Mullard Space science Laboratory
Department of Space & Climate Physics

# UV LF at $z \leq 1$, from XMM-OM and Swift-UVOT

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Mullard Space Science Laboratory,
University College London

and
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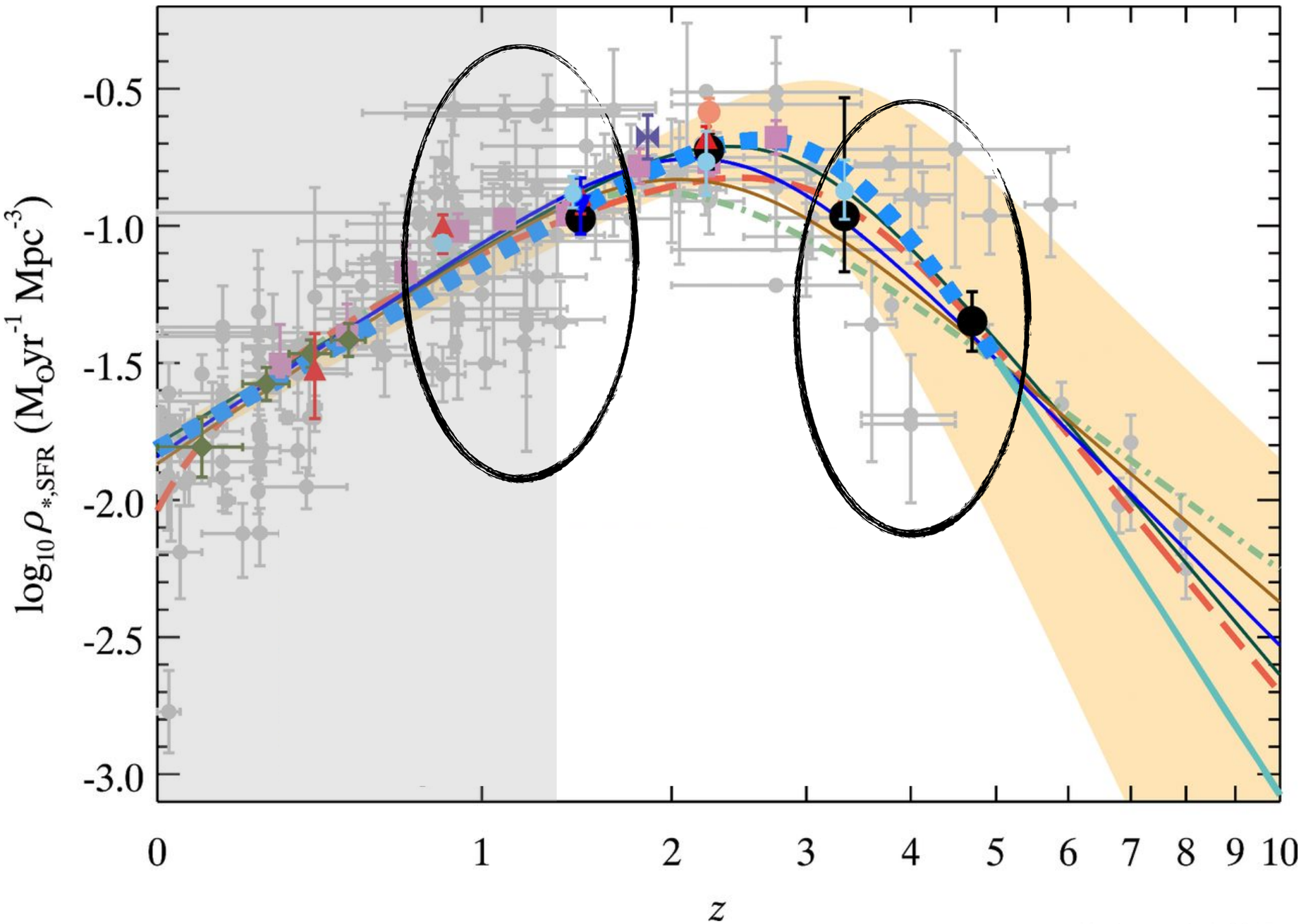
& Ignacio Ferreras @ IAC

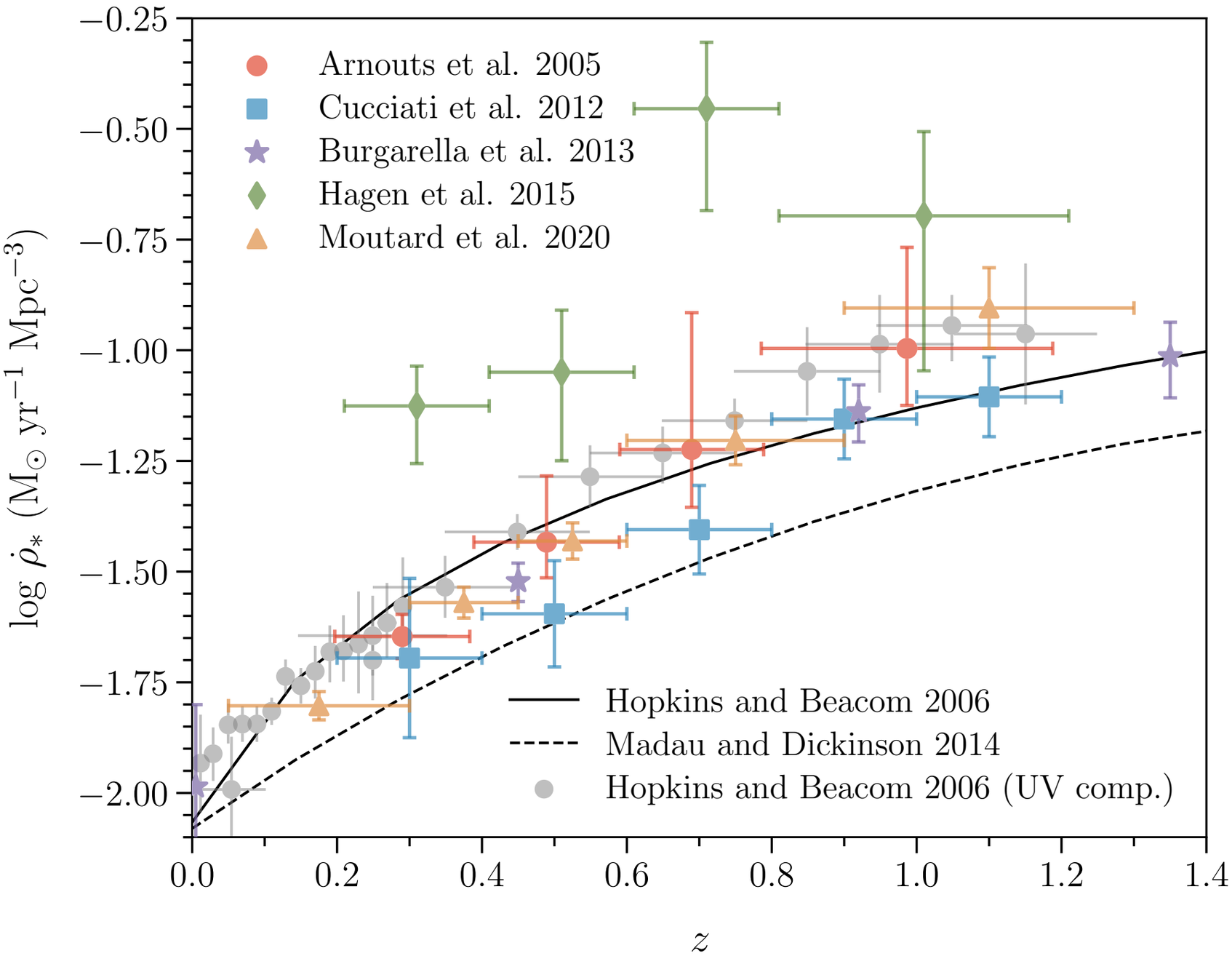
NUVA
e-meeting

# Context

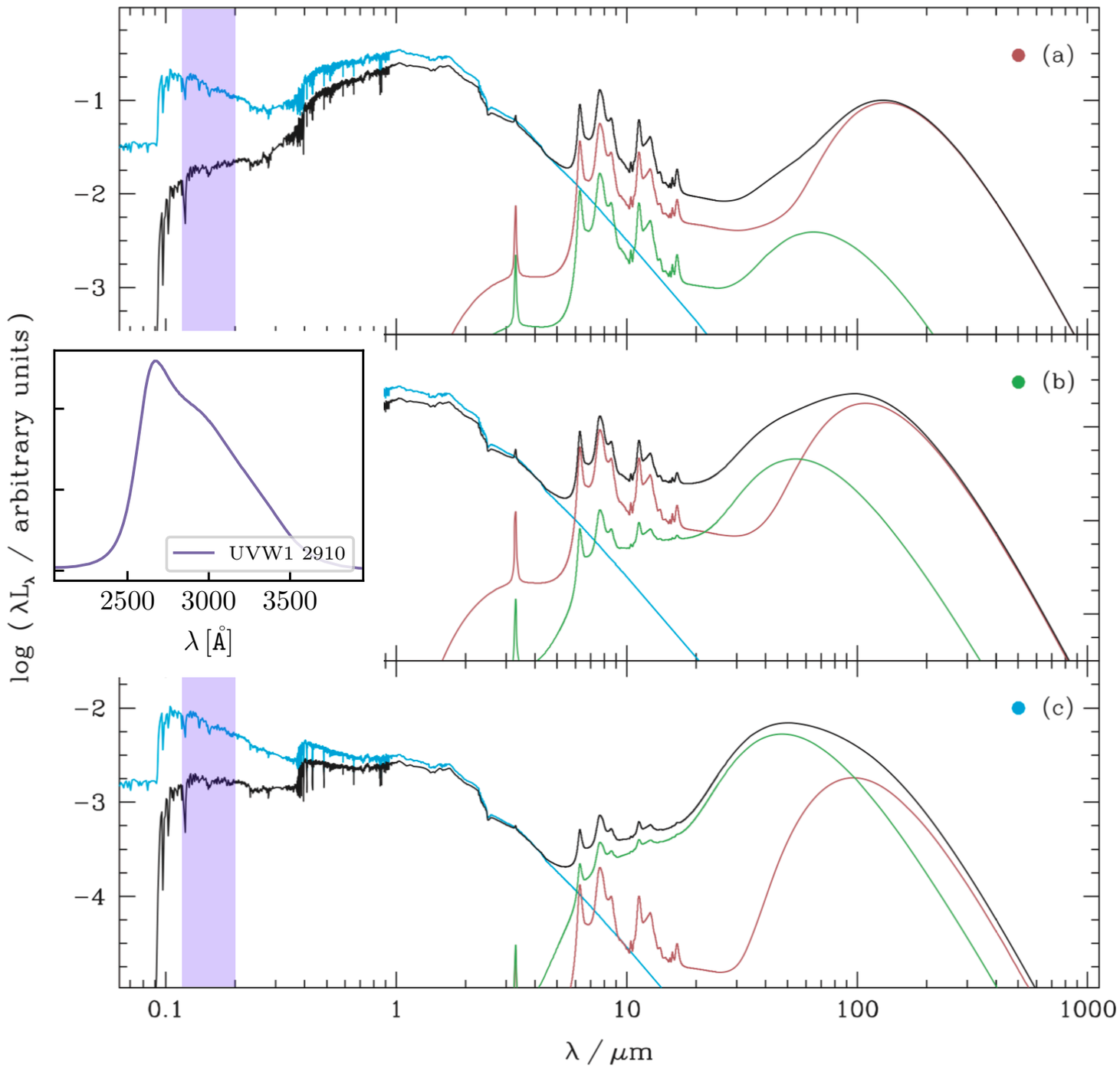



Kostovan et al. 2015

# SFRD

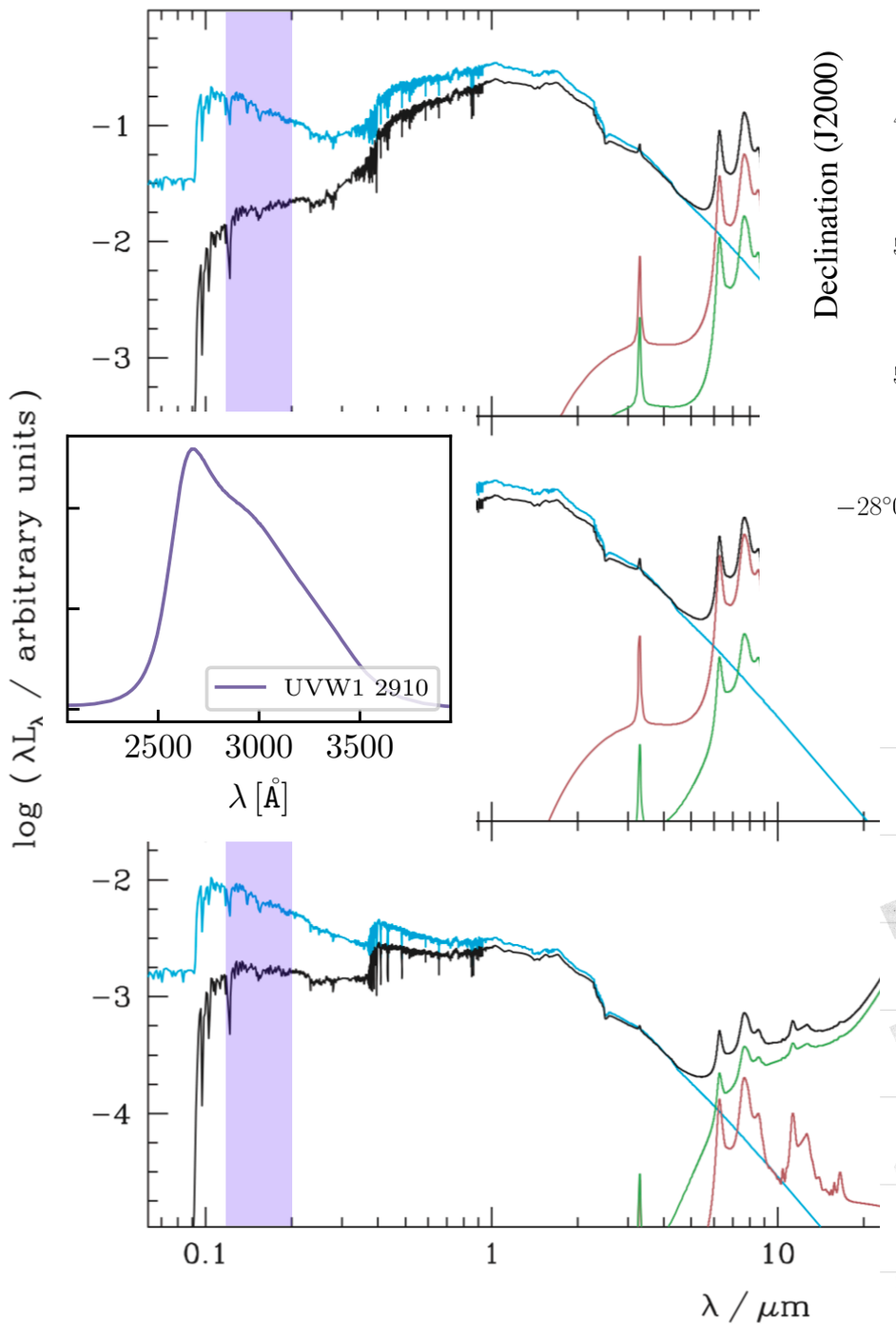

Arnouts et al. 2005
Cucciati et al. 2012
Burgarella et al. 2013
Hagen et al. 2015
Moutard et al. 2020
Hopkins and Beacom 2006
Madau and Dickinson 2014
Hopkins and Beacom 2006 (UV comp.)
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

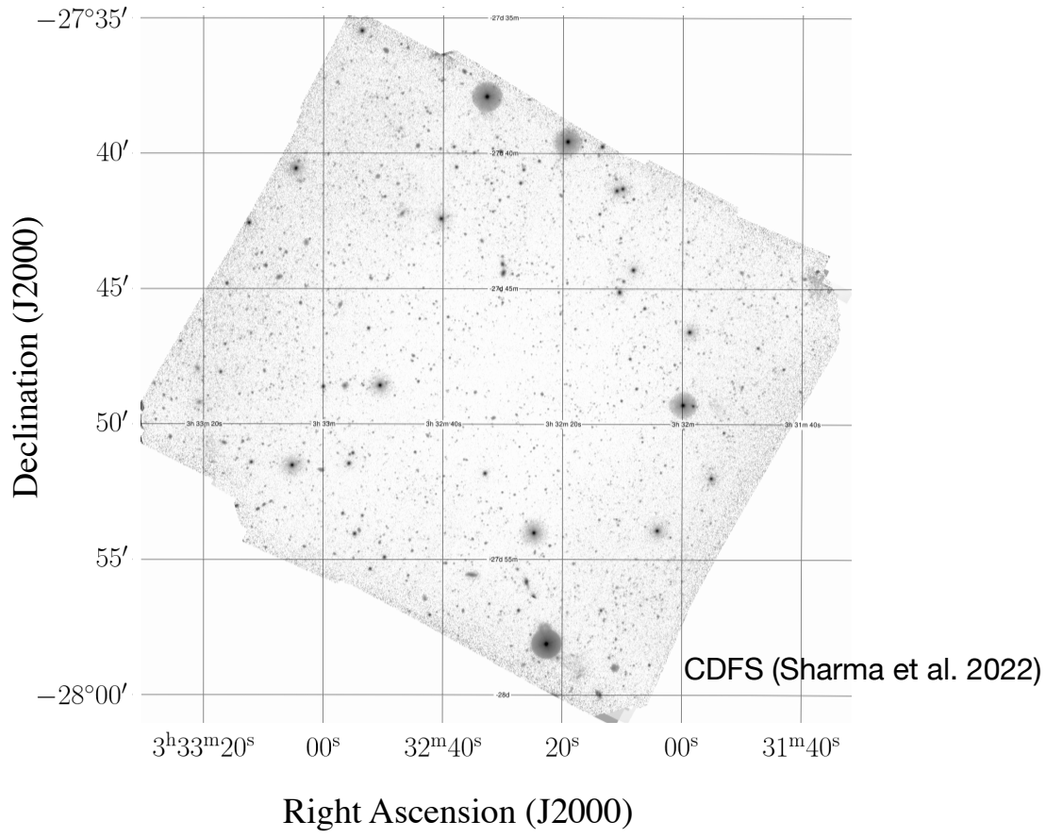
# XMM-OM UVW1



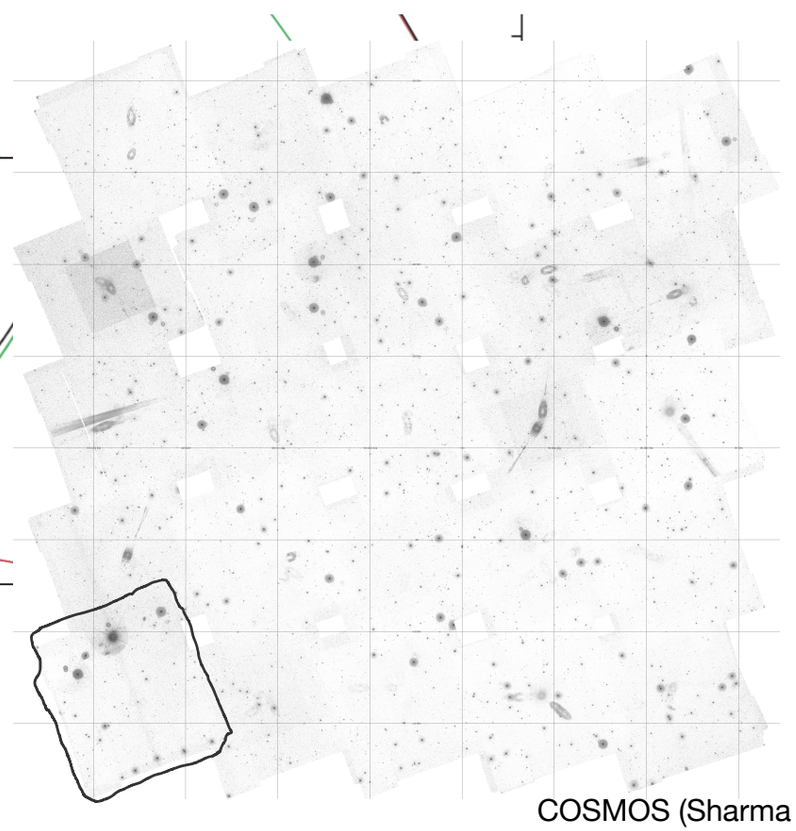

da Cunha et al. 2008

# UV Selection




CDFS (Sharma et al. 2022)



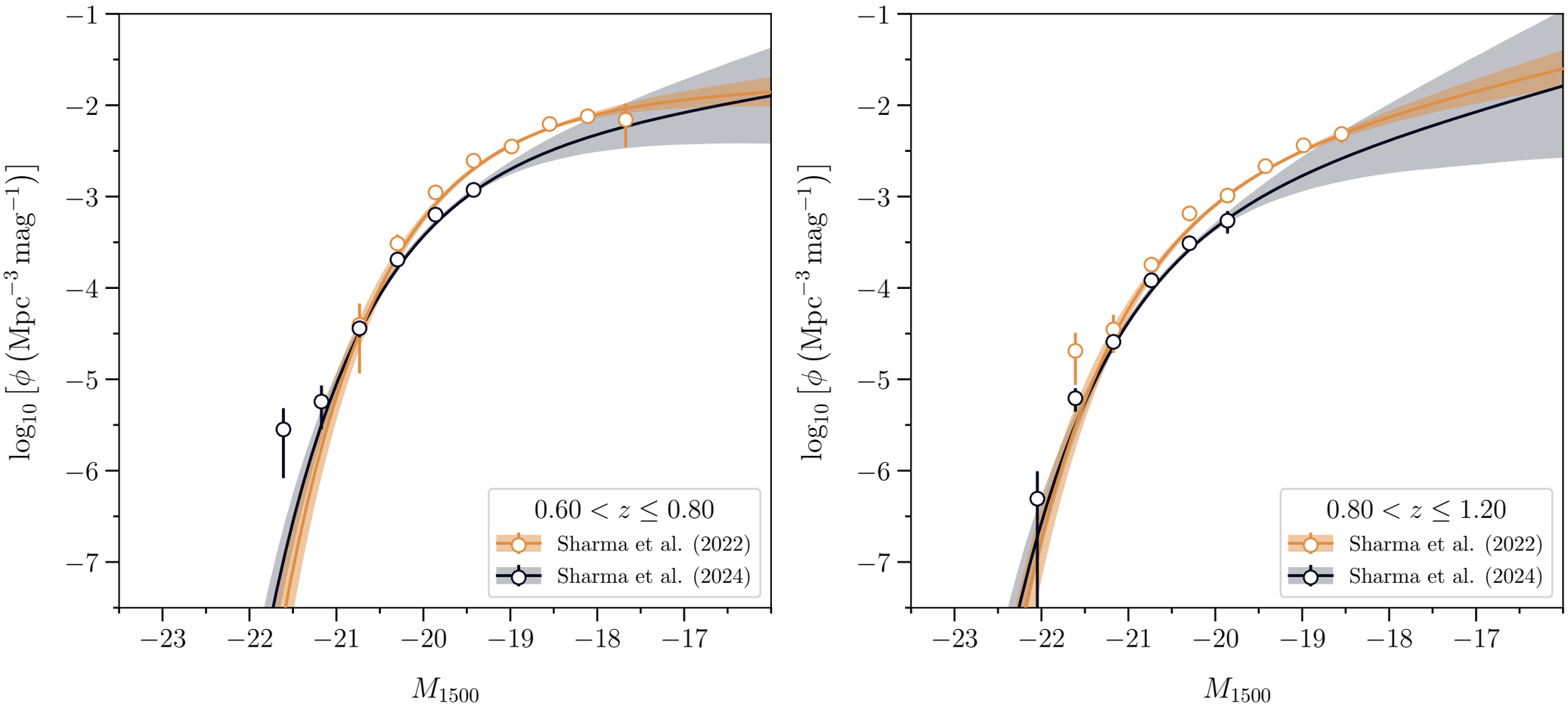
COSMOS (Sharma et al. 2024)

# UV LF @ z = 0.6-1.2

$$\Phi(L)dL = \Phi_* \left(\frac{L}{L_*}\right)^{\alpha} exp\left(-\frac{L}{L_*}\right)\frac{dL}{L_*}$$

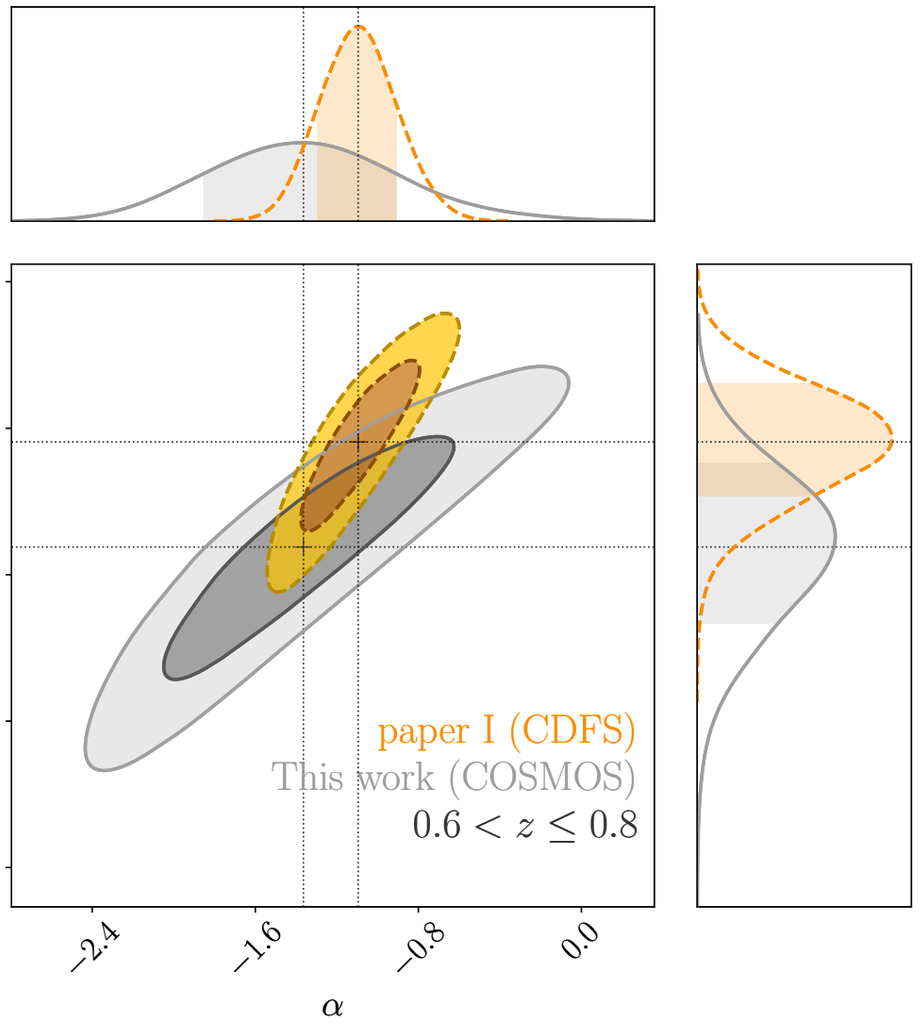
$$\frac{L}{L_*} = 10^{-0.4(M-M_*)}$$

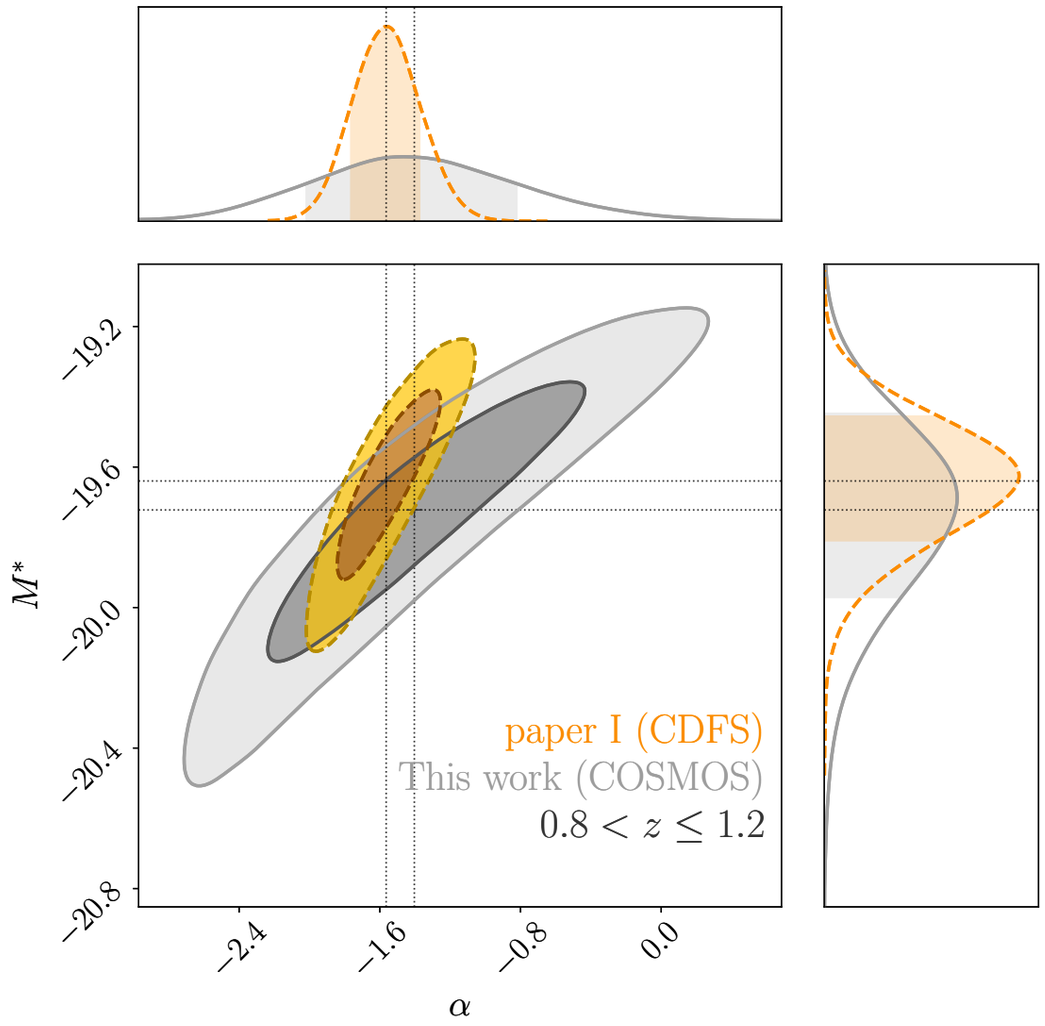
$$\Phi(M)dM = 0.4\, ln10\, \Phi_* 10^{-0.4(M-M_*)(\alpha+1)} e^{-10^{-0.4(M-M_*)}} dM$$



# UV LF @ z = 0.6-1.2

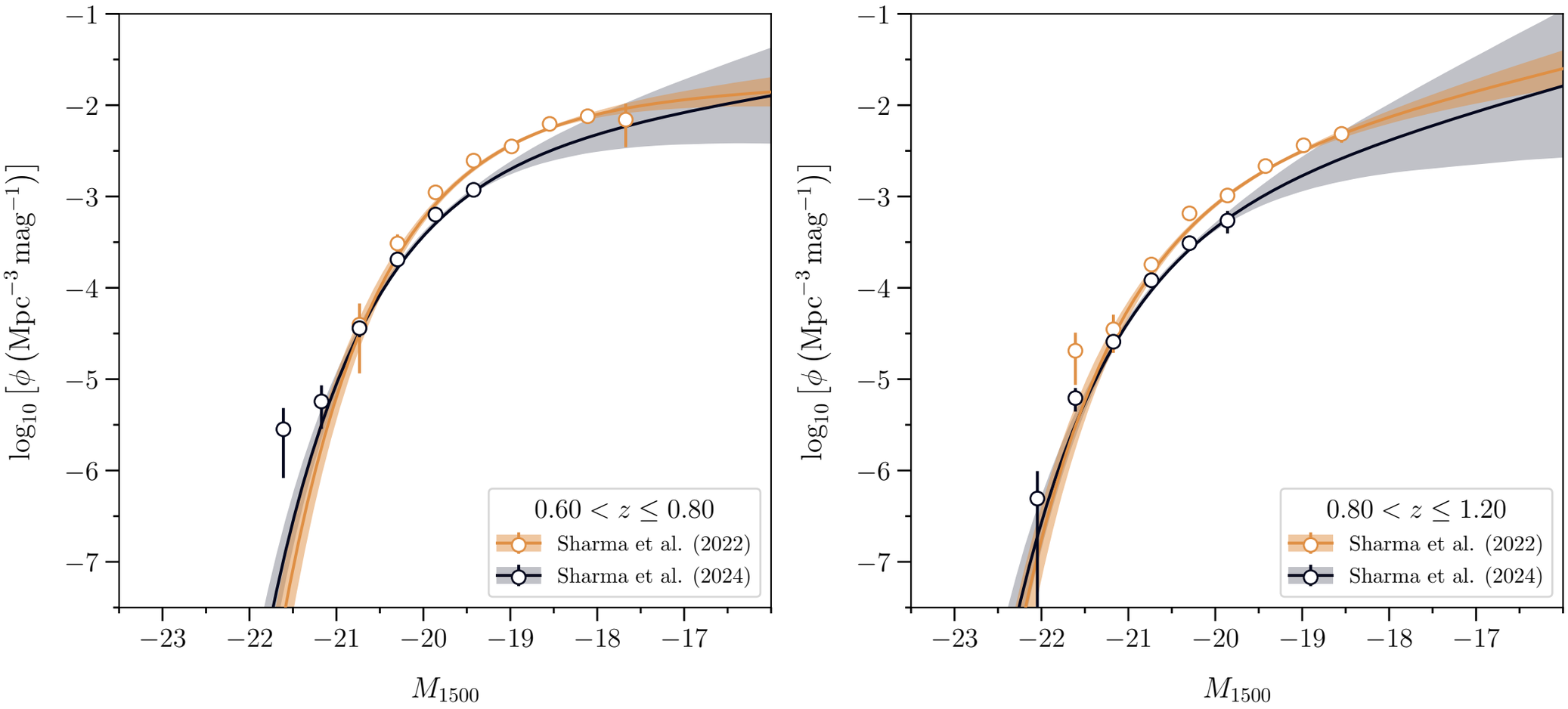
| $< z >$ | $\phi^*/10^{-3}$ (Mpc$^{-3}$) | $M^*$ | $\alpha$ | $\rho/10^{26}$ (erg s$^{-1}$ Hz$^{-1}$ Mpc$^{-3}$) |
|---|---|---|---|---|
| 0.7 | $12.73^{+2.03}_{-2.25}$ | $-18.84^{+0.14}_{-0.15}$ | $-1.10^{+0.19}_{-0.18}$ | $2.02^{+0.26}_{-0.18}$ |
| 1.0 | $4.26^{+1.18}_{-1.12}$ | $-19.64^{+0.16}_{-0.18}$ | $-1.56^{+0.19}_{-0.18}$ | $2.63^{+1.04}_{-0.55}$ |
| 0.7 | $5.04^{+0.76}_{-1.13}$ | $-19.12^{+0.19}_{-0.23}$ | $-1.36^{+0.46}_{-0.45}$ | $1.34^{+1.46}_{-0.49}$ |
| 1.0 | $1.82^{+0.36}_{-0.47}$ | $-19.72^{+0.23}_{-0.27}$ | $-1.40^{+0.60}_{-0.56}$ | $0.85^{+1.15}_{-0.36}$ |



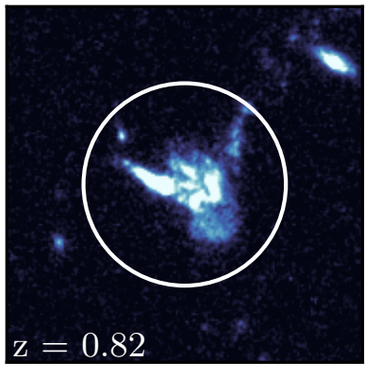



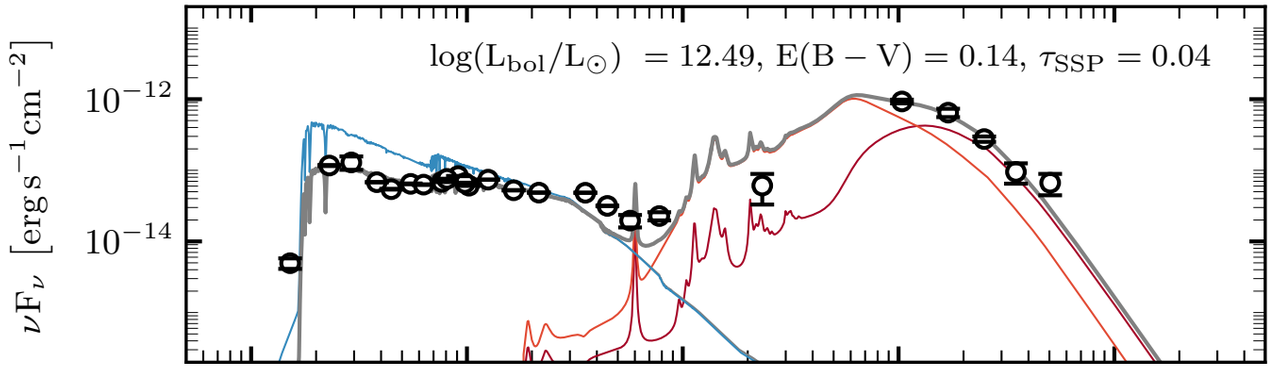
# UV LF shape @ z = 0.6-1.2

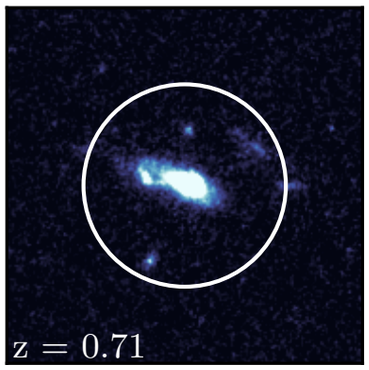
Deviations from the Schechter shape suggest scenarios such as the absence of dust attenuation, amplified star formation efficiency, a top-heavy IMF, the emergence of AGN, non-ΛCDM cosmologies (Ferrara et al., 2023; Ziparo et al., 2023; Boylan-Kolchin, 2023; Wang, et al., 2024).

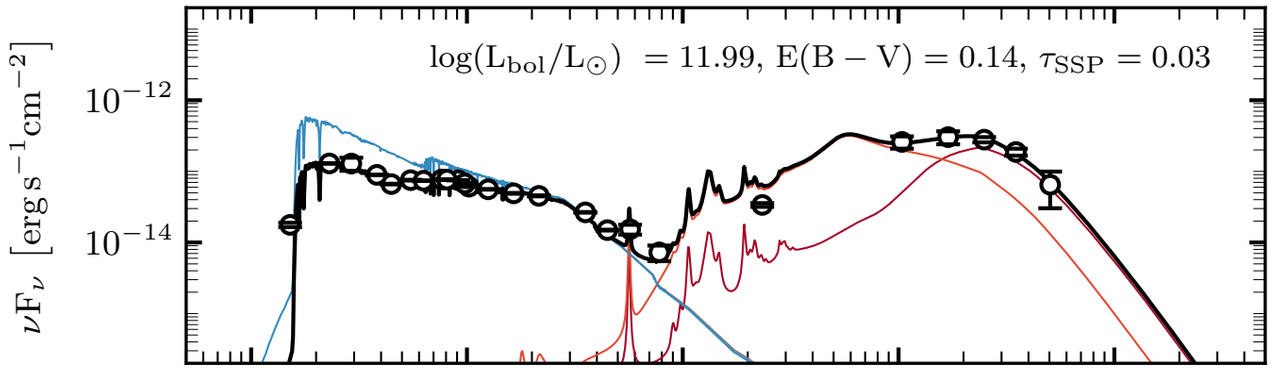


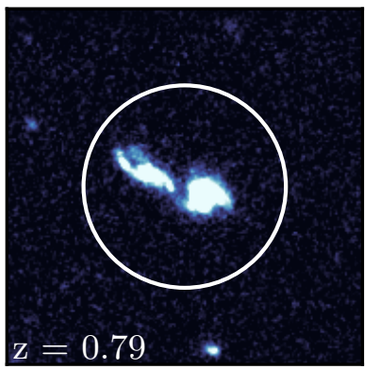
# UV LF @ z = 0.6-1.2

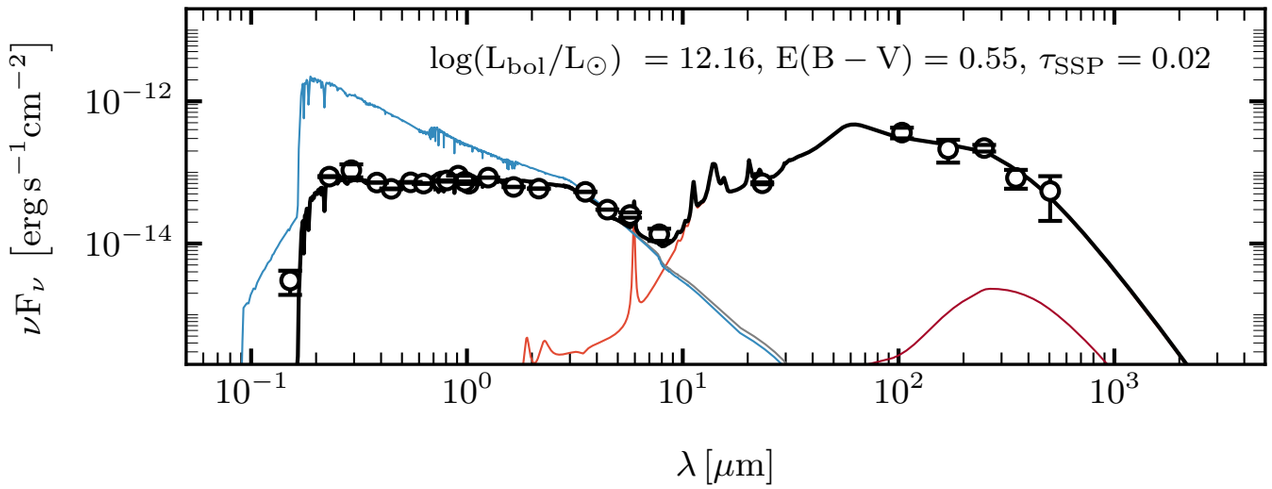

z = 0.82


log(L_bol/L_⊙) = 12.49, E(B − V) = 0.14, τ_SSP = 0.04
νF_ν [erg s^−1 cm^−2]
10^−12
10^−14

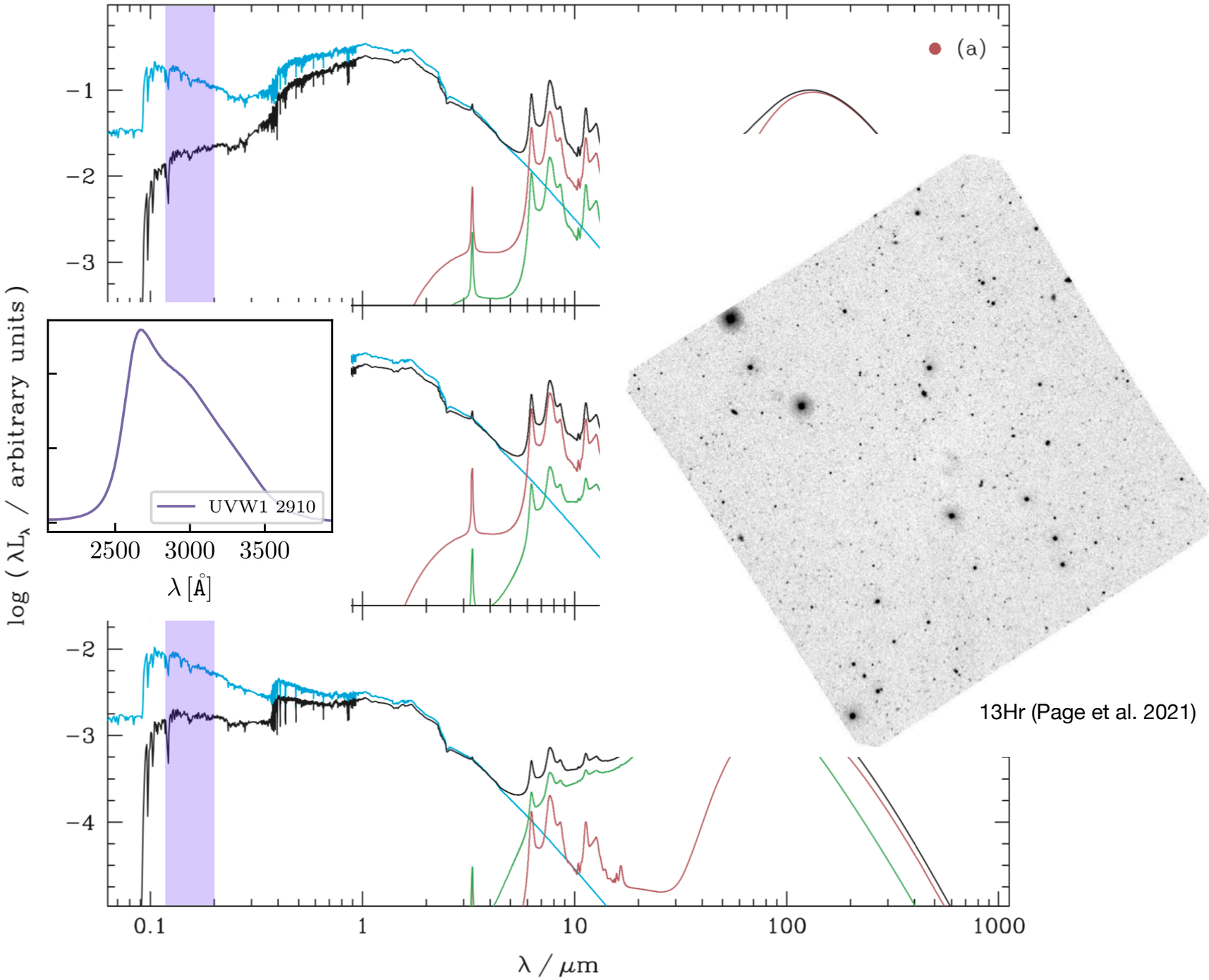

z = 0.71


log(L_bol/L_⊙) = 11.99, E(B − V) = 0.14, τ_SSP = 0.03
νF_ν [erg s^−1 cm^−2]
10^−12
10^−14


z = 0.79


log(L_bol/L_⊙) = 12.16, E(B − V) = 0.55, τ_SSP = 0.02
νF_ν [erg s^−1 cm^−2]
10^−12
10^−14
10^−1
10^0
10^1
10^2
10^3
λ [μm]

# UV Selection




13Hr (Page et al. 2021)

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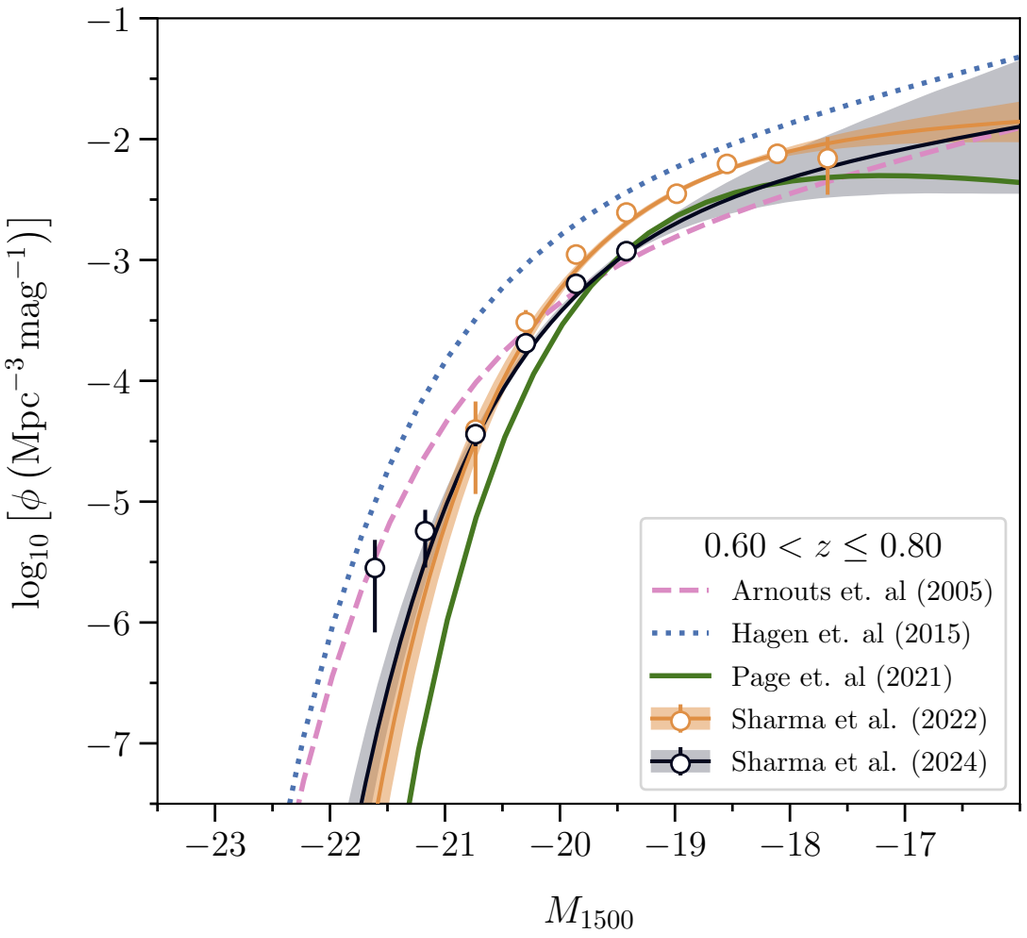


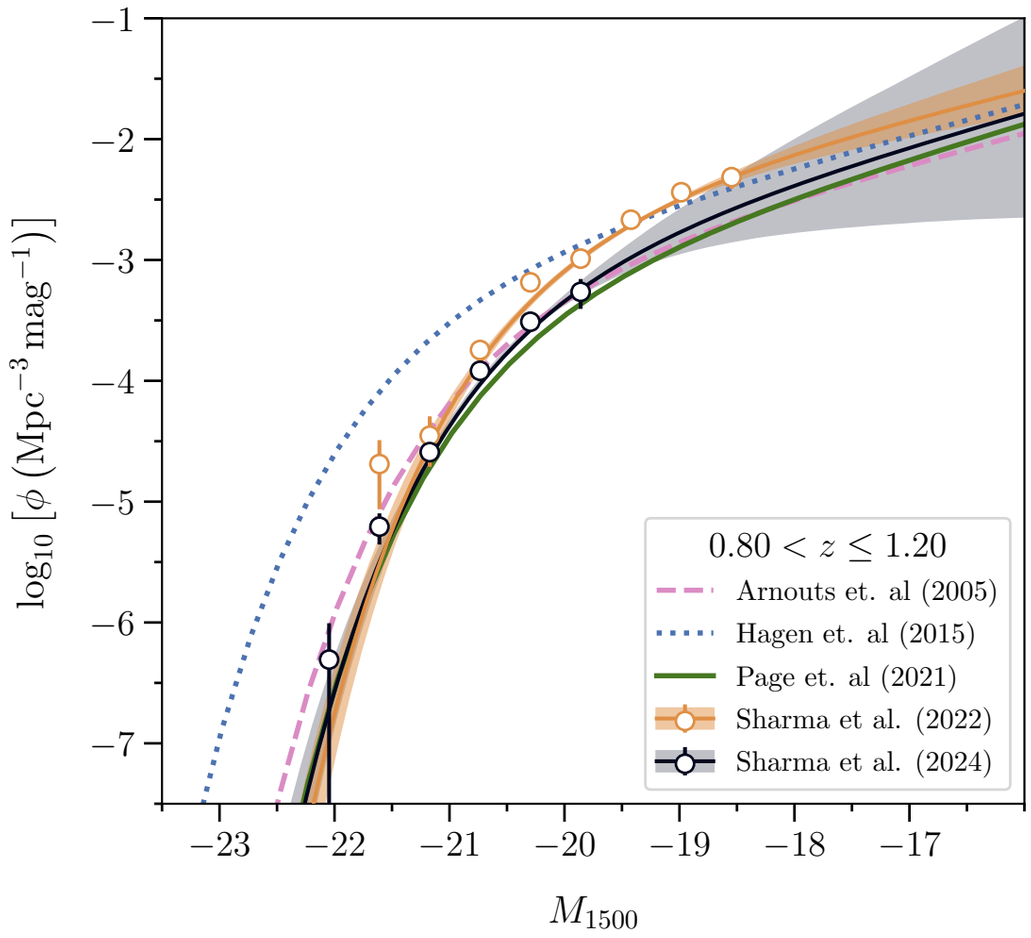

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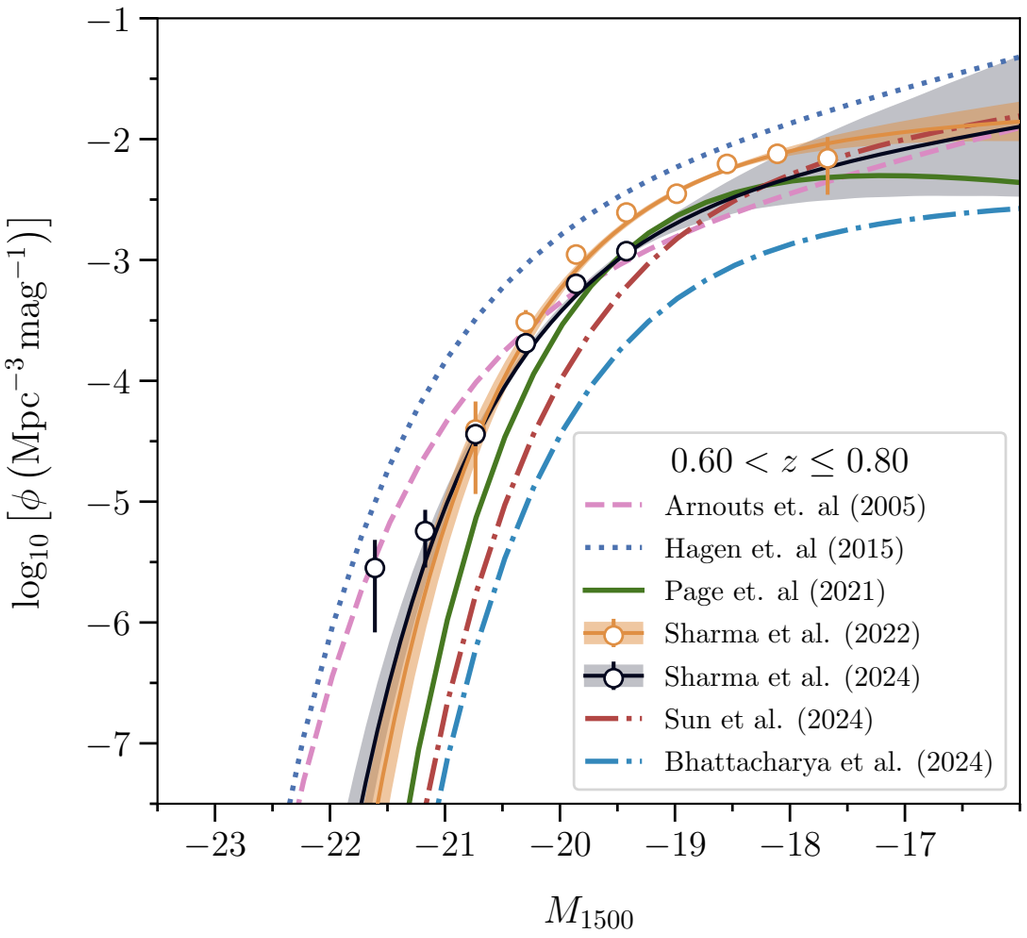
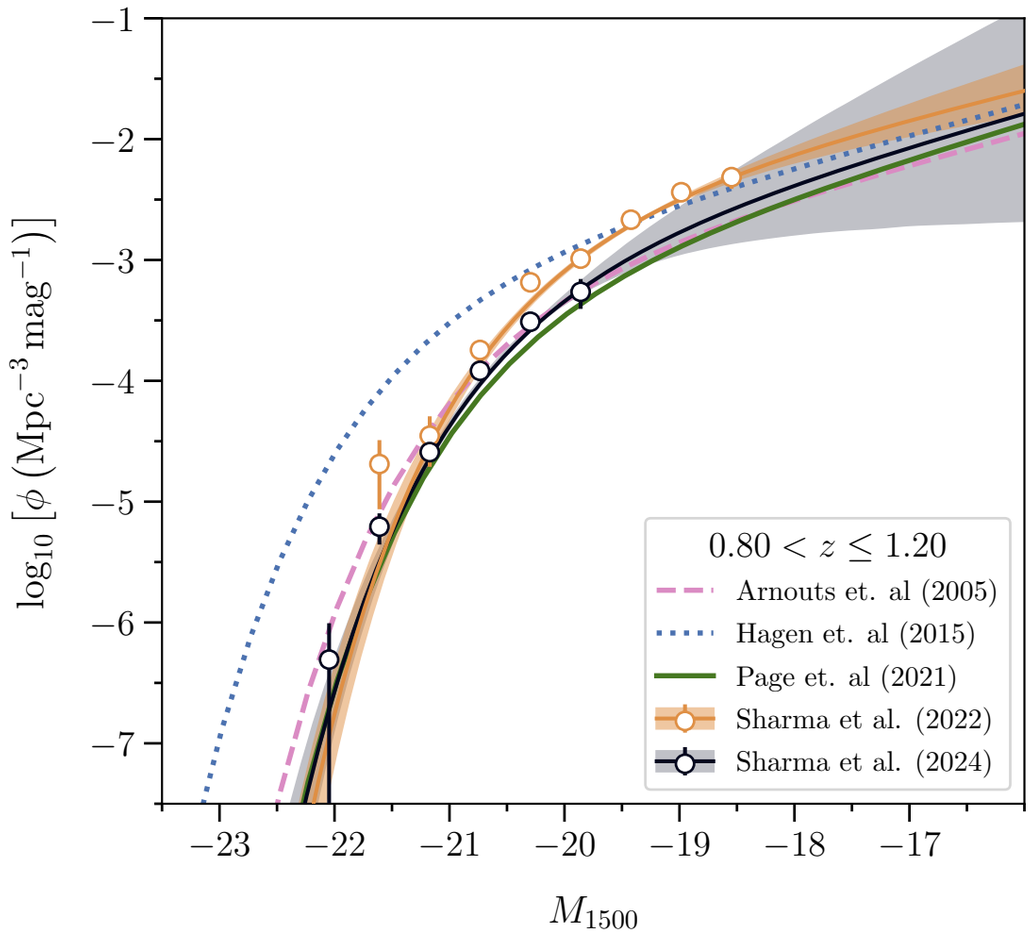
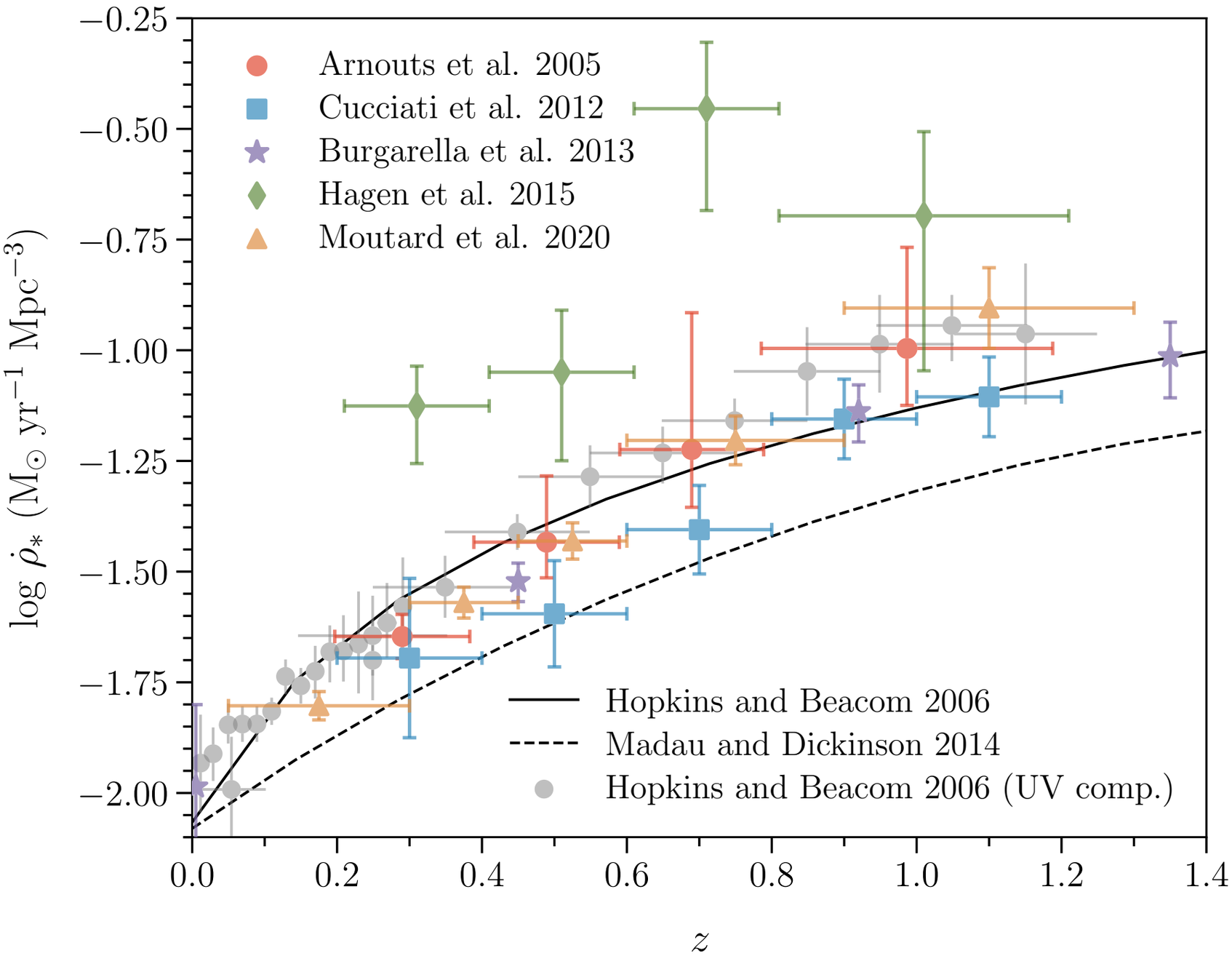


# SFRD


Arnouts et al. 2005
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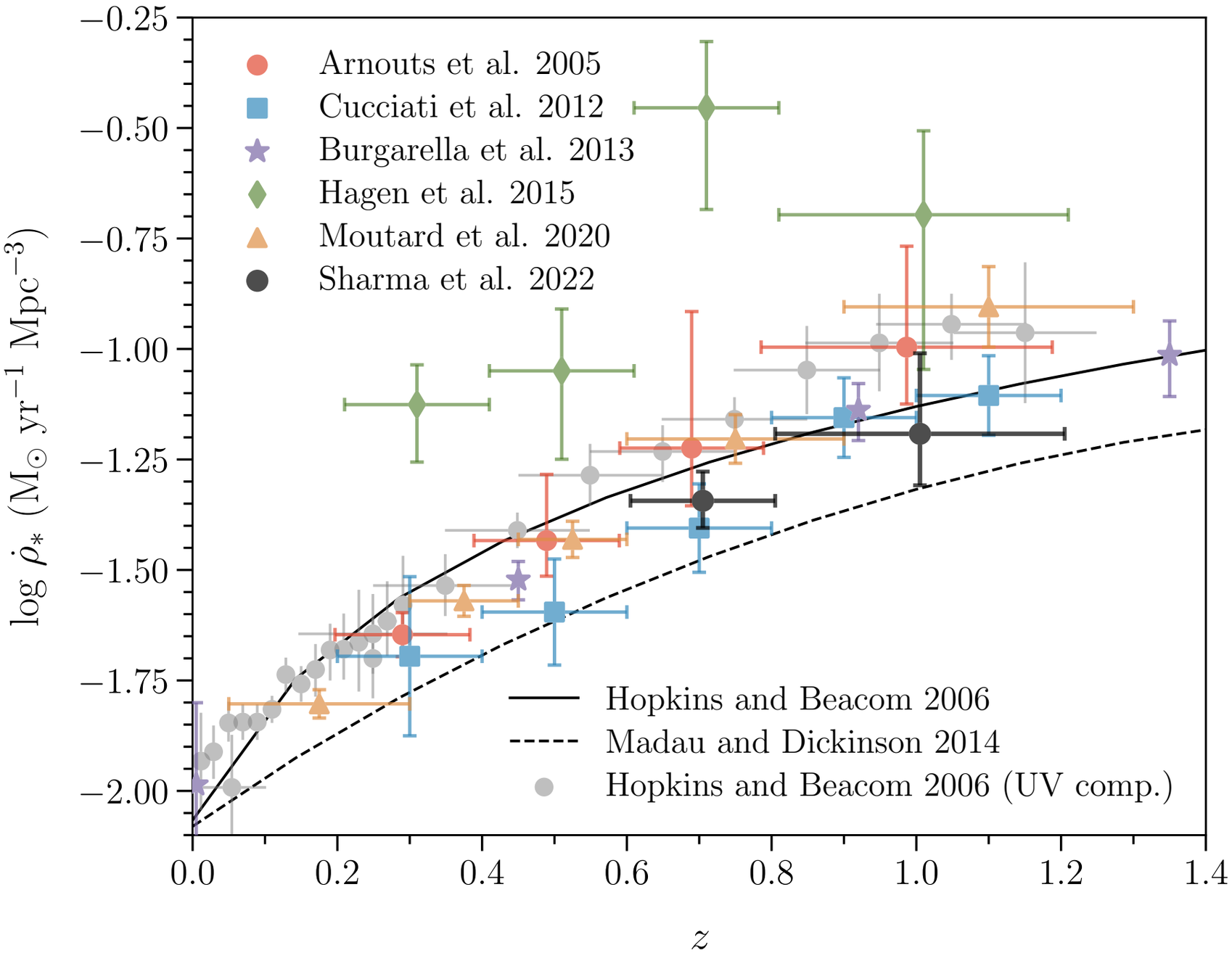
Hagen et al. 2015
Moutard et al. 2020
Hopkins and Beacom 2006
Madau and Dickinson 2014
Hopkins and Beacom 2006 (UV comp.)
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# SFRD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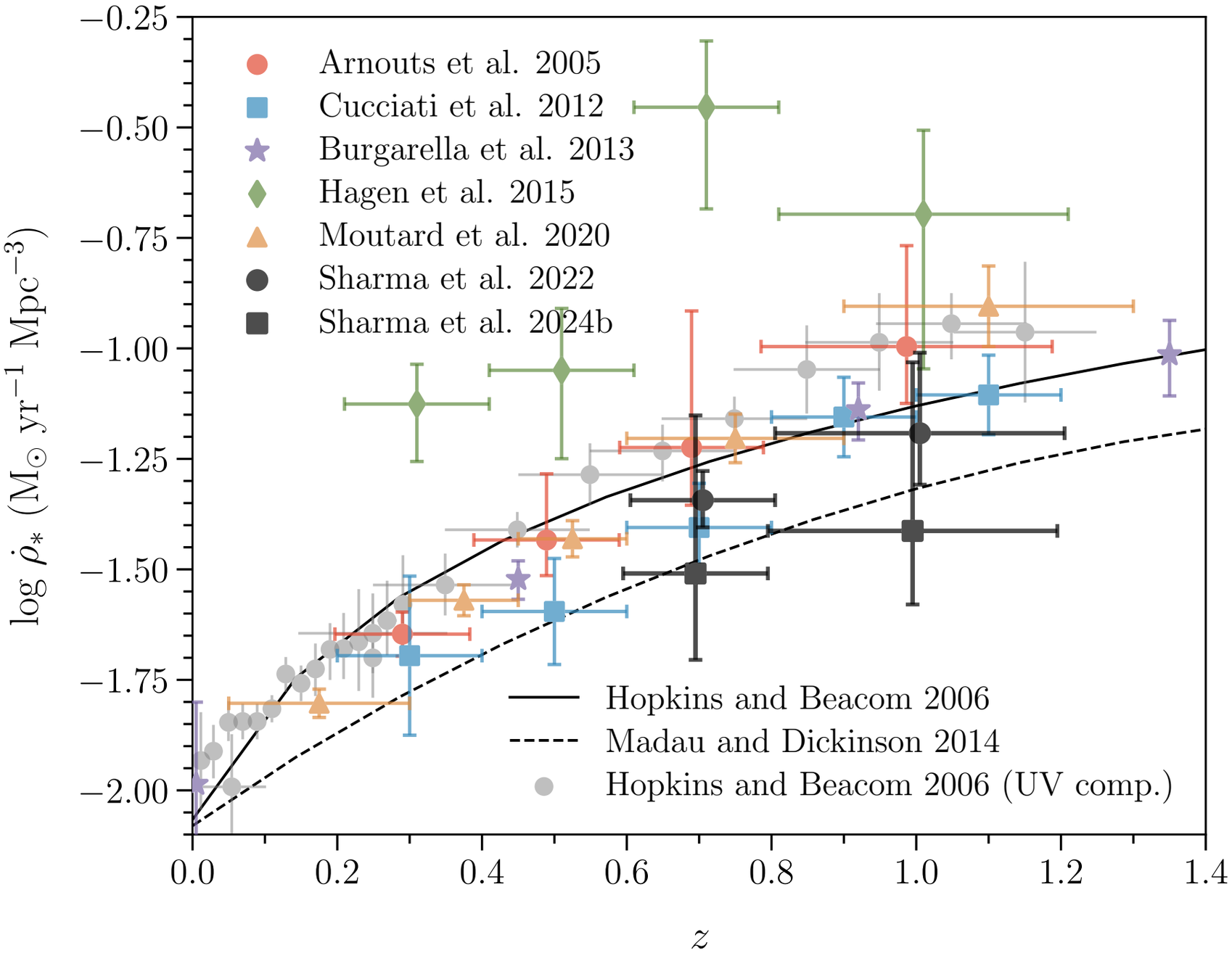
Hopkins and Beacom 2006
Madau and Dickinson 2014
Hopkins and Beacom 2006 (UV comp.)
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# SFRD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Hopkins and Beacom 2006
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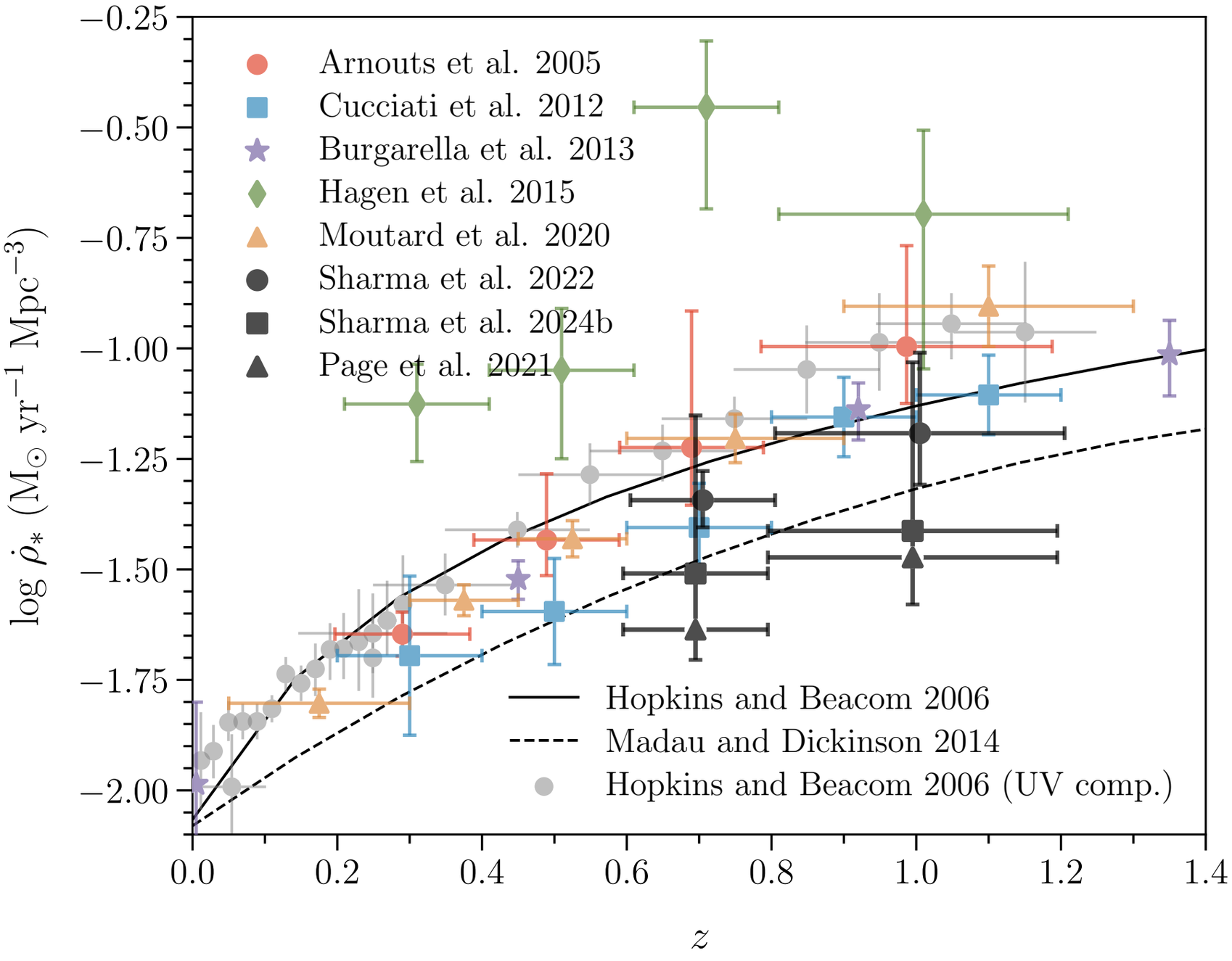
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# SFRD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Hopkins and Beacom 2006
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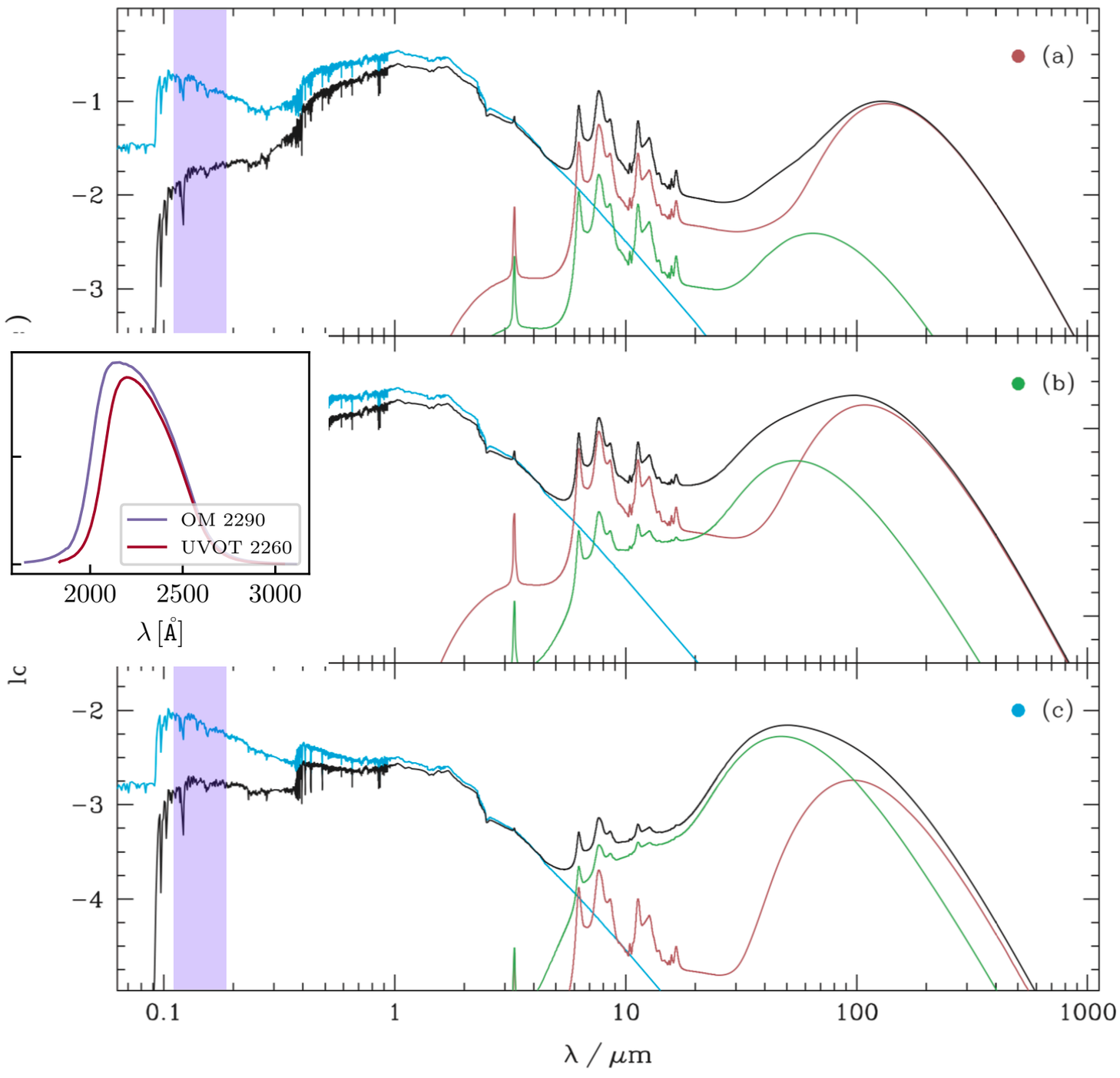
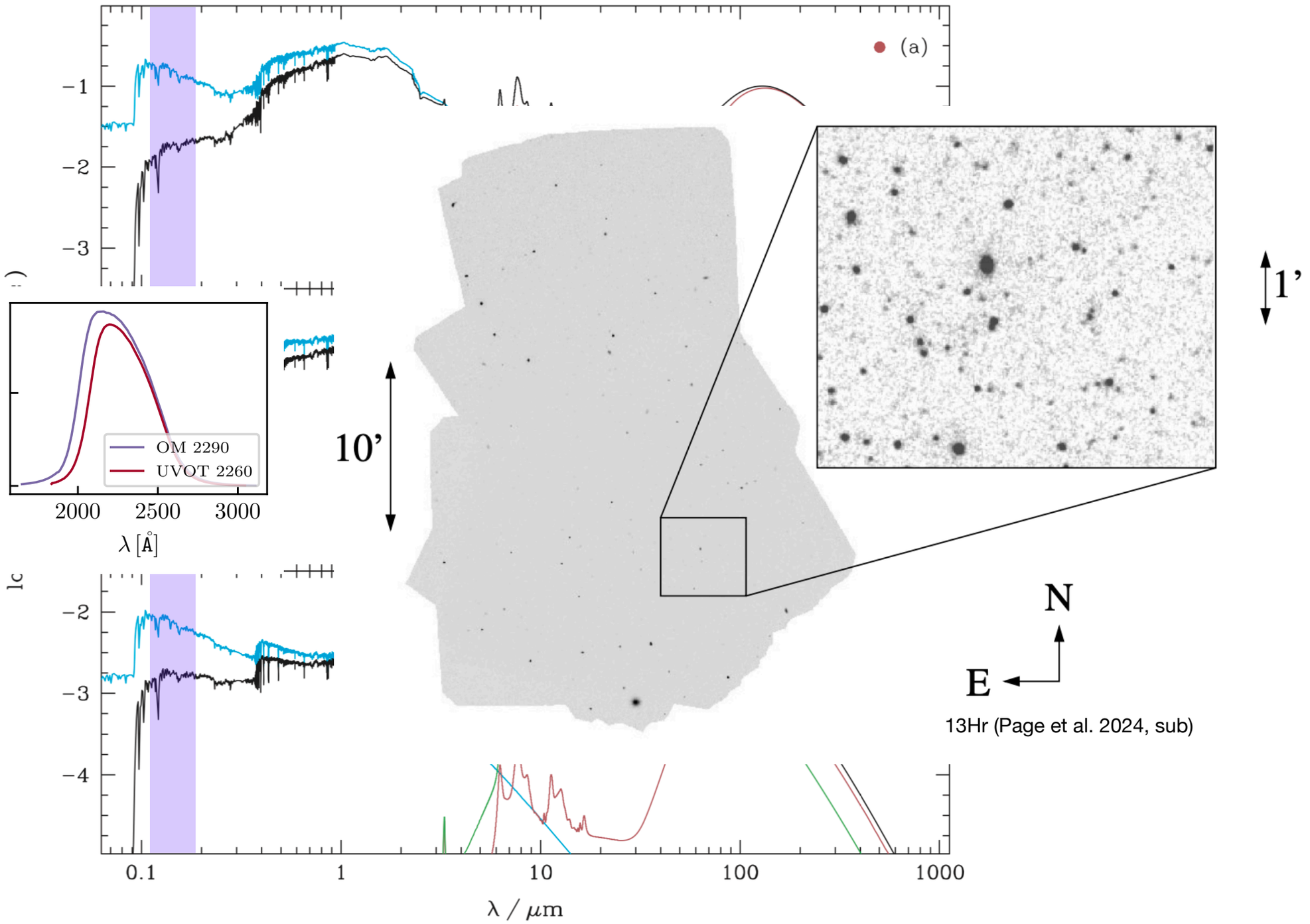
Hopkins and Beacom 2006 (UV comp.)
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# XMM-OM UVM2+ Swift UVOT




da Cunha et al. 2008

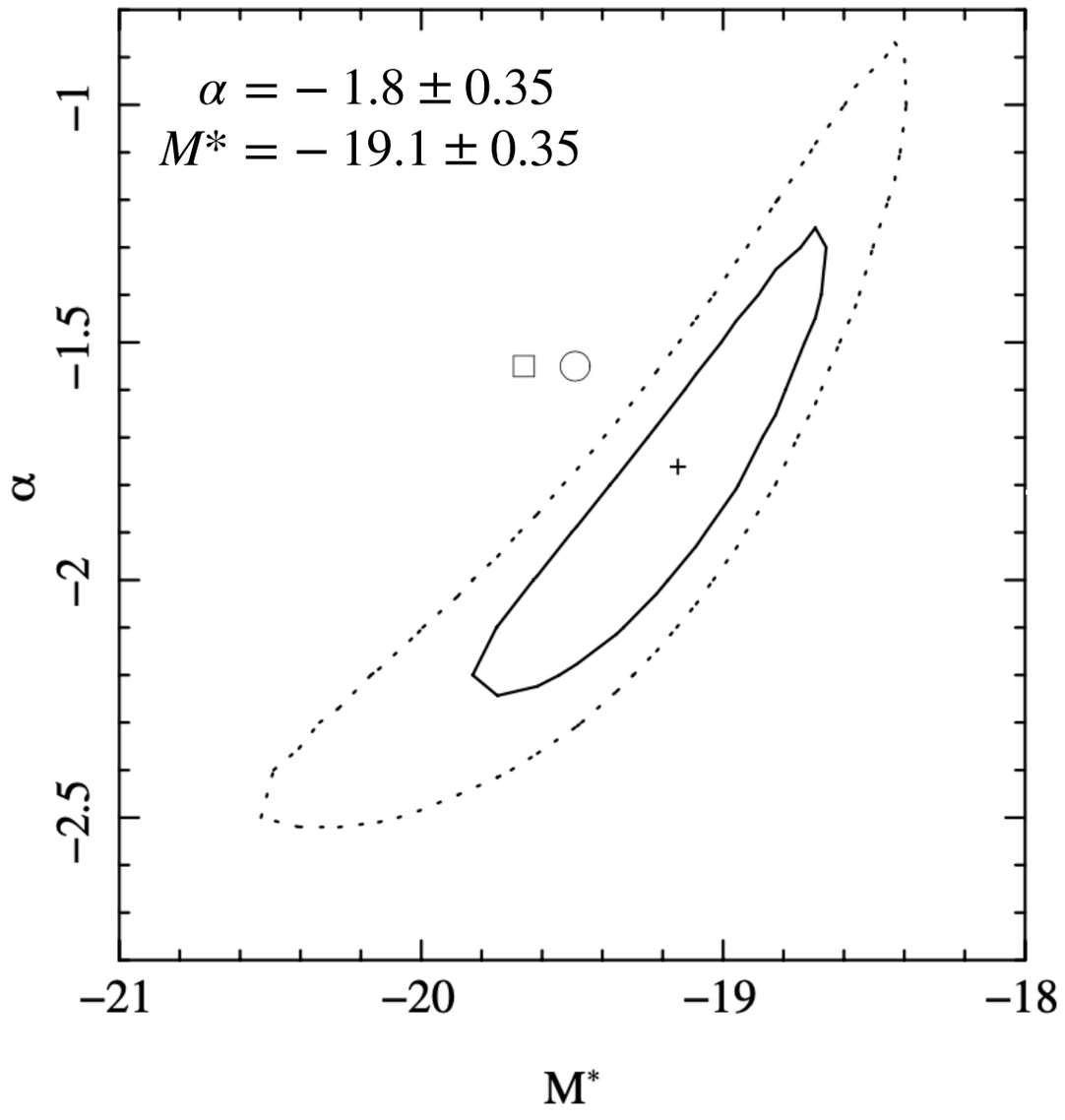
# XMM-OM UVM2+ Swift UVOT

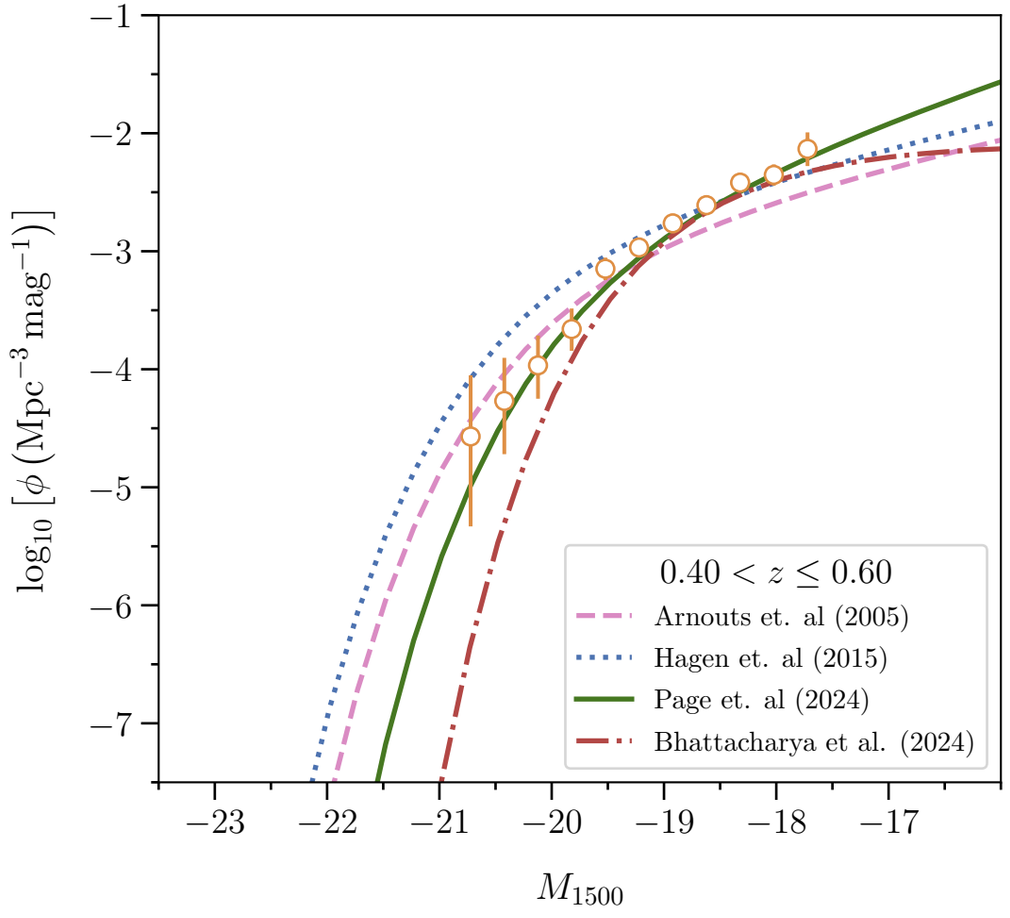



13Hr (Page et al. 2024, sub)

da Cunha et al. 2008

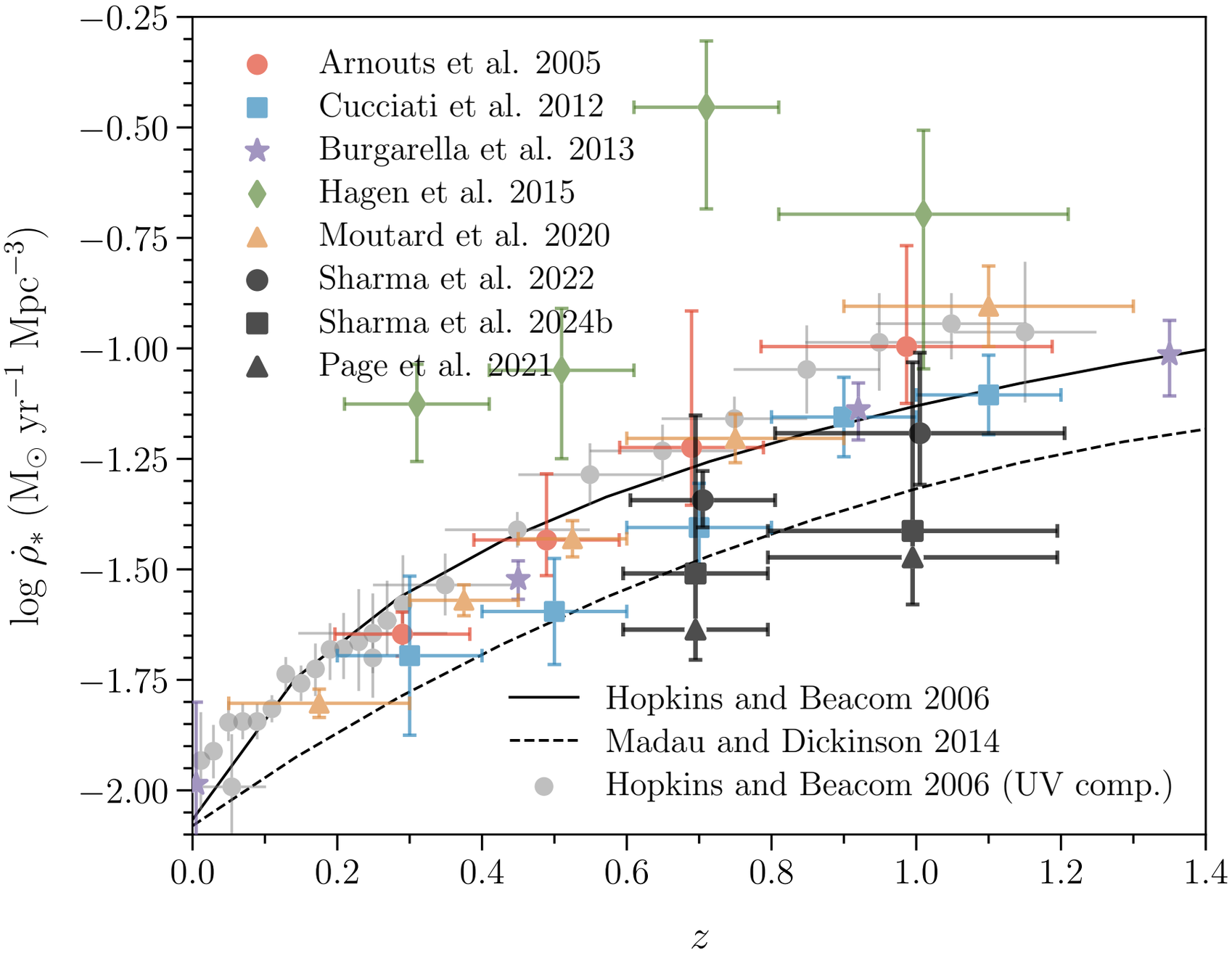
# UV LF @ z = 0.4-0.6




13Hr (Page et al. 2024, sub)

# SFRD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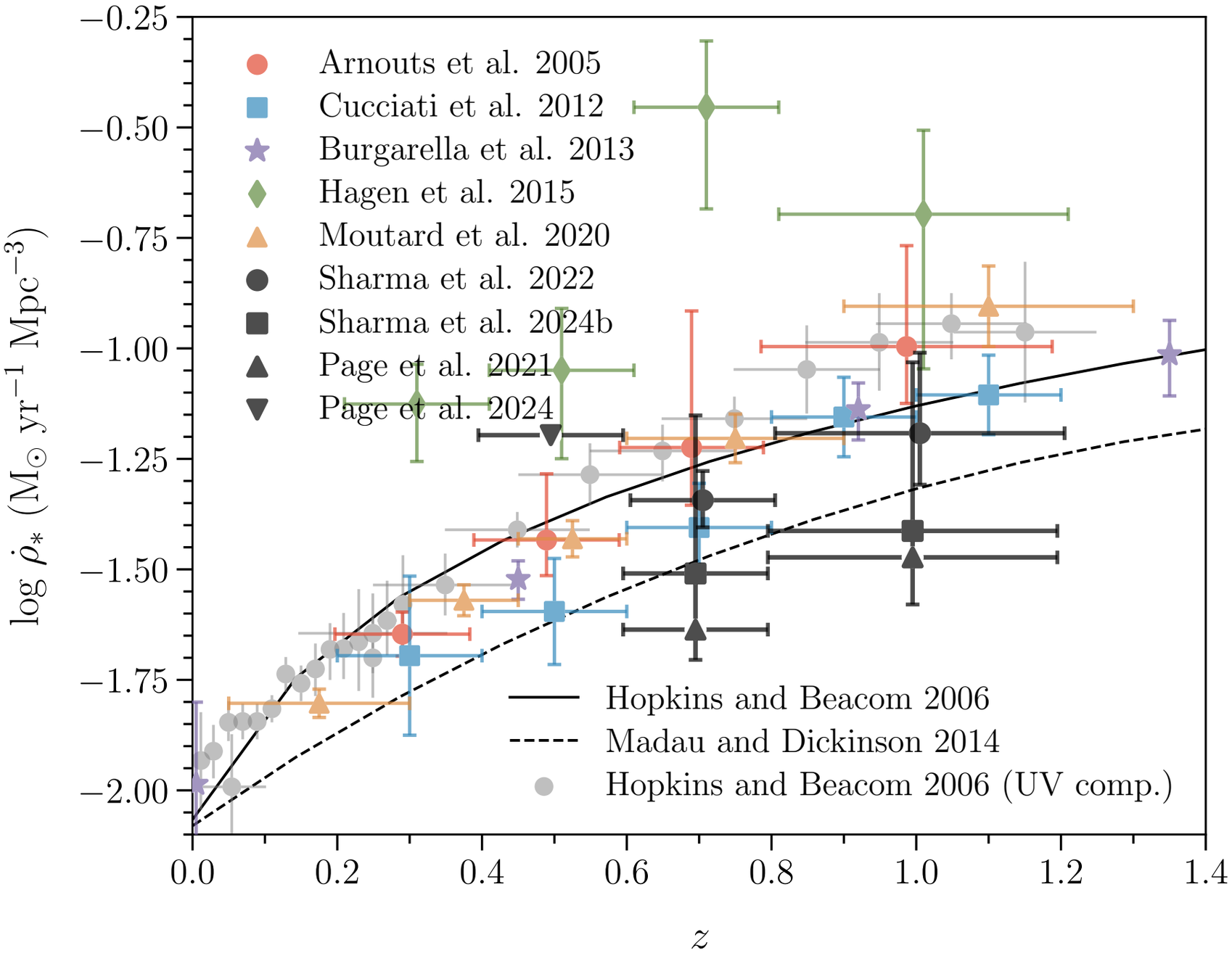
log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# SFRD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log $\dot{\rho}_*$ ($M_\odot$ yr$^{-1}$ Mpc$^{-3}$)
$z$
−0.25
−0.50
−0.75
−1.00
−1.25
−1.50
−1.75
−2.00
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4

# Summary

- The LF shape at redshifts 0.5, 0.7, 1.0 is consistent with the Schechter form.
- The characteristic magnitudes are fainter than previous studies, implying possible AGN contamination.
- Galaxy mergers at scales smaller compared to photometric apertures can cause artificial flattening at the bright end of the LFs.
- Combining OM and UVOT data showing promise for extending the UV LF studies to lower redshifts. Stay Tuned!

- arXiv:2106.08200, arXiv:2203.03563, arXiv:2212.00215