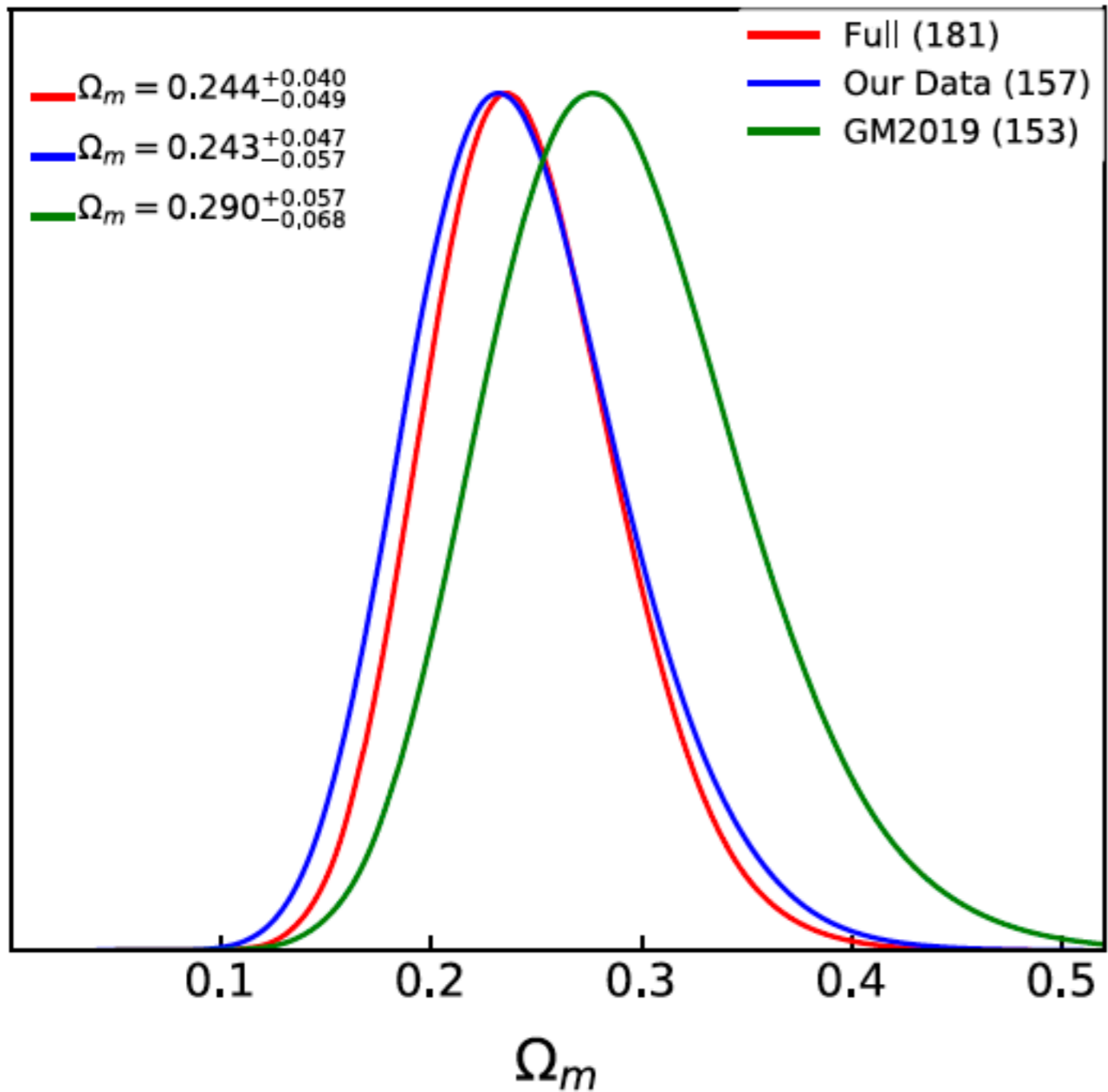
The L- σ Relation



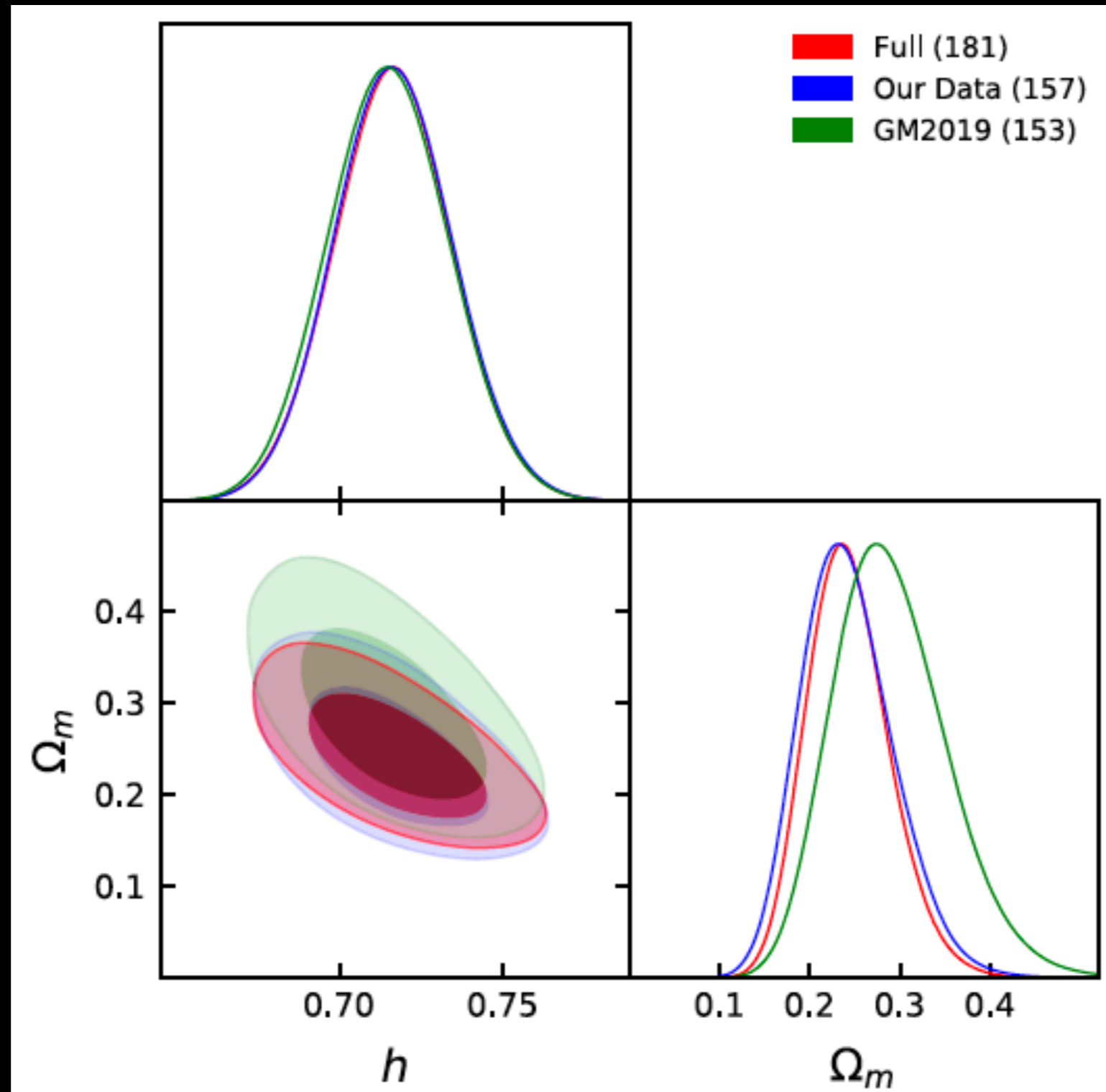
The Hubble diagram



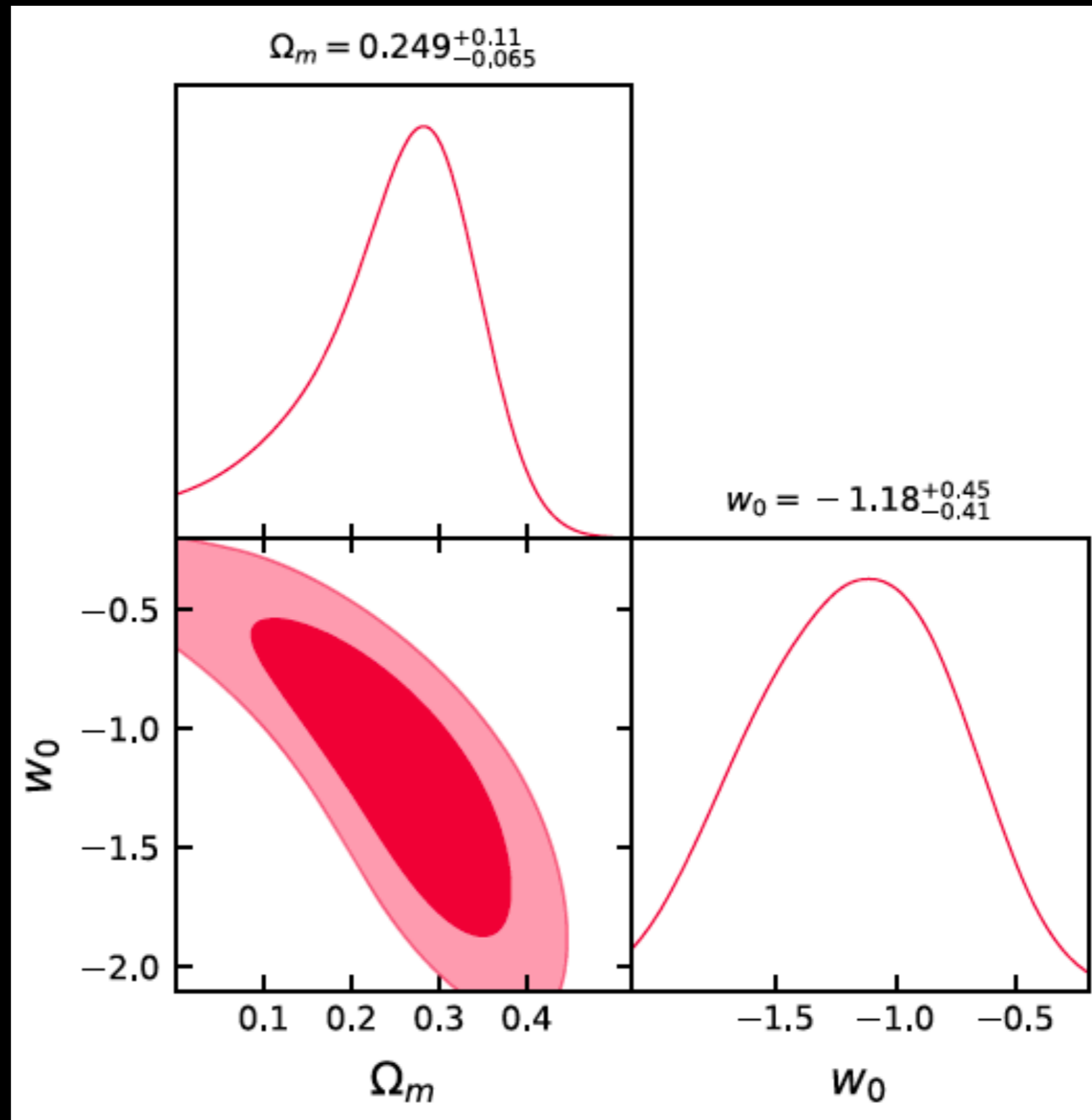
Cosmological Constraints



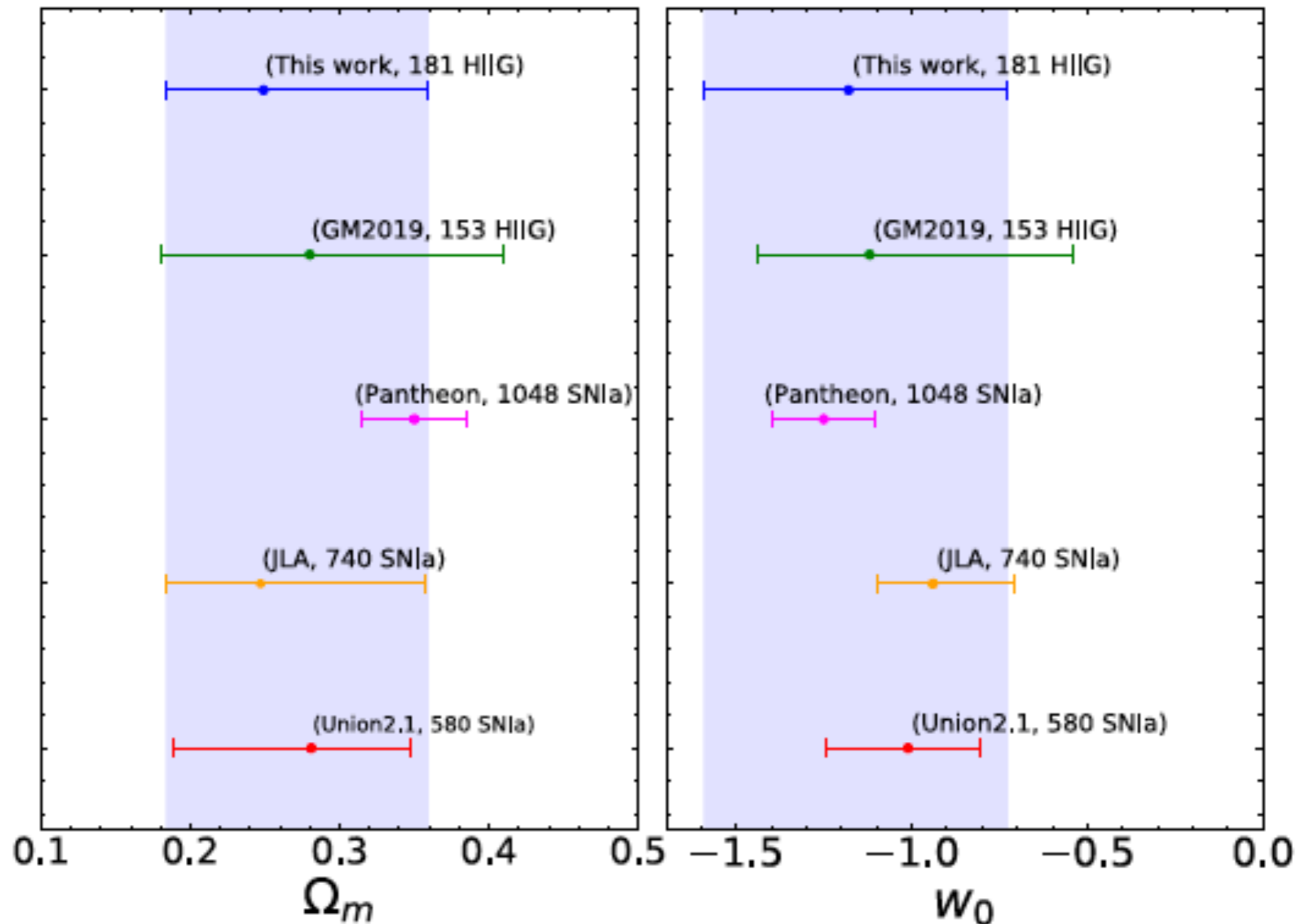
Cosmological Constraints



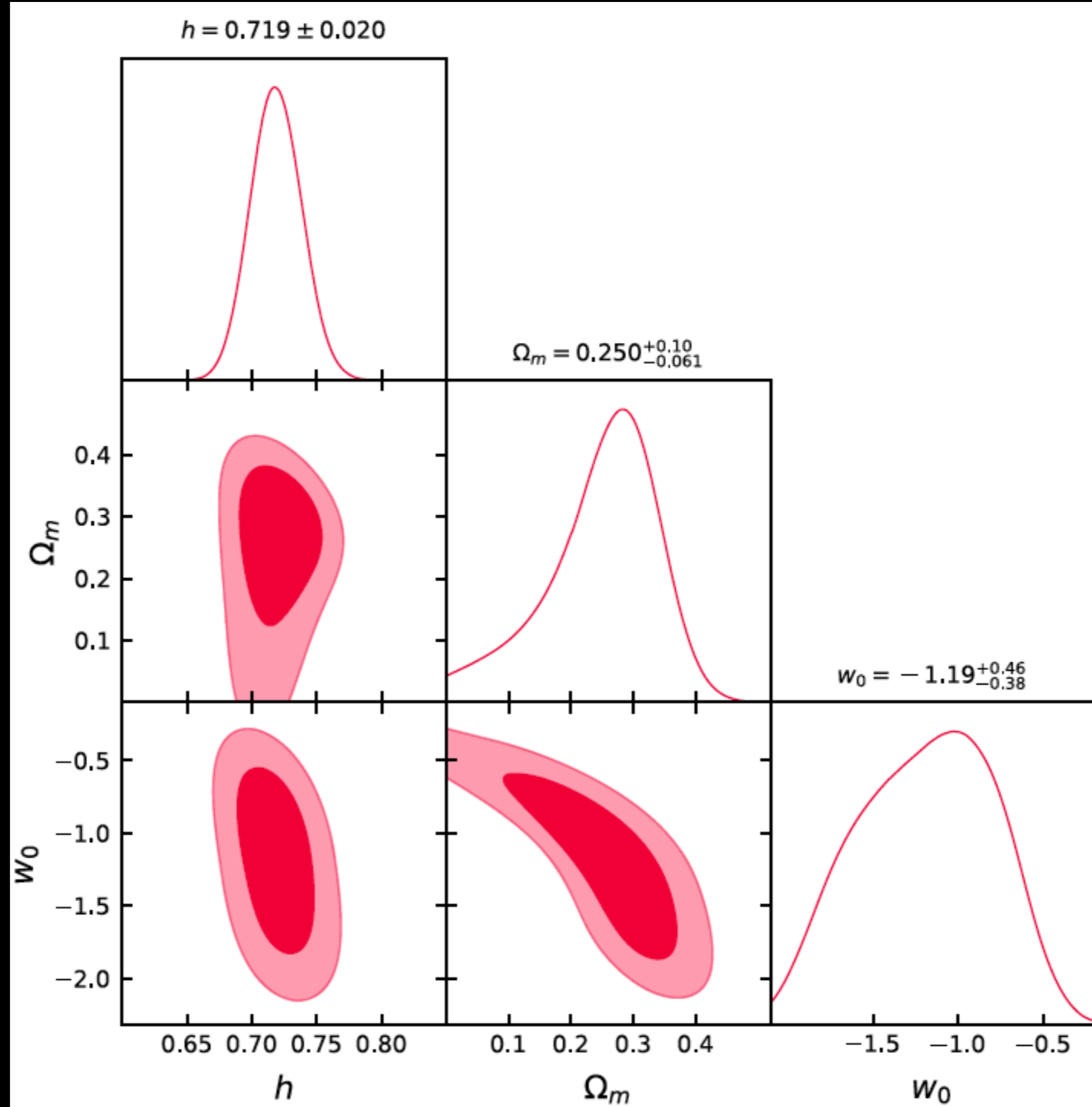
Cosmological Constraints



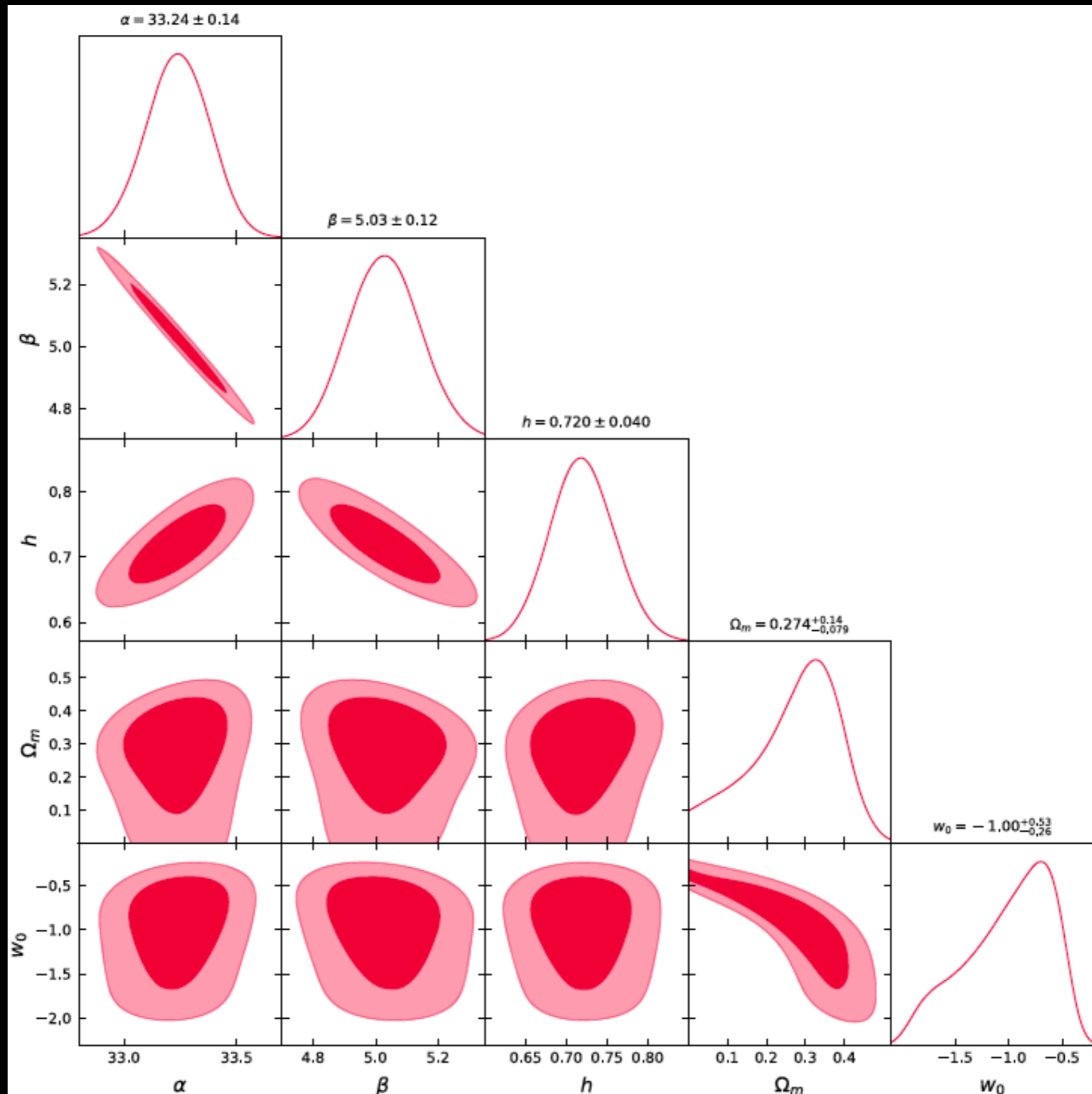
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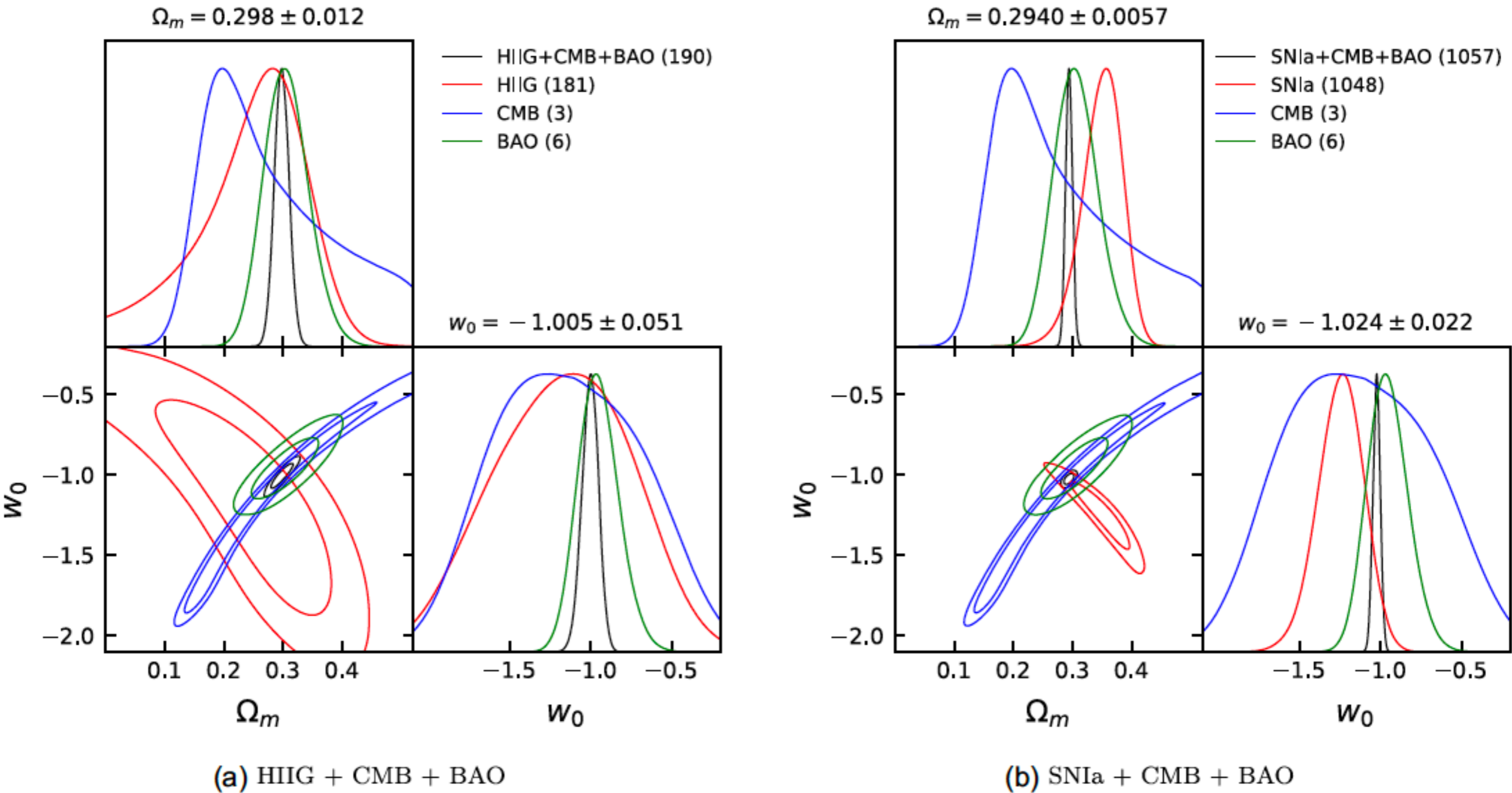
Cosmological Constraints



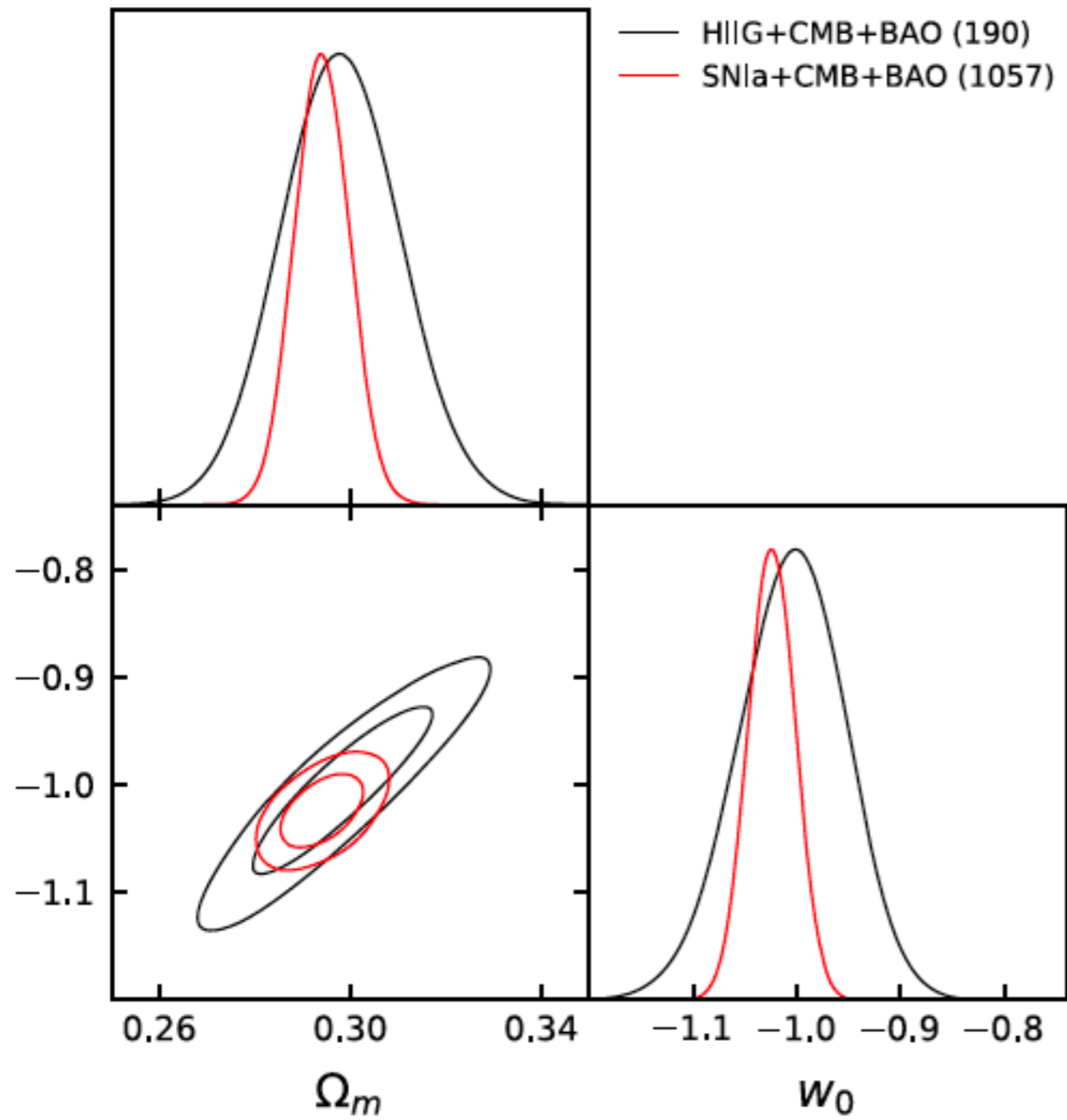
Cosmological Constraints



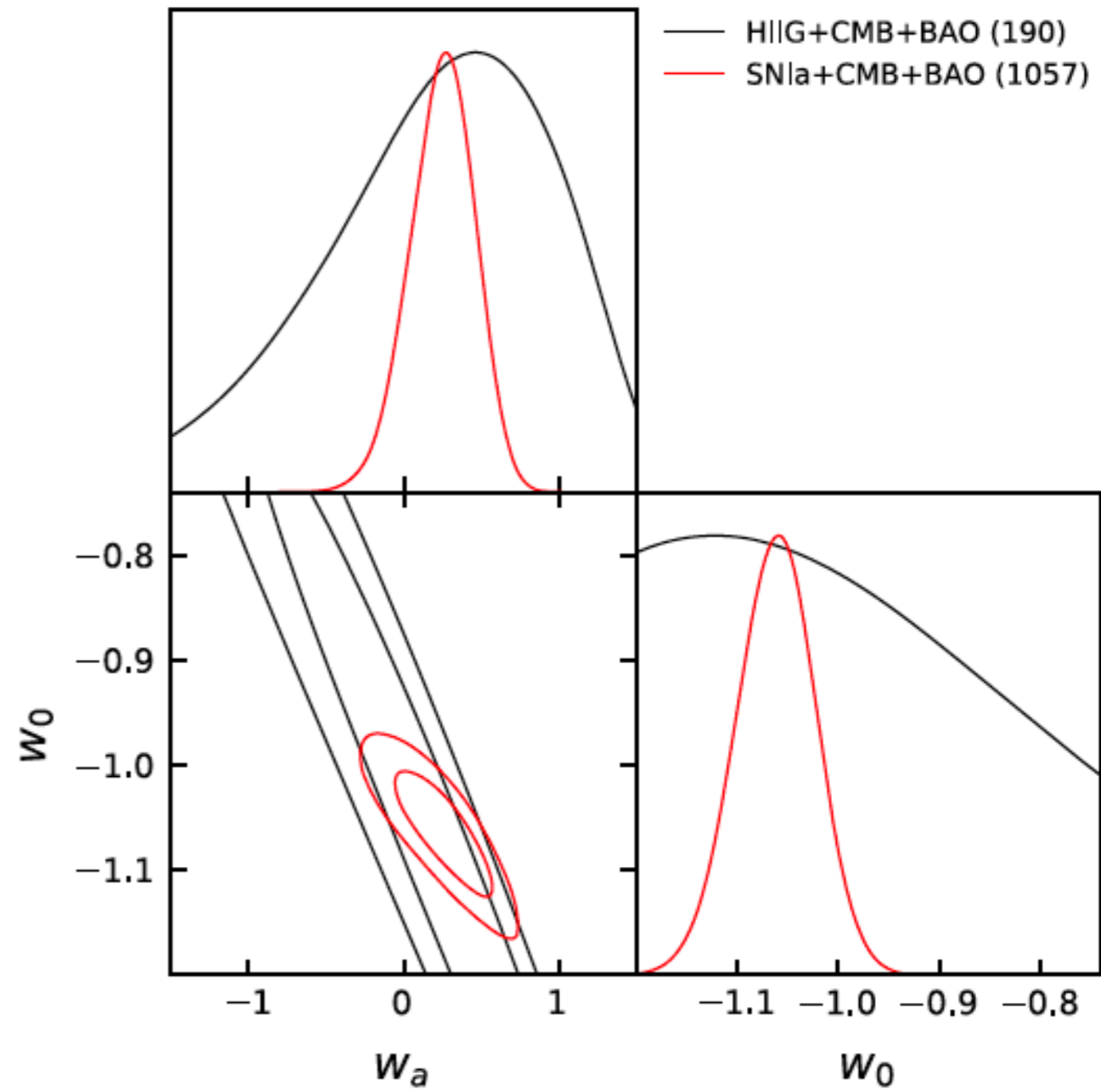
Cosmological Constraints



Cosmological Constraints

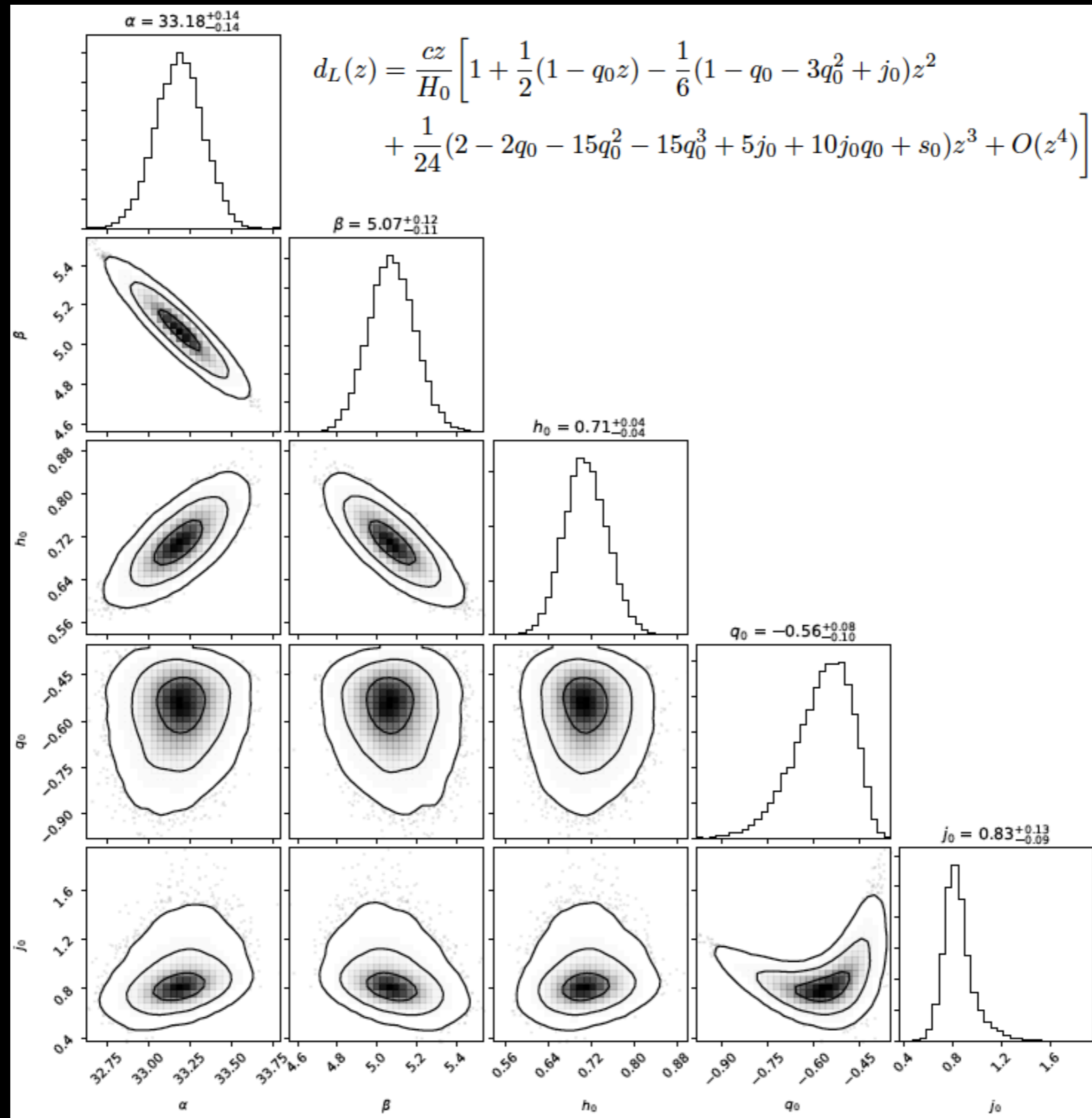


(a) wCDM

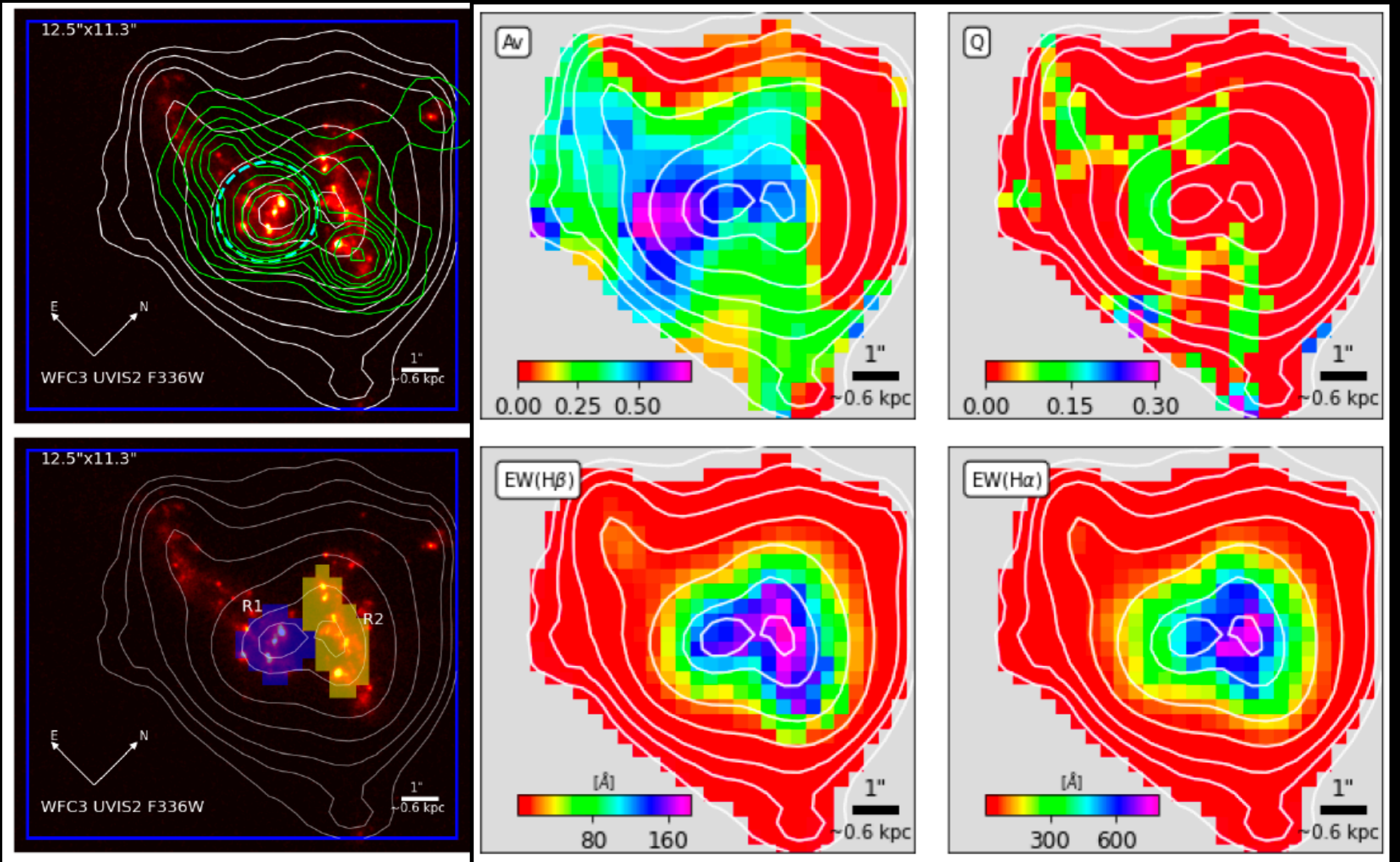


(b) CPL

Cosmography with HII Galaxies

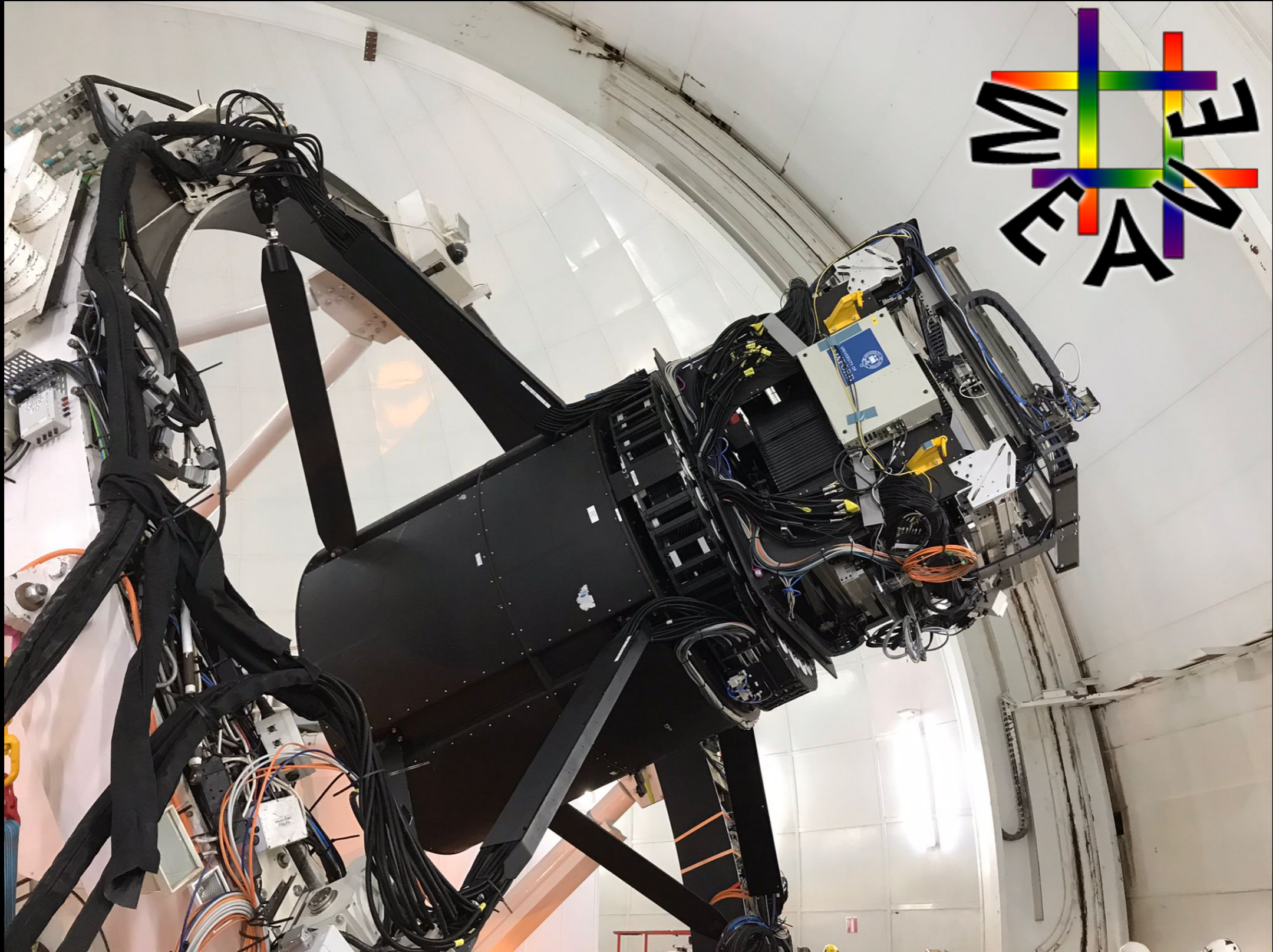


J084220 with Megara



From Fernández-Arenas et al. 2022, submitted

Future Work



Concluding Remarks

- GEHR and HIIG are ideal laboratories to understand the feedback of star formation (SF) on the dynamics and energetics of the interstellar medium (ISM).
- We present constraints to H_0 from a local sample of HII Galaxies.
- We present constraints to the parameter of the DE EoS from a sample of HII galaxies from the local Universe and up to redshift 2.5. Our constraints agree well with the results from other well developed methodologies.

References

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