

# Simulating the IR sky with a SPRITZ

Laura Bisigello

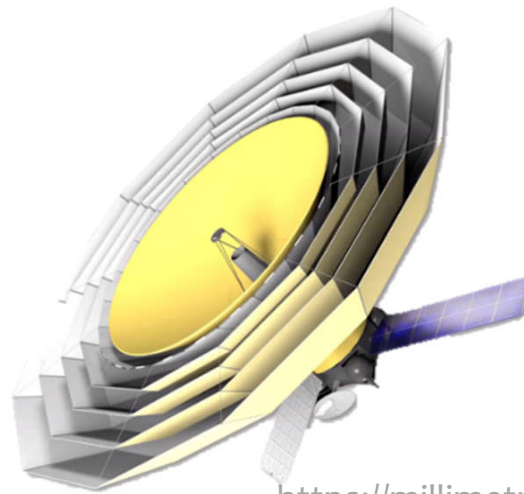
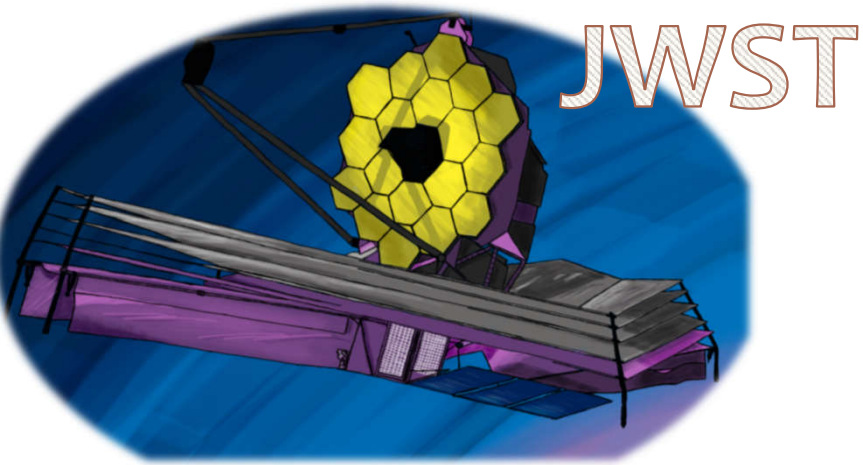
14<sup>th</sup> April 2021

Submillimetre and Millimetre Astronomy, Moscow

Collaborators: C. Gruppioni, A. Feltre, F. Calura, F. Pozzi, C. Vignali, L. Barchiesi, G. Rodighiero, M. Negrello

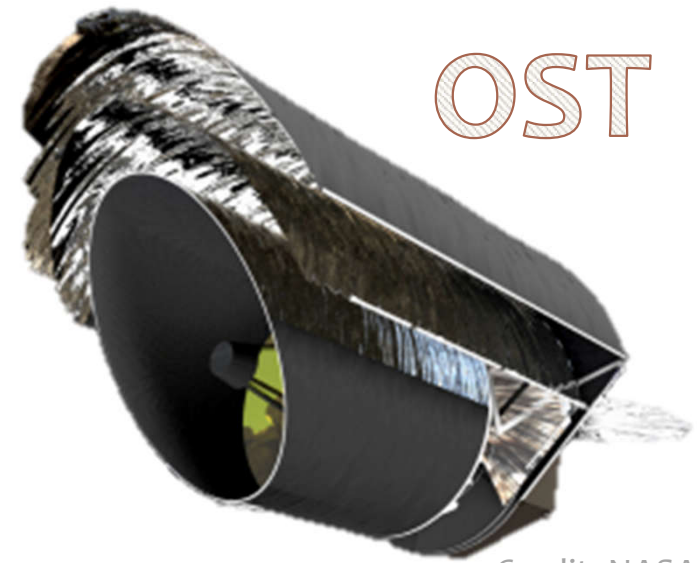


# Future IR telescopes

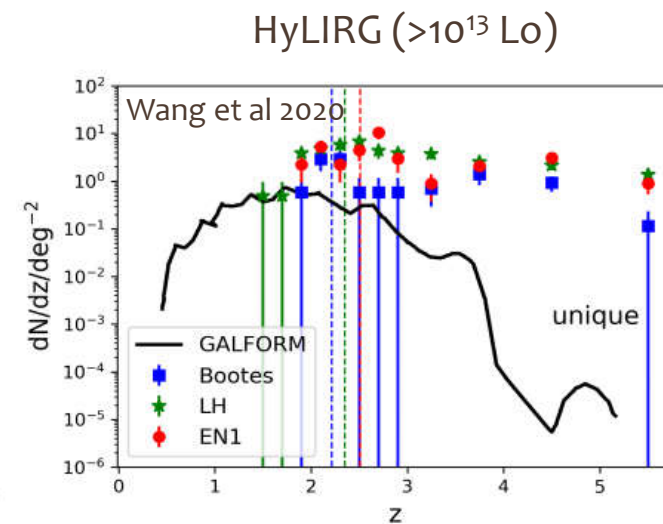
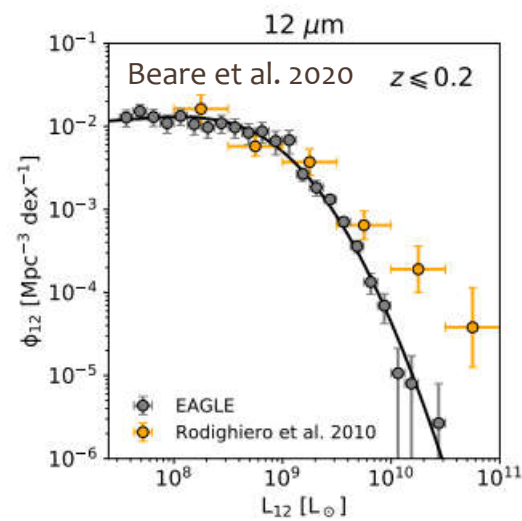
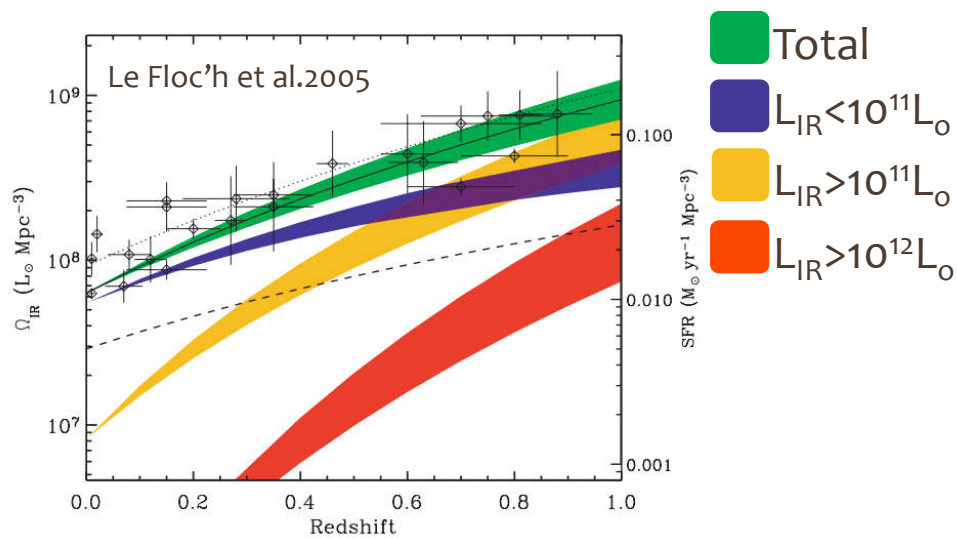
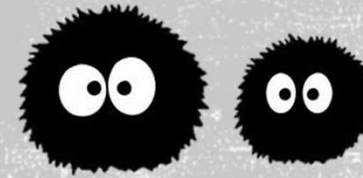


Millimetron

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# The dusty monsters







SPECTRO-PHOTOMETRIC  
REALISATIONS OF INFRARED-  
SELECTED TARGETS AT ALL-Z  
(ARXIV:2011.07074)

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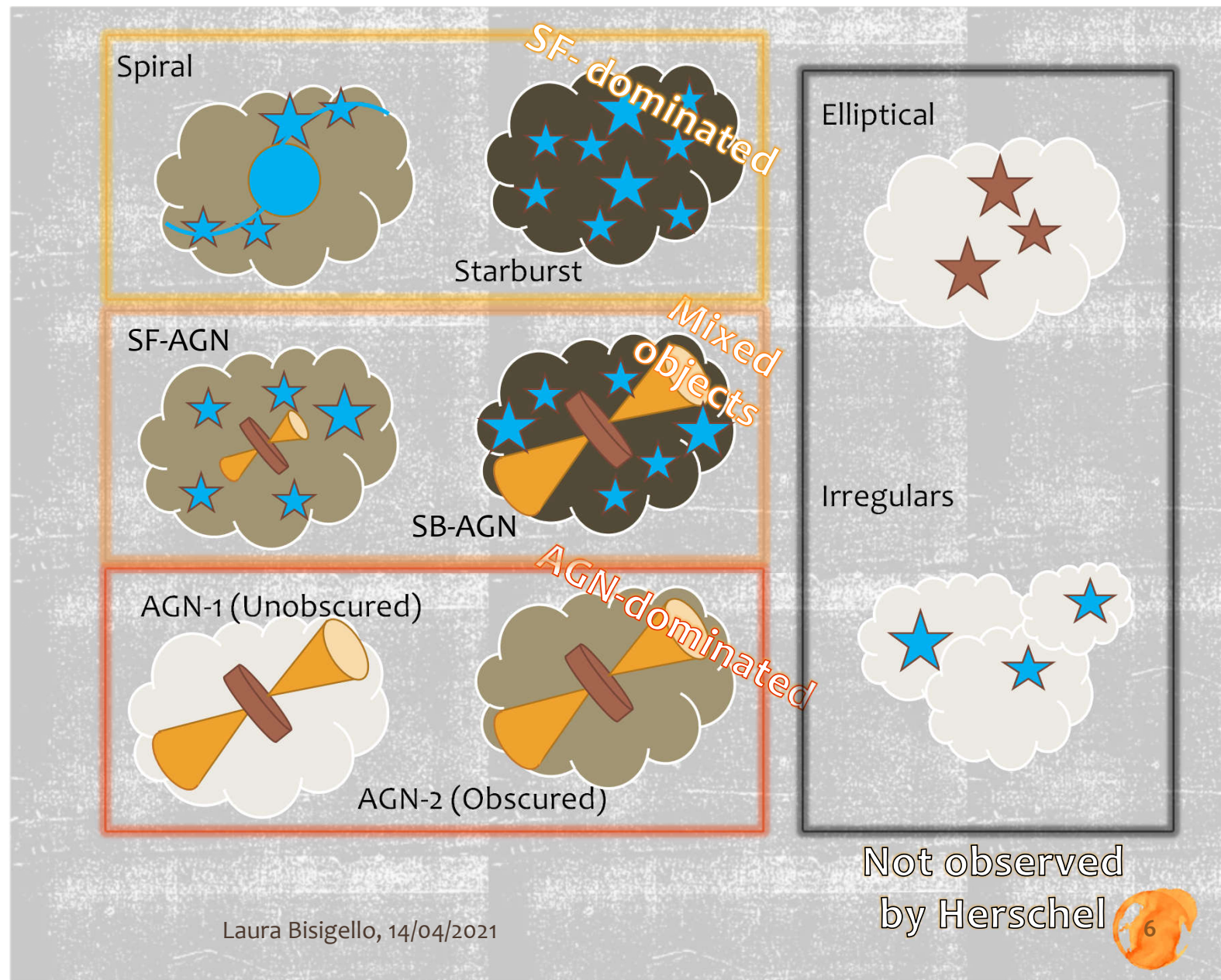


- Simulation structure and creation of mock catalogues
  - Validation with observations
- Applications to future IR telescopes



- ❖ Herschel IR LF (Gruppioni+2013)
- ❖ AGN1-2 LF combining Herschel and UV
- ❖ K-band LF (Arnouts+2007, Cirasuolo+2007 and Beare+2019)
- ❖ GSMF for Irregulars (Huertas-Company+ 2016)

35 SED  
(Polletta+2007, Rieke+2009,  
Gruppioni+2010, Bianchi+2018)





physical  
properties

mock  
fluxes and  
spectra

emission  
line  
luminosities

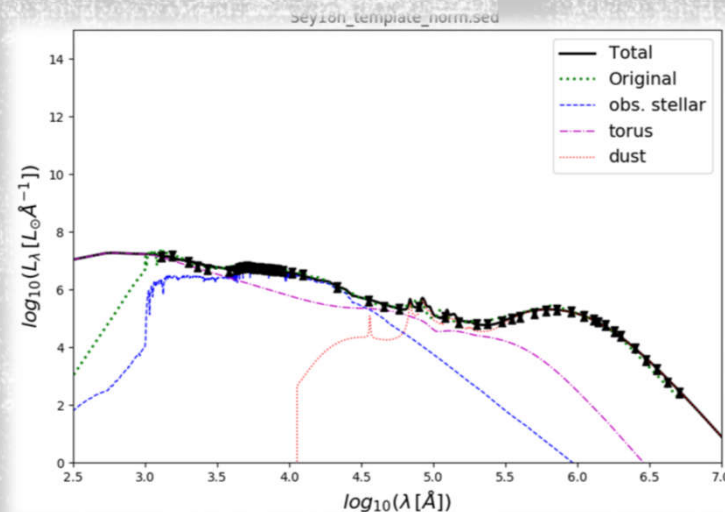
Realistic  
galaxy  
distribution

35 SED

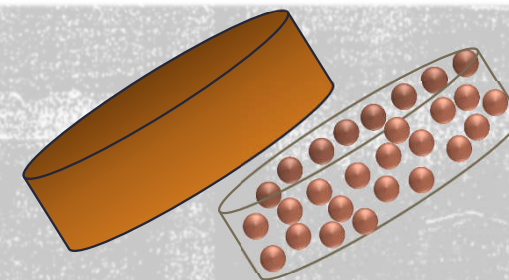
(Polletta+2007, Rieke+2009,  
Gruppioni+2010, Bianchi+2018)

Magphys/Sed3fit

(da Cunha et al. 2008, Berta et al.  
2013)



- Smooth torus (Fritz+2006, Feltre+2012)
- Clumpy torus (Nenkova 2008/b)



- Stellar mass
- AGN fraction
- Accretion luminosity
- Dust extinction
- SFR (IR+UV)
- Hydrogen column density

Photometry in ~150 filters

- ❖ ELT
- ❖ JWST
- ❖ Herschel
- ❖ AKARI ...and others

LR spectroscopy

- X-ray luminosity (from 12μm luminosity, Asmus+2015)
- Metallicity (mass-Z relation, Wuyts+2014)
- Radio luminosity 1.4 GHz (Delhaize+2017 & radio-loud AGN) and 150 MHz (Gürkan+2018)
- >80 emission features (SF+ AGN from NLR) from optical to far-IR

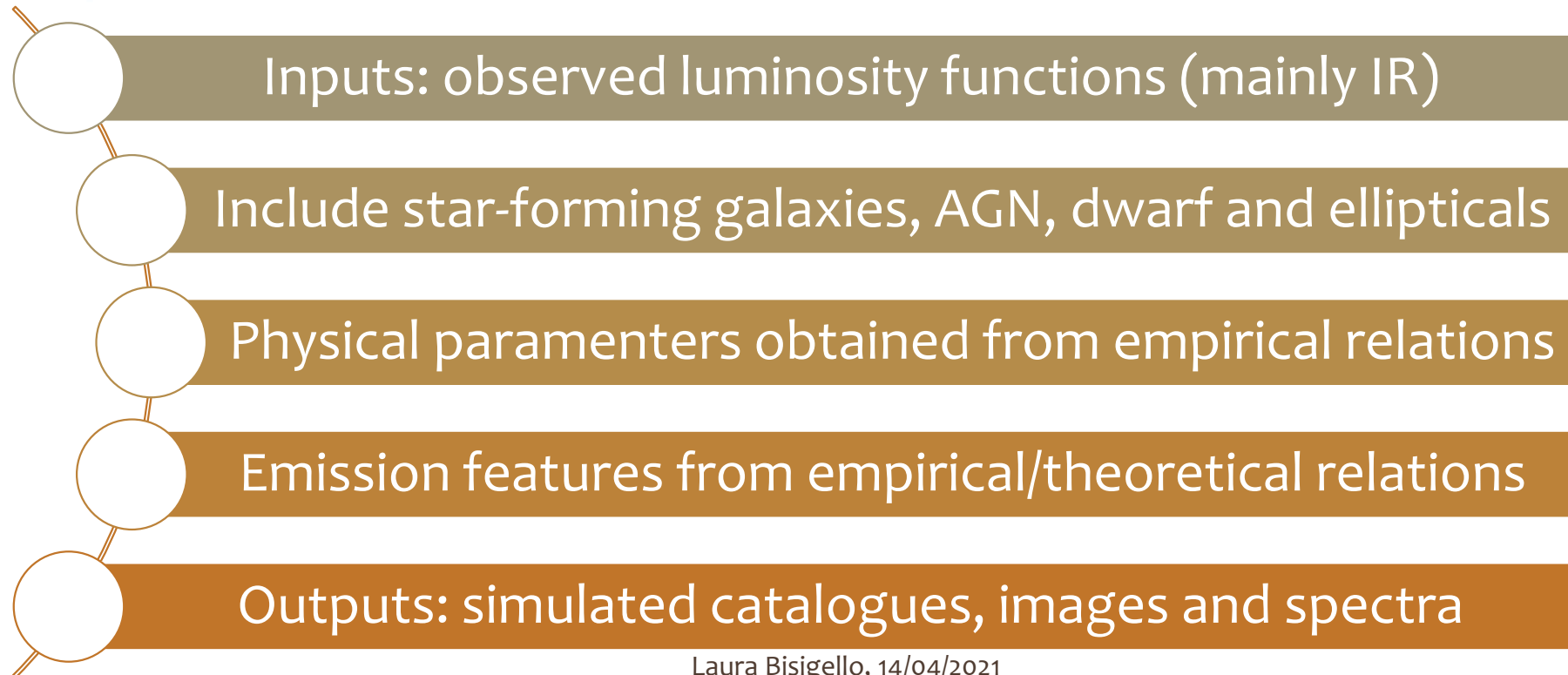
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# SPECTRO-PHOTOMETRIC REALISATIONS OF INFRARED-SELECTED TARGETS AT ALL-Z

(BISIGELLO ET AL., SUBM., ARXIV:2011.07074)



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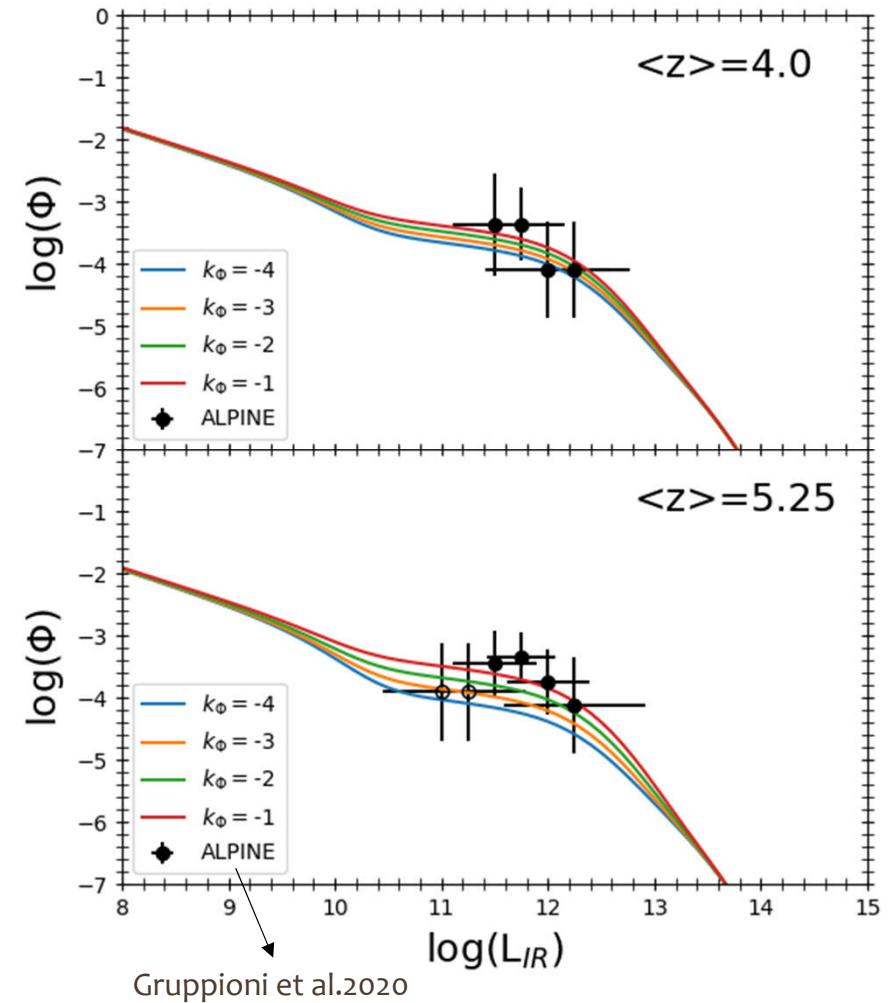
- ✓ Simulation structure and creation of mock catalogues
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# HIGH- $z$ ( $z > 3$ ) EXTRAPOLATION

$$\Phi(L)d\log_{10}L = \Phi^* \left( \frac{L}{L^*} \right)^{(1-\alpha)} \exp \left[ -\frac{1}{2\sigma^2} \log_{10}^2 \left( 1 + \frac{L}{L^*} \right) \right] d\log_{10}L$$

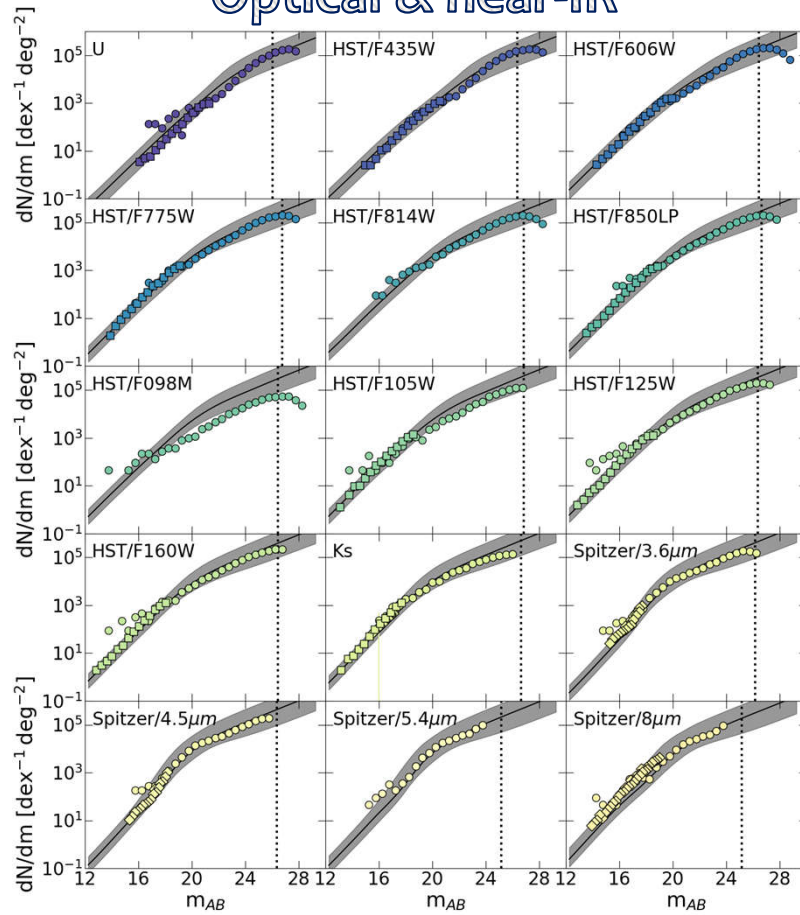
$$\Phi^* \propto \begin{cases} (1+z)^{k_{\rho,1}}, & \text{if } z \leq z_{\rho} \\ (1+z)^{k_{\rho,2}}, & \text{if } z_{\rho} < z < 3 \\ (1+z)^{k_{\phi}}, & \text{if } z \geq 3 \end{cases}$$

$$L^* \propto \begin{cases} (1+z)^{k_{L,1}}, & \text{if } z \leq z_L \\ (1+z)^{k_{L,2}}, & \text{if } z_L < z < 3 \\ \text{constant}, & \text{if } z_L \geq 3 \end{cases}$$

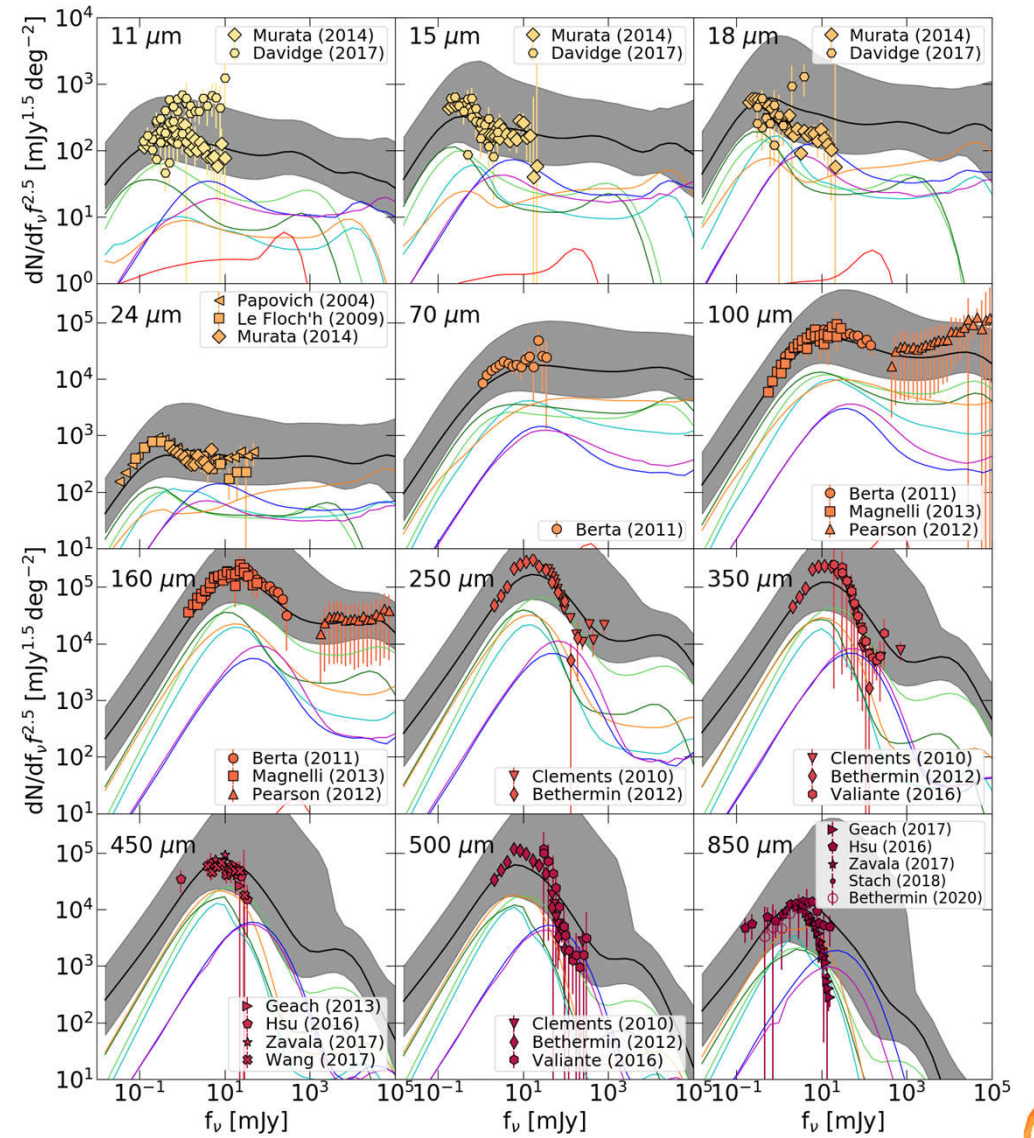


# NUMBER COUNTS

## Optical & near-IR



## Far-IR



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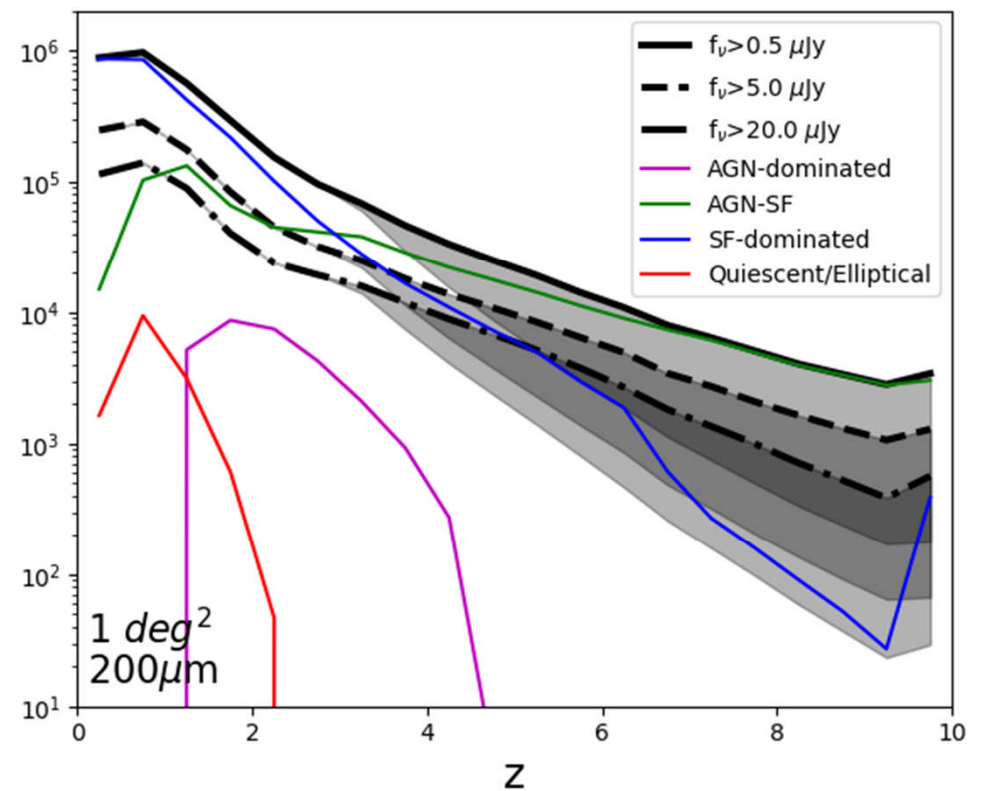
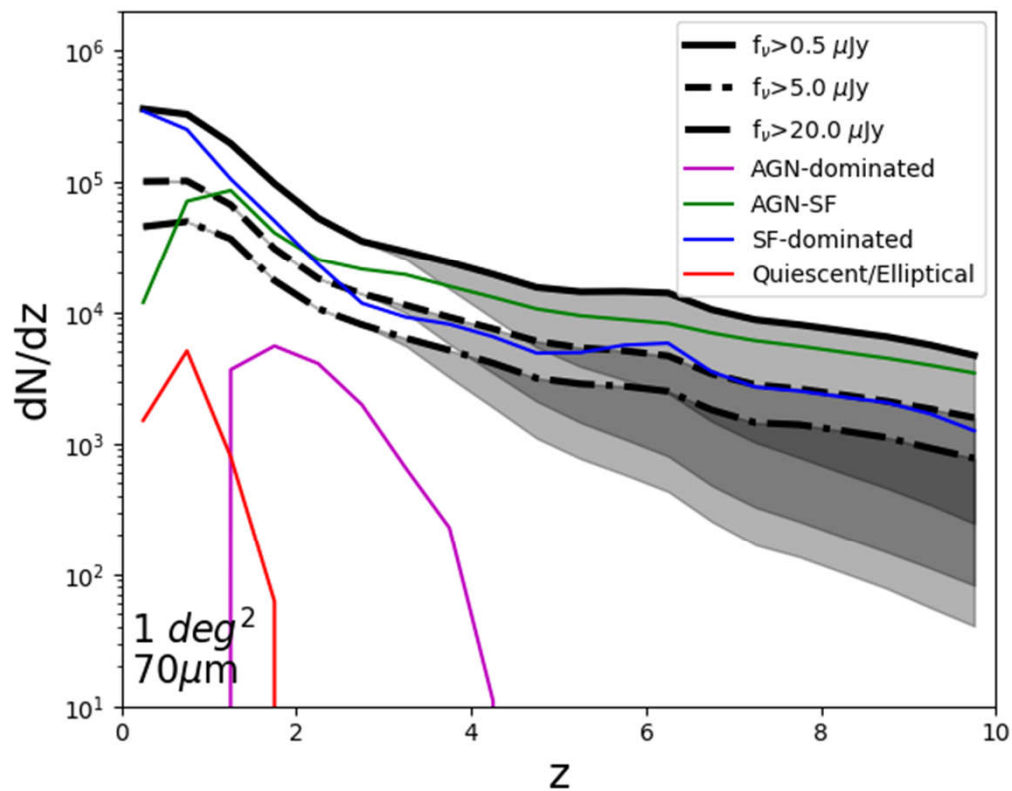




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# REDSHIFT DISTRIBUTION

It can be repeated with  
different settings to  
test different survey  
planning!



Precise Millimetron filters can be  
included in the future

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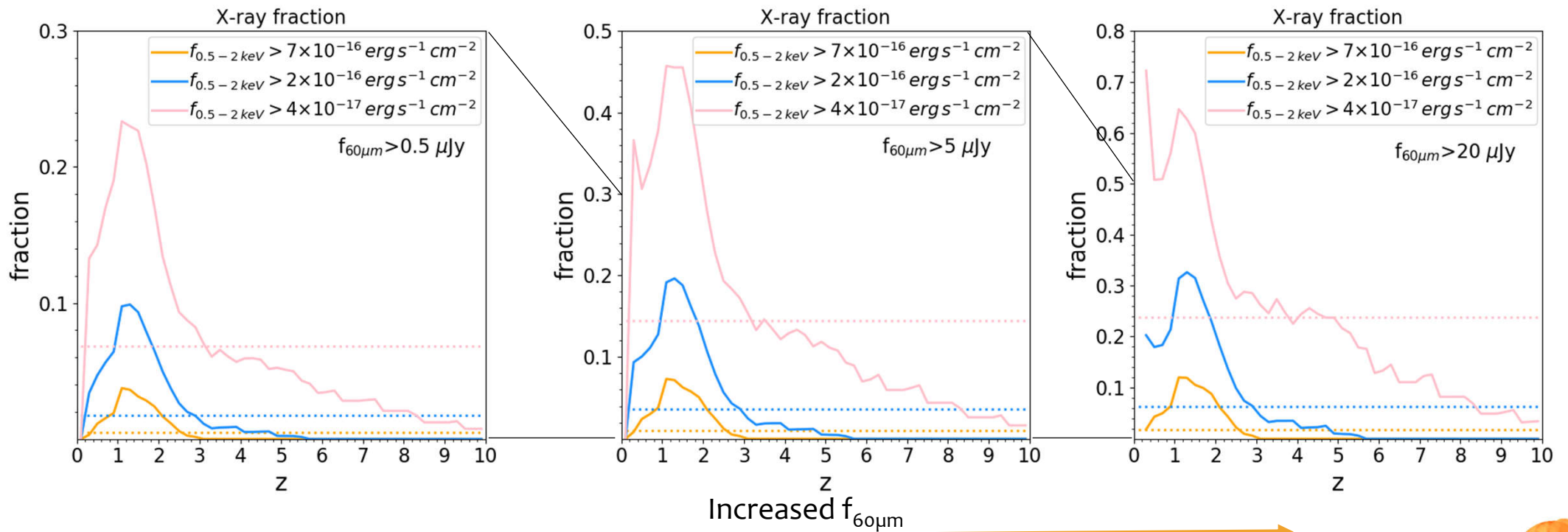


# X-RAY/IR SYNERGIES

— XMM-Newton Deep survey in COSMOS

— Chandra Deep survey in COSMOS

— Athena Deep Survey

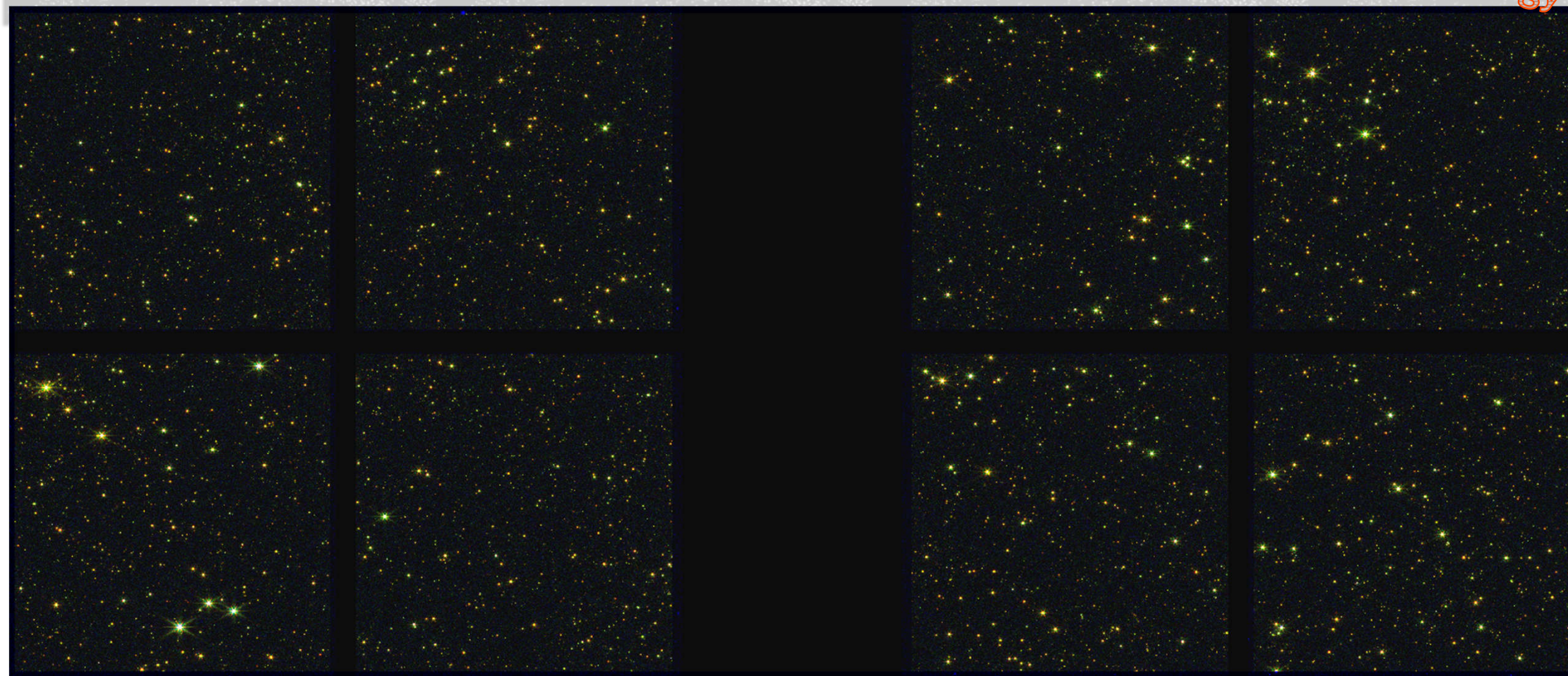


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# SIMULATED IMAGES FOR JWST

Next-step:  
Include morphology

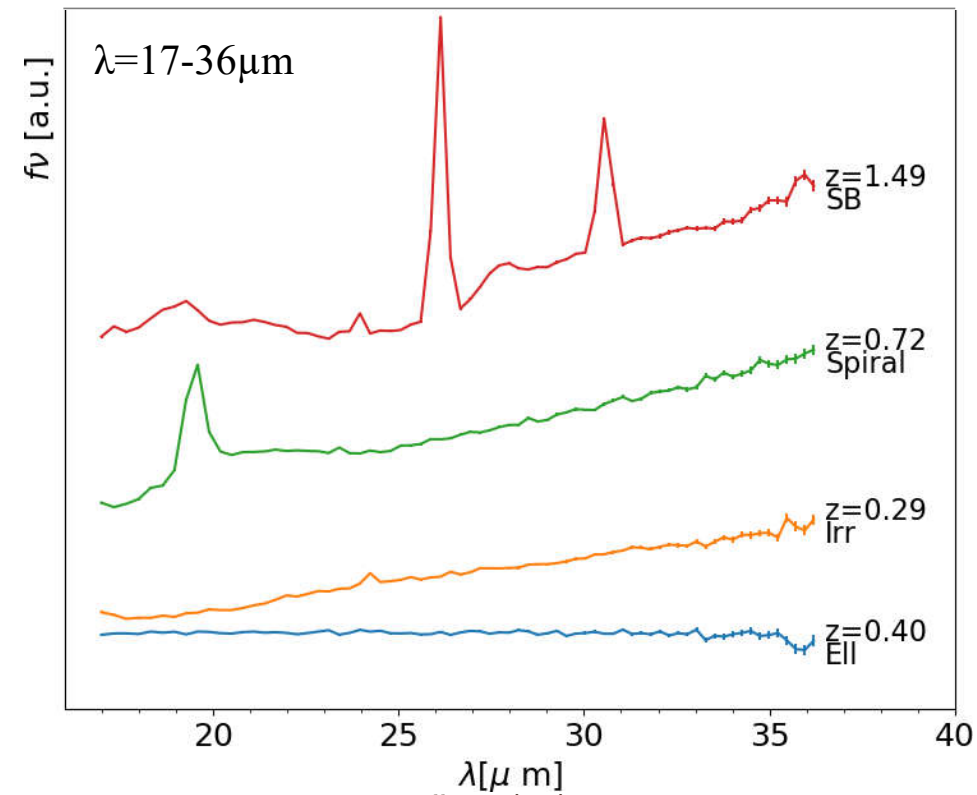


F090W (blue), F277W (green) and F444W (red)

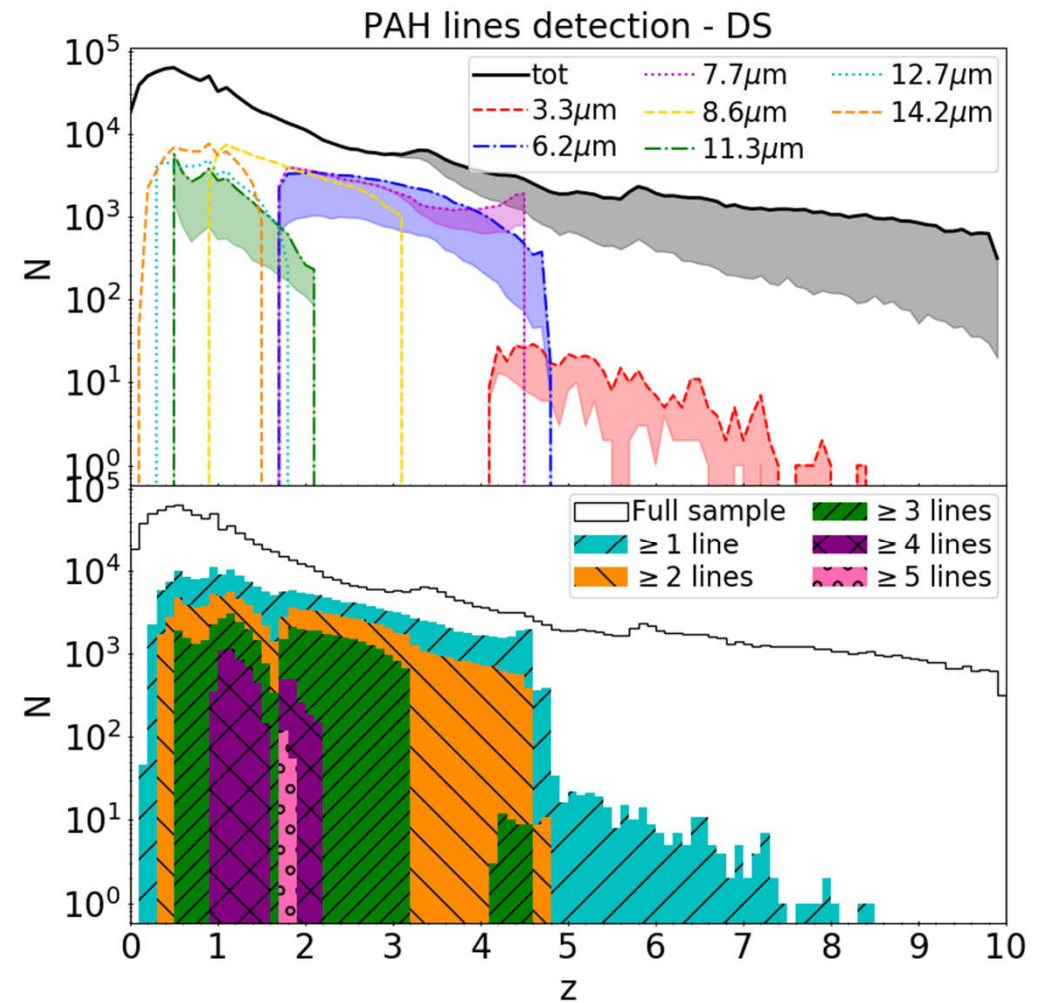
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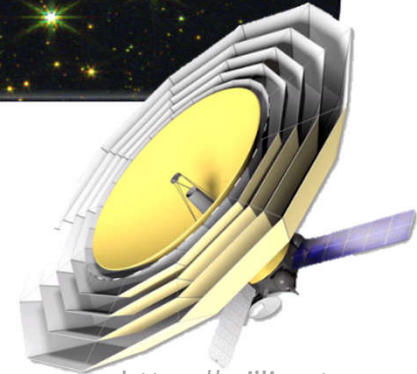
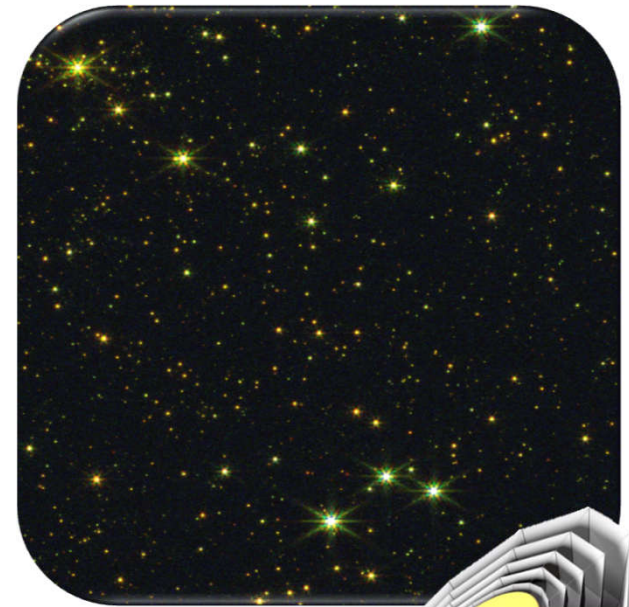


# SIMULATED SPECTRA A SPICA EXAMPLE



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<https://millimetre.ru/>

## SPECTRO-PHOTOMETRIC REALISATIONS OF INFRARED- SELECTED TARGETS AT ALL-Z

(BISIGELLO ET AL. SUBM, ARXIV:2011.07074)

[HTTPS://SITES.GOOGLE.COM/INAF.IT/LAURABISIGELLO/SPRITZ](https://sites.google.com/inaf.it/laurabisigello/spritz)

**New version available!**

Laura Bisigello, 14/04/2021