JWST PEARLS: Prime Extragalactic Areas for Reionization and Lensing Science: Project Overview and First Results

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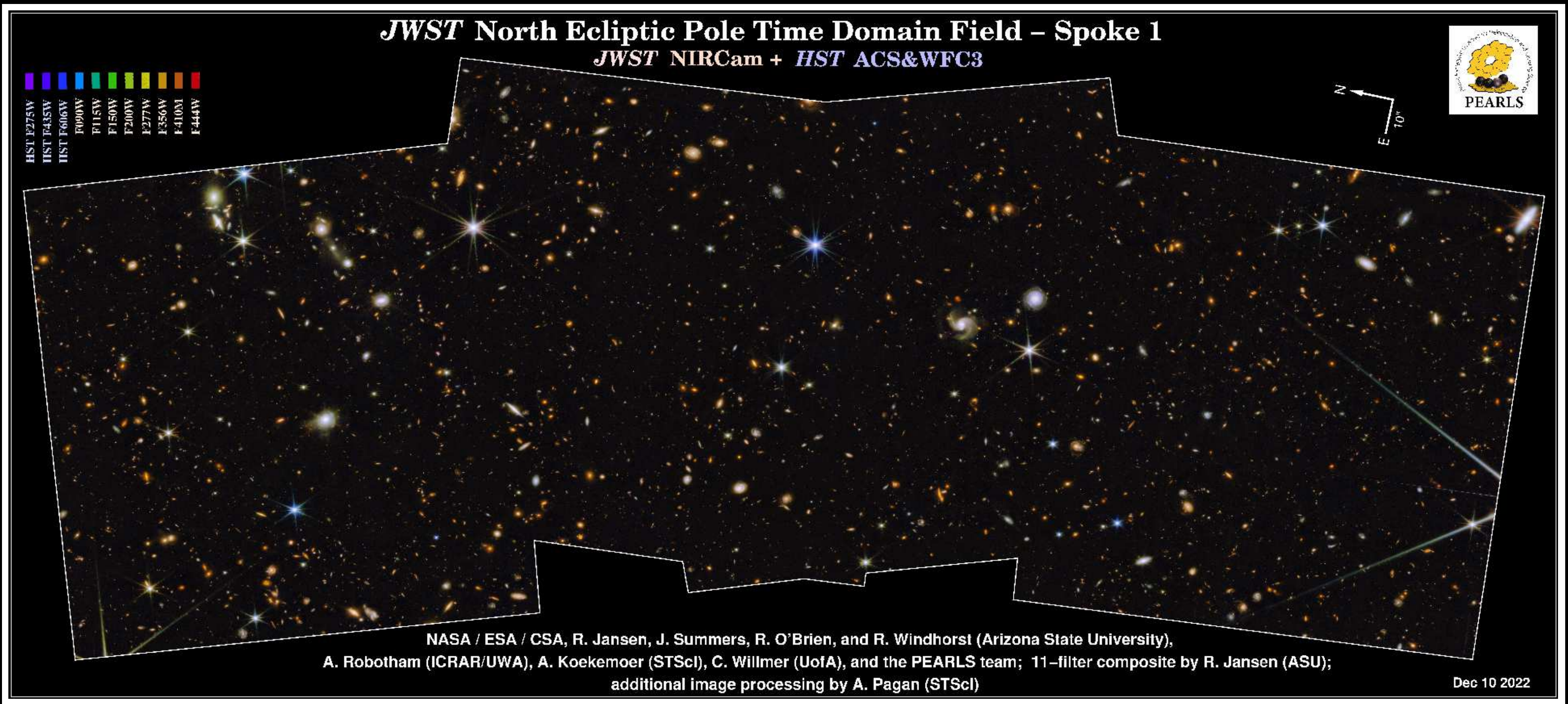


AAS 241 talk, session 143.03, Monday Jan 9, 2023, 2:00 pm (Seattle WA, via Zoom)

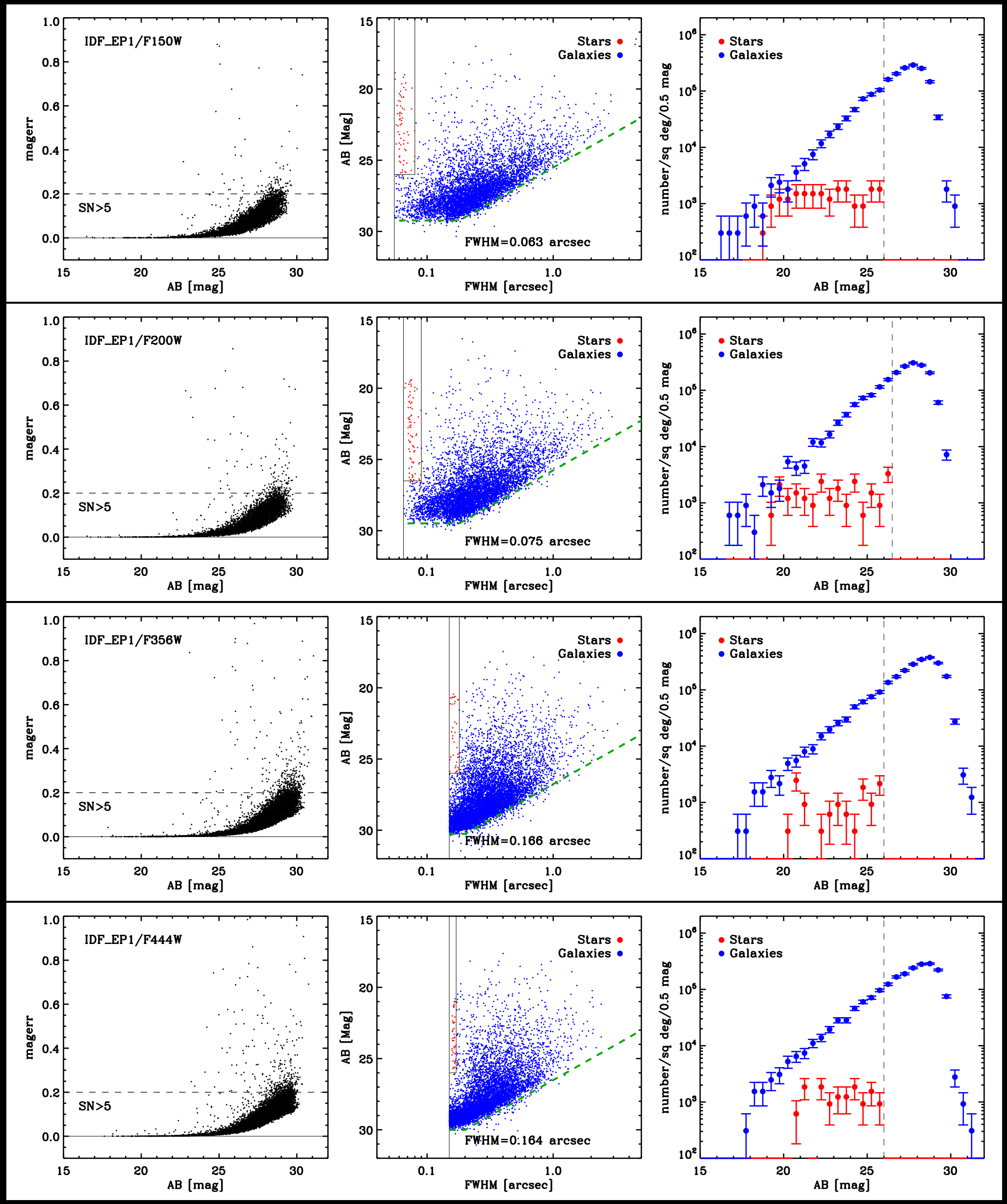
PDF on: `http://www.asu.edu/clas/hst/www/jwst/jwsttalks/aas241_143_JWST_PEARLS23.pdf`

PEARLS Overview: Windhorst et al. (2023, AJ, 165, 13; astro-ph/2209.04119):

PEARLS = 3 Medium-deep NIRCam fields; 7 lensing clusters; 2 high-z protoclusters; 2 z$\sim$6 QSOs, and the backlit spiral VV 191.

Some remarkable results in PEARLS and other JWST projects:

- (Old SED) tidal tails everywhere: $\lesssim$20% of Integrated Galaxy Light (IGL).
- Abundance of red (dusty) spirals. Galaxy counts to AB$\lesssim$28.5–29 mag.

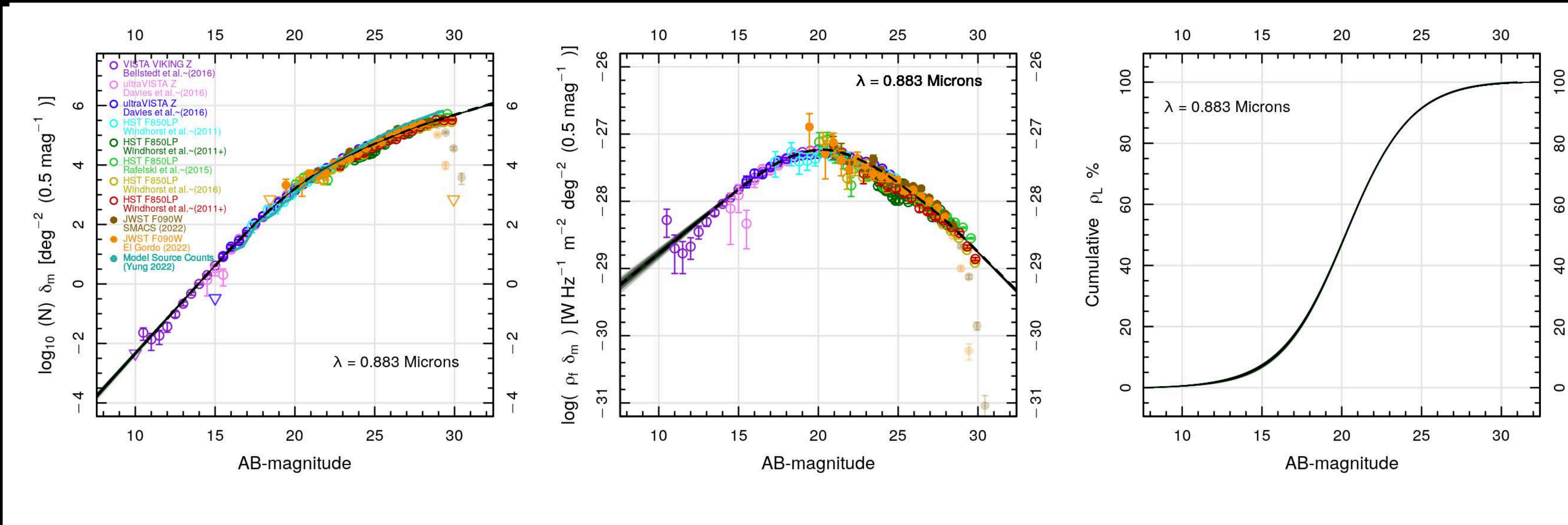


[Left]: Mag-error vs. AB: 5σ catalog completeness to AB$\lesssim$28.5–29 mag.

[Middle]: AB vs. FWHM: accurate star-galaxy separation to AB$\lesssim$26-27!

• Stellar sequence FWHM improves below 2.00 μm JWST diffraction limit!

[Right]: 0.9–4.5μm Galaxy counts complete to AB$\lesssim$28.5–29 mag, resp.



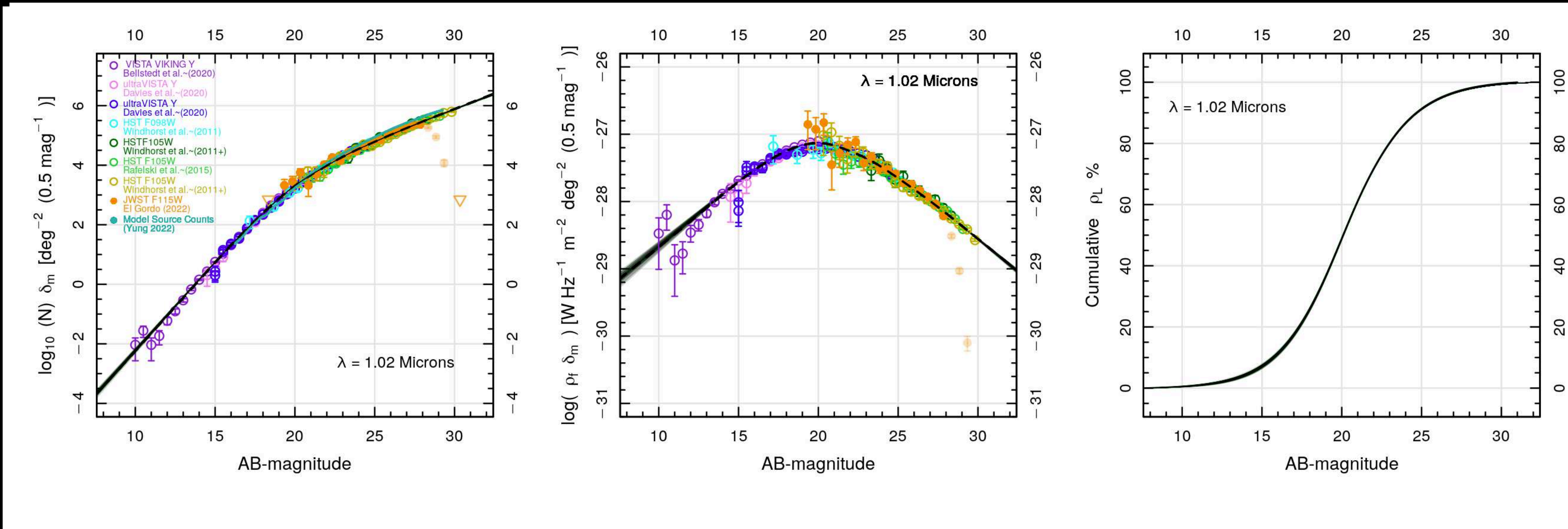
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

0.88 μm Ground-based+HST+JWST galaxy counts (AB≃10–30 mag).

- Energy counts narrow with increasing λ. Peak amplitude around 2 μm.



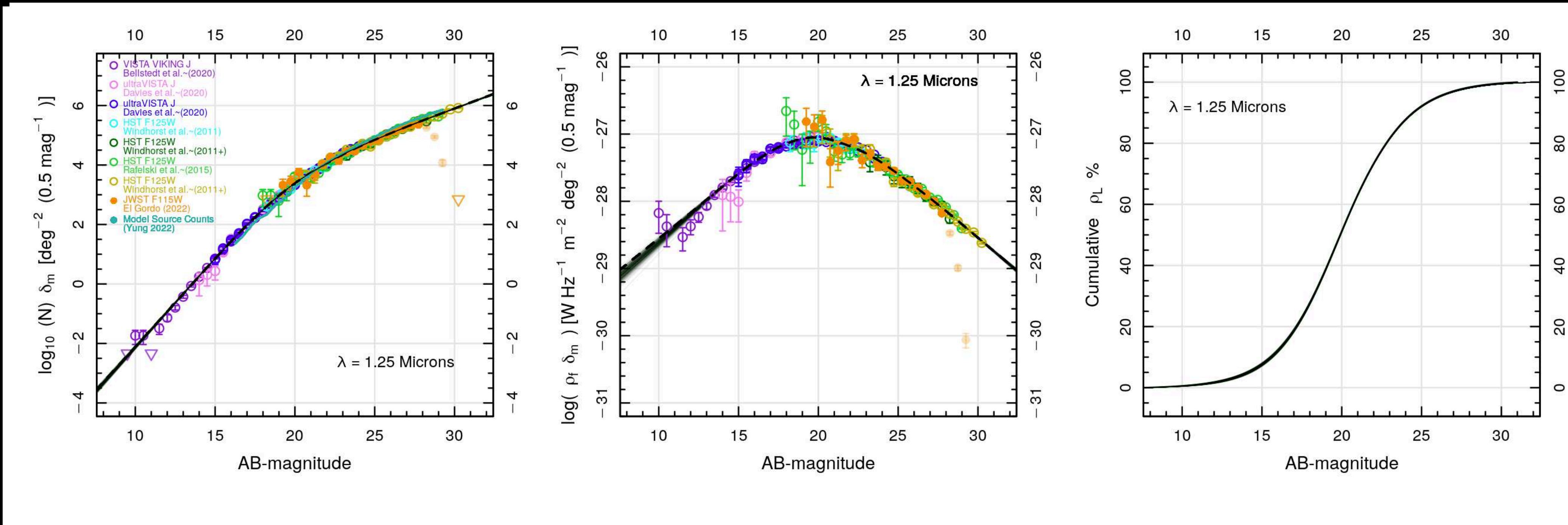
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

1.02 μm Ground-based+HST+JWST galaxy counts (AB≃10–30 mag).

- Energy counts narrow with increasing λ. Peak amplitude around 2 μm.



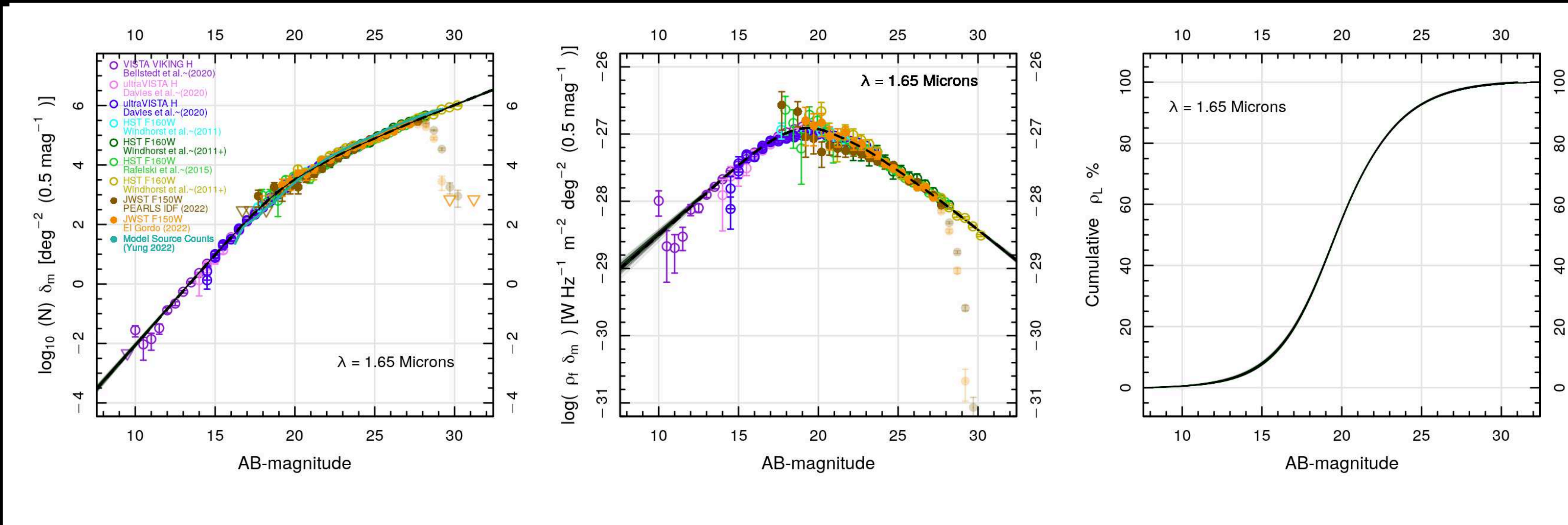
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

1.25 μm Ground-based+HST+JWST galaxy counts (AB≃10–30 mag).

- Energy counts narrow with increasing λ. Peak amplitude around 2 μm.



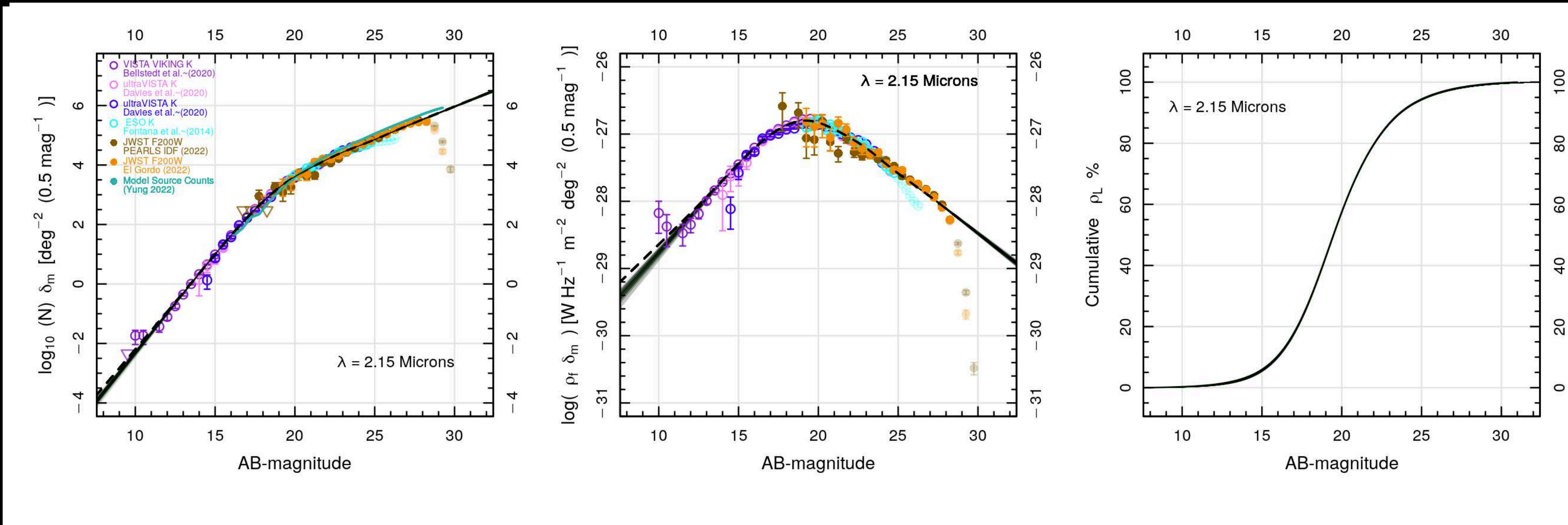
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

1.65 μm Ground-based+HST+JWST galaxy counts (AB$\simeq$10–30 mag).

- Energy counts narrow with increasing $\boldsymbol{\lambda}$. Peak amplitude around 2 μm.



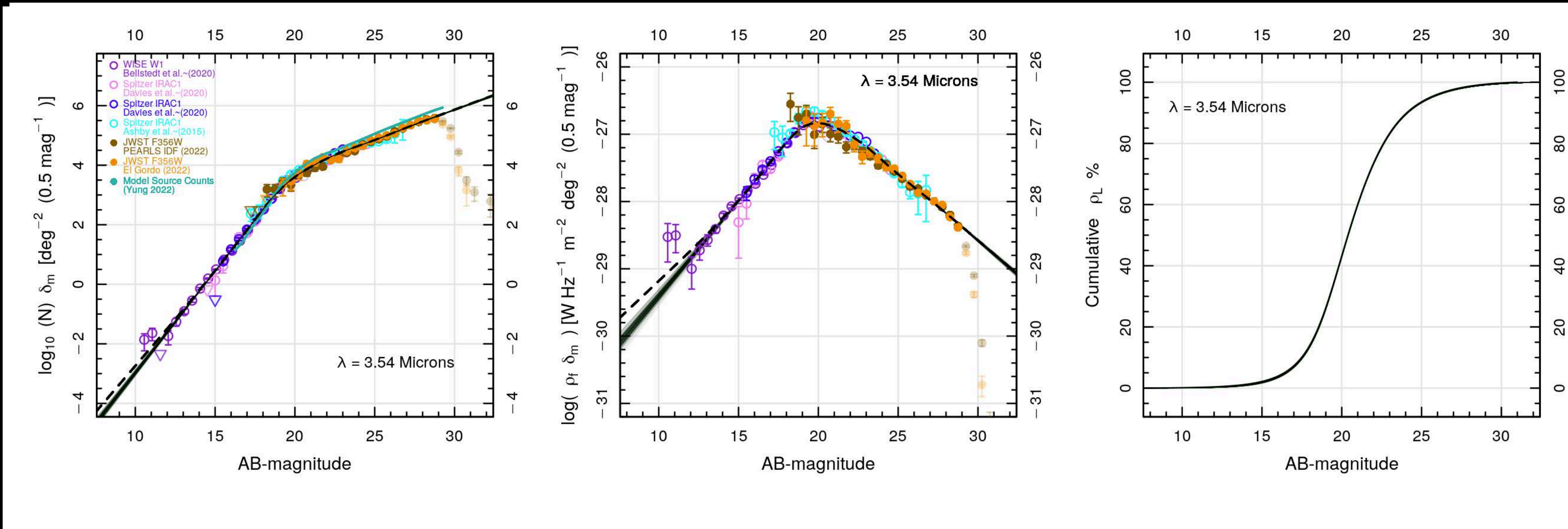
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

2.15 μm Ground-based+JWST galaxy counts (AB$\simeq$10–30 mag).

- Energy counts narrow with increasing $\boldsymbol{\lambda}$. Peak amplitude around 2 μm.



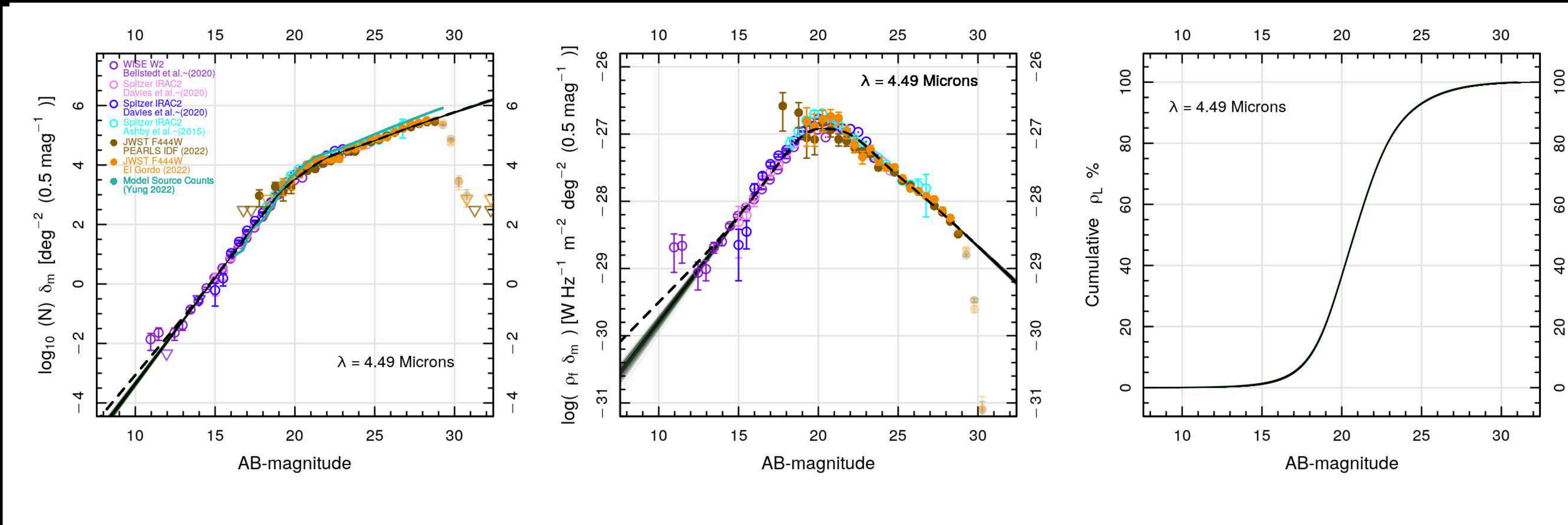
[Left]: Normalized differential galaxy counts.

[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

[Right]: Integrated Galaxy Light (IGL) from best fit spline.

3.54 μm WISE+Spitzer+JWST galaxy counts (AB$\simeq$10–30 mag).

- Energy counts narrow with increasing $\boldsymbol{\lambda}$. Peak amplitude around 2 μm.



[Left]: Normalized differential galaxy counts.

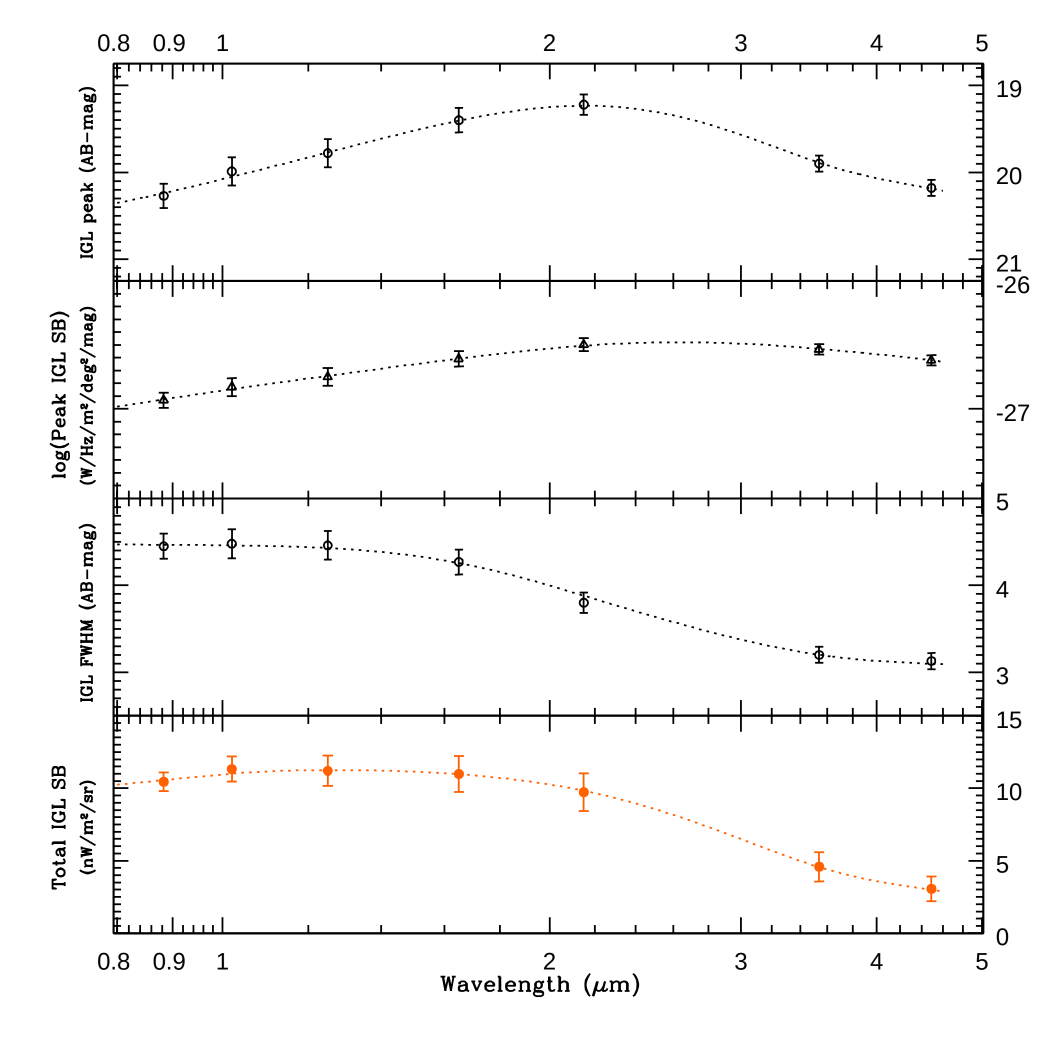
[Middle]: Galaxy energy counts (after dividing by 0.4 dex/mag slope).

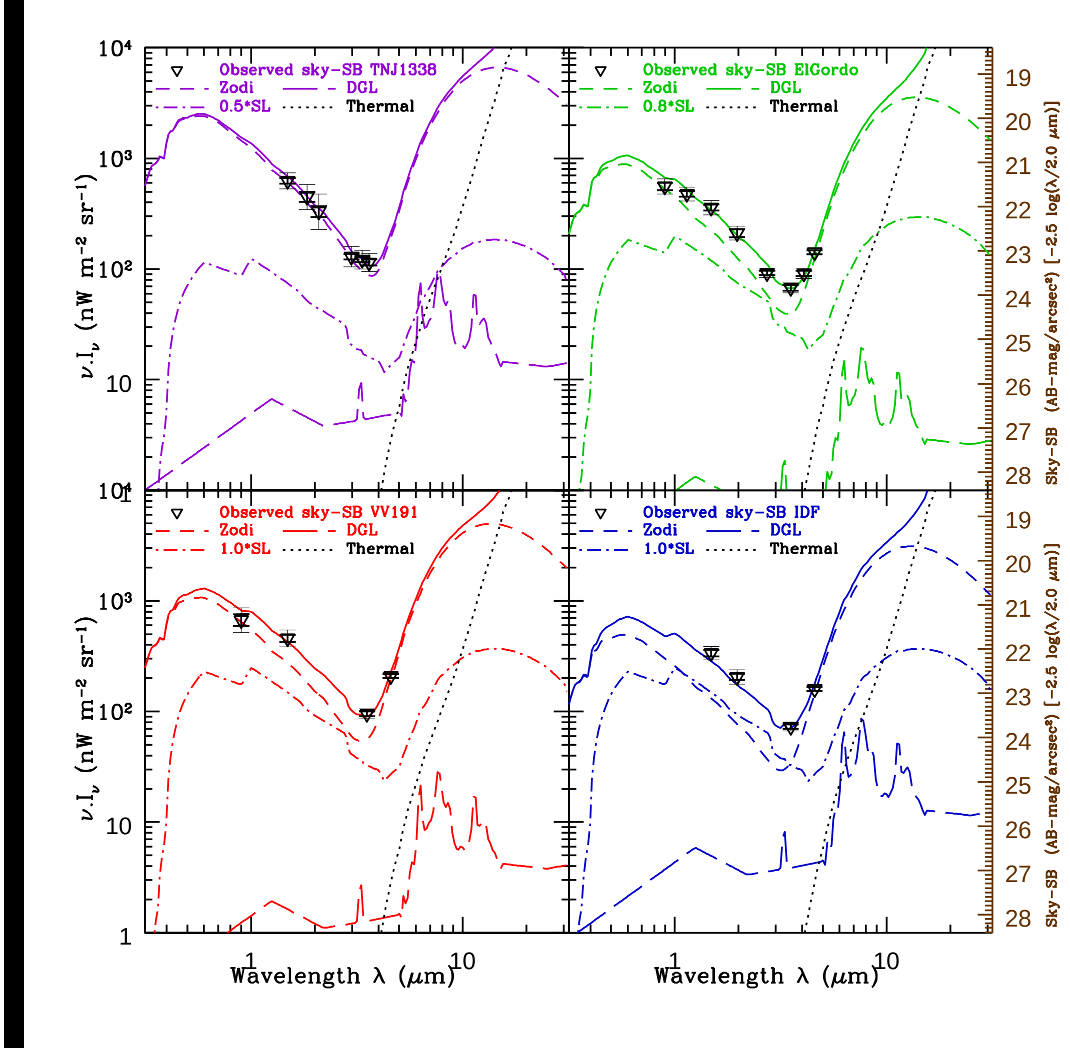
[Right]: Integrated Galaxy Light (IGL) from best fit spline.

4.49 μm WISE+Spitzer+JWST galaxy counts (AB$\simeq$10–30 mag).

- Energy counts narrow with increasing $\boldsymbol{\lambda}$. Peak amplitude around 2 μm.
- 0.9–4.5 μm Integrated Galaxy Light (IGL) now well determined ($\sim$10%)!

(These figures by Scott Tompkins).



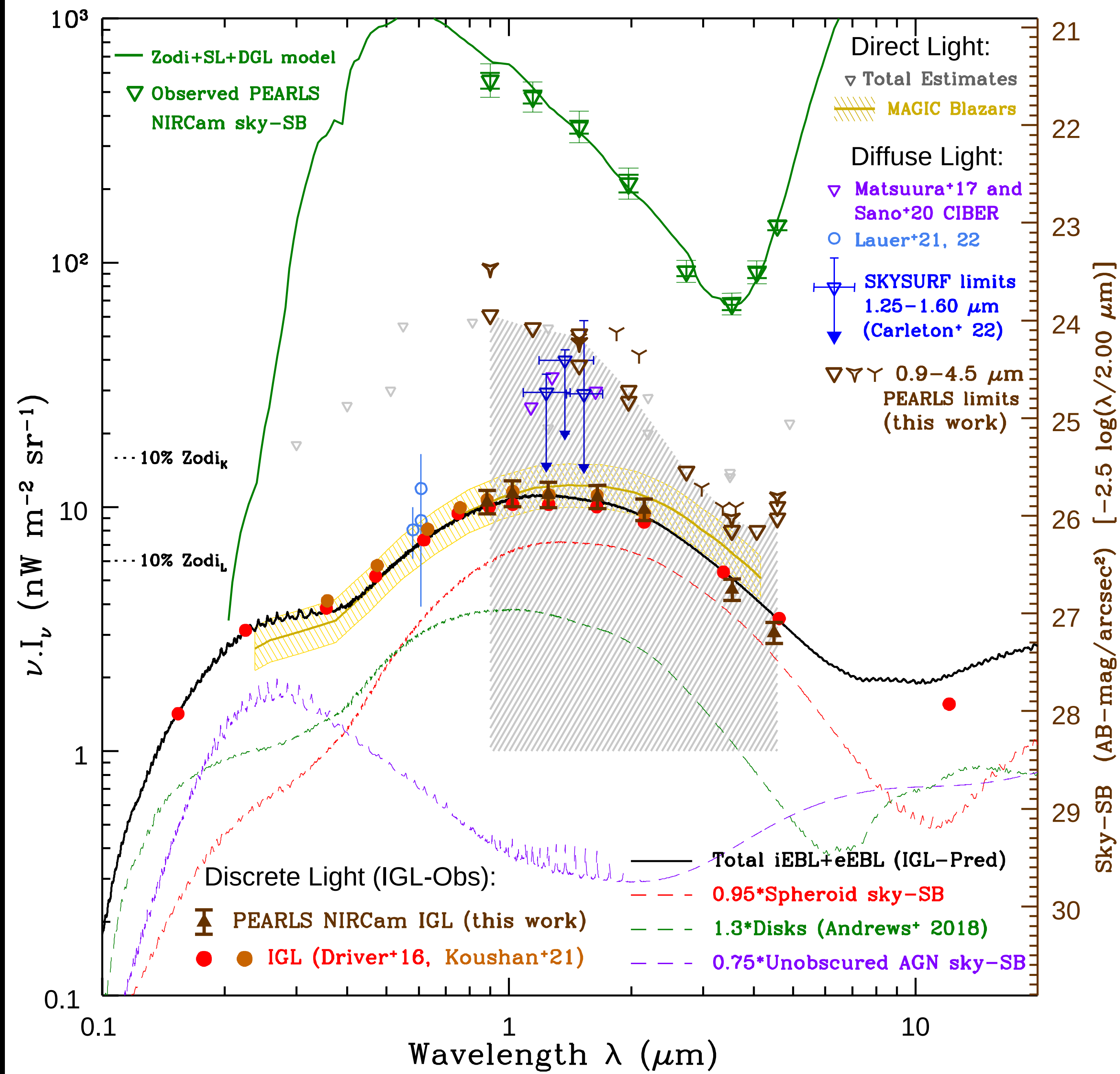


[Left]: IGL vs. $\boldsymbol{\lambda}$: Peak (AB & mks units); IGL FWHM (AB); and $\boldsymbol{\nu . I_\nu}$.

- 0.9–4.5 $\boldsymbol{\mu}$m Integrated Galaxy Light (IGL) now well determined (∼10%)!

[Right]: 13-band sky-SB vs. $\boldsymbol{\lambda}$: Model-sum = Zodi + JWST-Straylight (SL) + Diffuse Galactic Light (DGL) + JWST Thermal

- Model-sums match total JWST NIRCam sky-SB within ∼10% of Zodi.



Conclusions: (1) JWST NIRCam accurately determined 0.9-4.5 μm IGL.

(2) 0.9-2μm diffuse light limits confirm previous work. Firm 2.7-4.5μm limits.

- These limits can significantly improve with many more JWST fields.

Windhorst GTO Lensing Clusters – NIRCam imaging

Soon in a theater near you: JWST data on 7 lensing clusters,
in collaboration with other GTO teams and GO projects, *e.g.*, :

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Cheng, C., Huang, J.-S., Smail, I., et al. 2023, ApJ, 942, L19 (astro-ph/2210.08163)
Diego, J. M., Meena, A. K., Adams, N. J., et al. A&A, submitted (astro-ph/2210.06514)
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• References and other sources of material

Talk: http://www.asu.edu/clas/hst/www/jwst/aas241_143_JWST_PEARLS23.pdf

Data: https://sites.google.com/view/jwstpearls and http://skysurf.asu.edu/

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https://blogs.nasa.gov/webb/2022/12/14/webb-glimpses-field-of-extragalactic-pearls-studded-with-galactic-diamonds/

https://esawebb.org/images/pearls1/zoomable/

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