

SPHEREx and redshifts

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Johns Hopkins University

Extragalactic SPHEREx

1 million quasar spectra

100 million high-quality redshifts

1 billion sources

10 million blended sources

10 billion pixels

1 trillion spectral-spatial elements

redshift estimation

source with spec z

source with $p(z | \text{knowledge})$

overlapping sources

photon field



SPHEREx redshift estimation

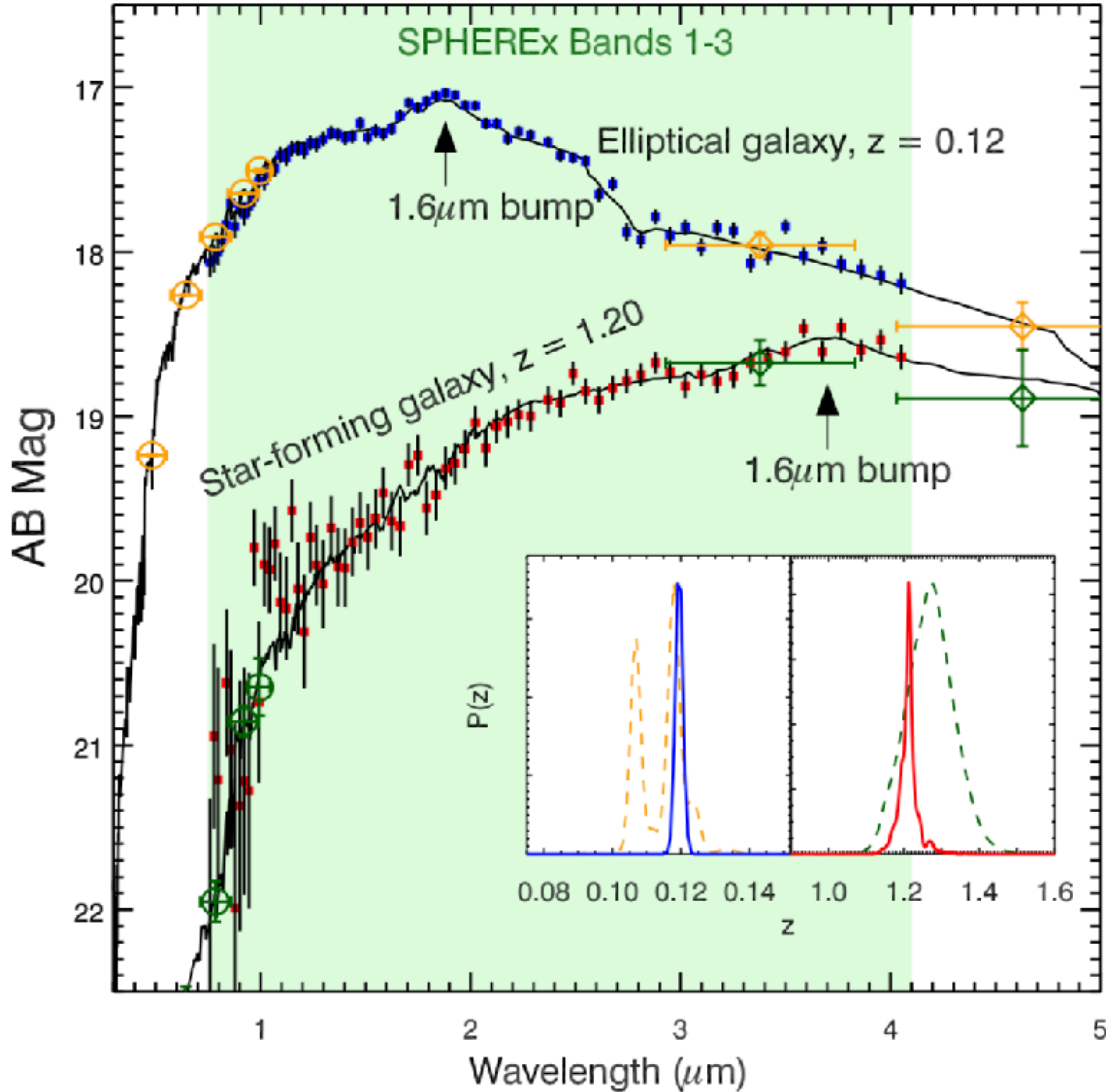
Doré et al.

source with spec z

source with p(z | knowledge)

overlapping sources

photon field



SPHEREx redshift estimation

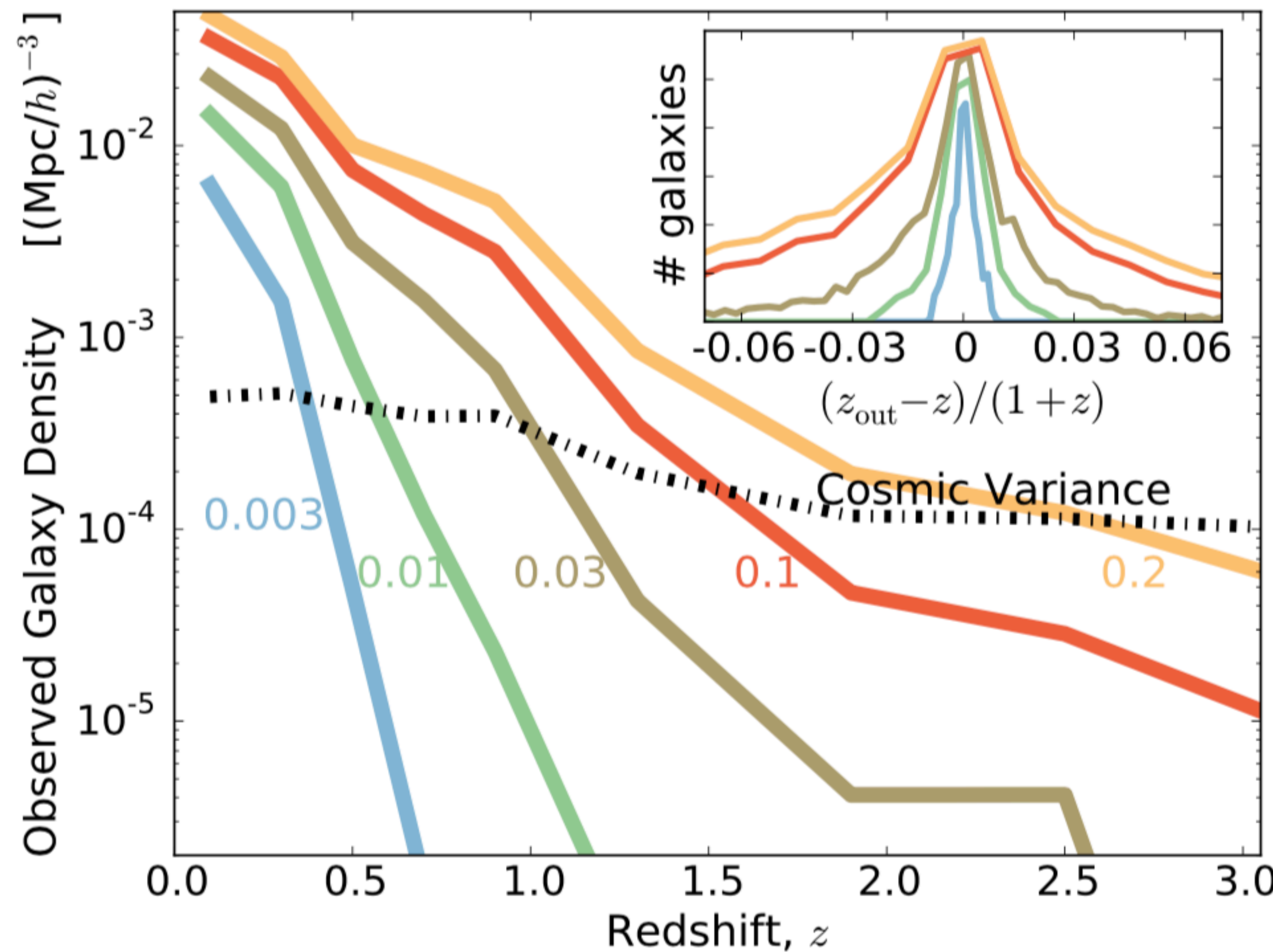
source with spec z

source, $p(z | \text{knowledge})$

overlapping sources

photon field

$p(z | \text{photometry, spectral templates})$ Doré et al.



100 million “high-quality” redshifts

SPHEREx redshift estimation

redshift estimation

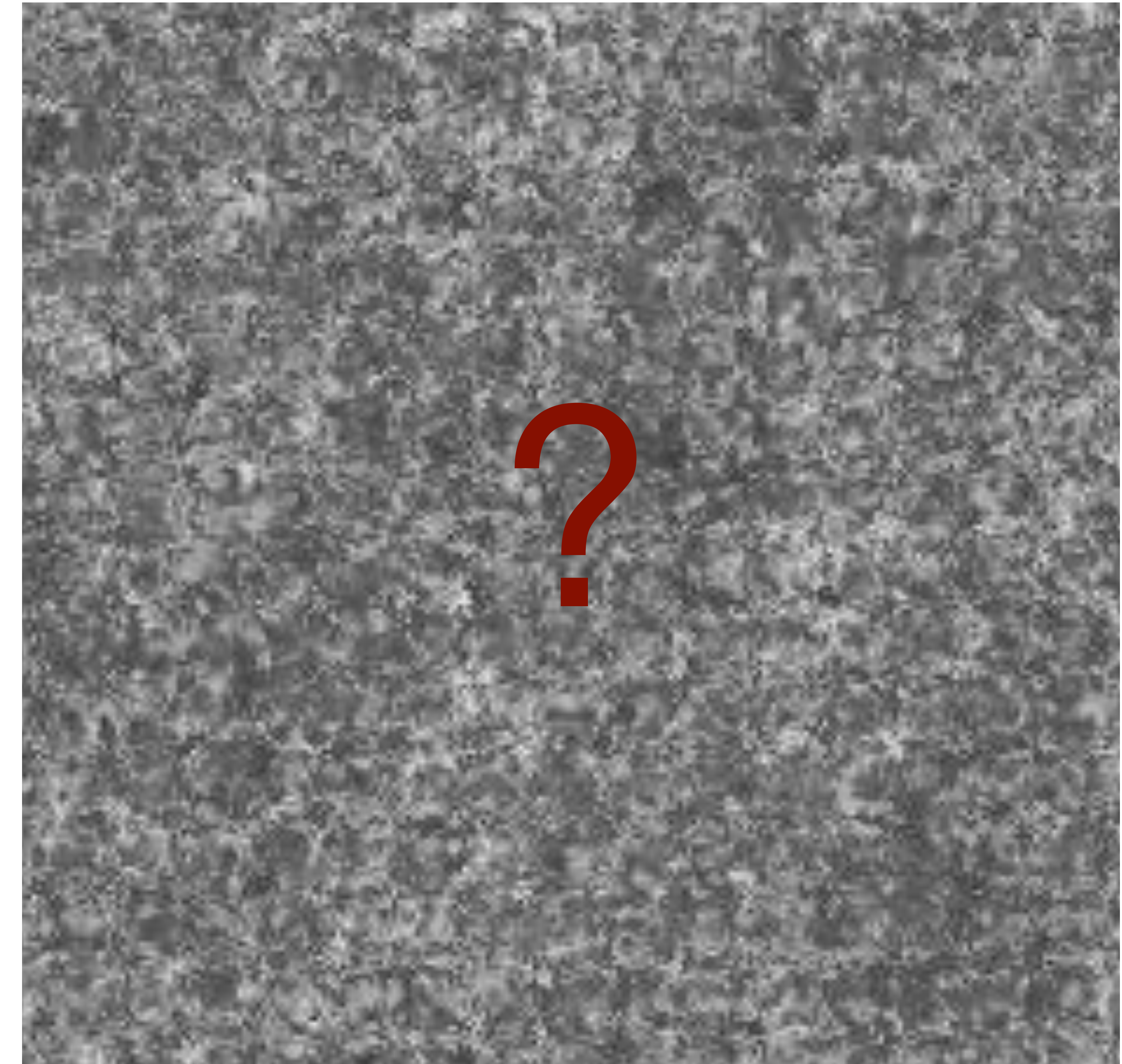
$$p(z \mid \text{photometry}, \delta_{3D})$$

source with spec z

source, $p(z \mid \text{knowledge})$

overlapping sources

photon field



SPHEREx redshift estimation

redshift estimation

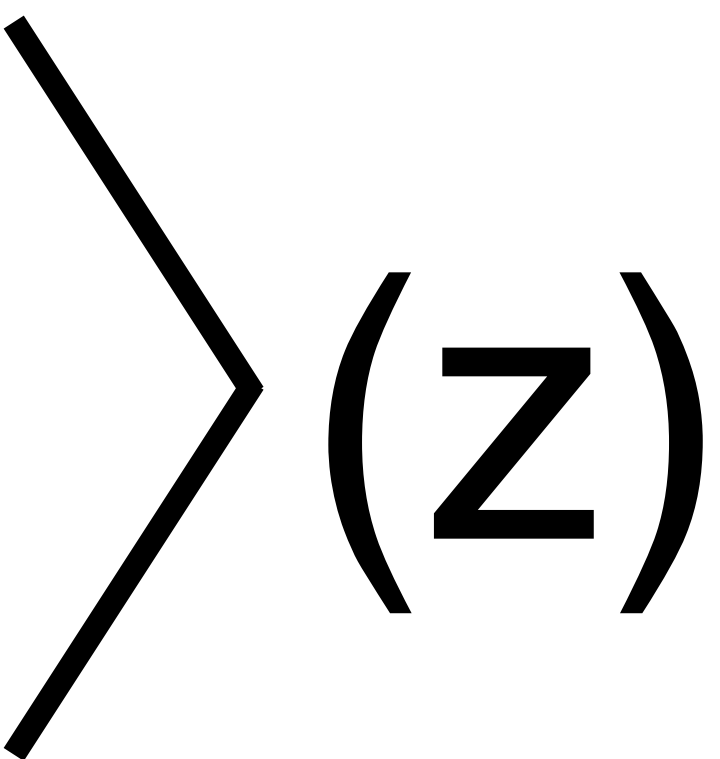
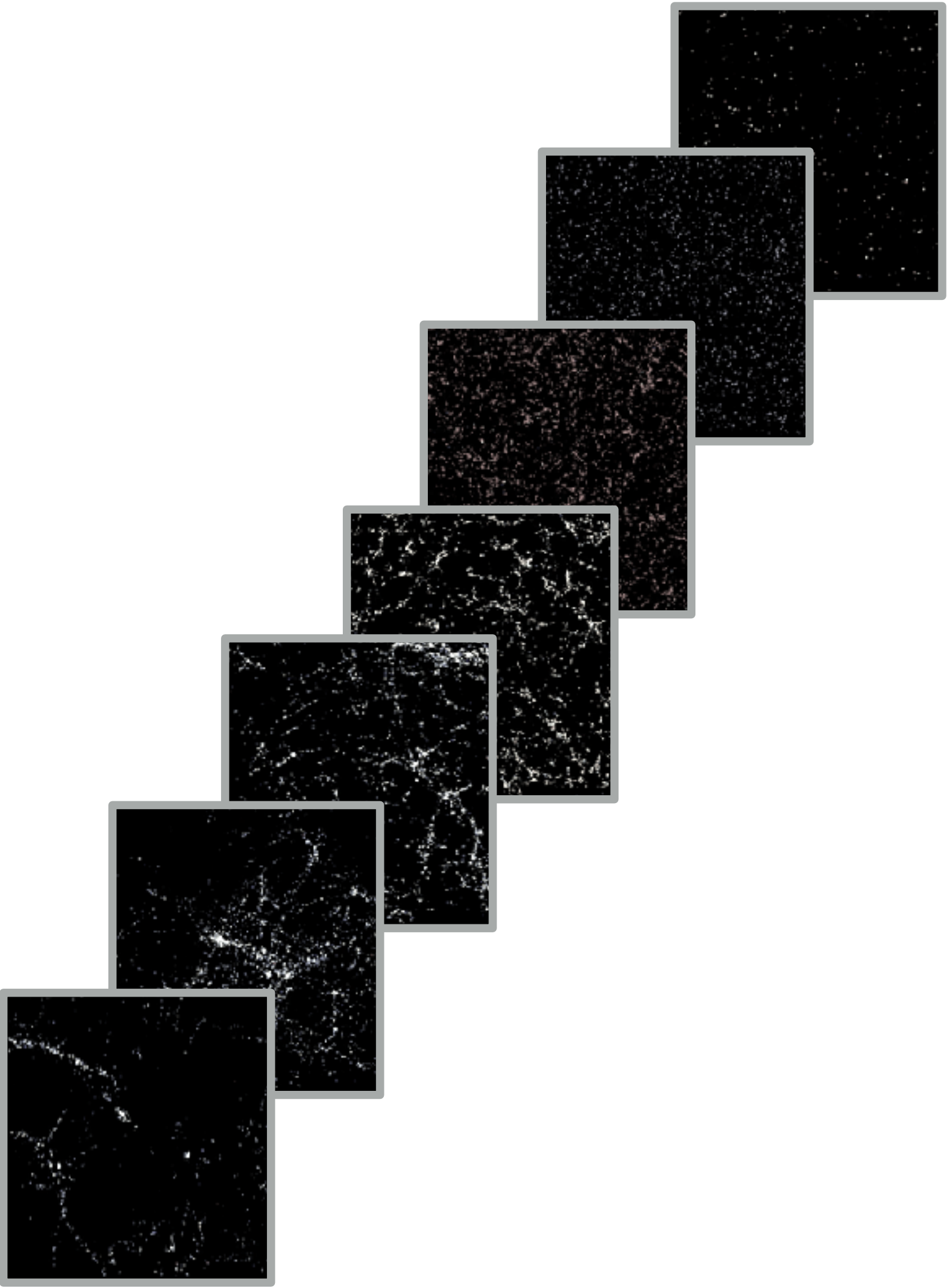
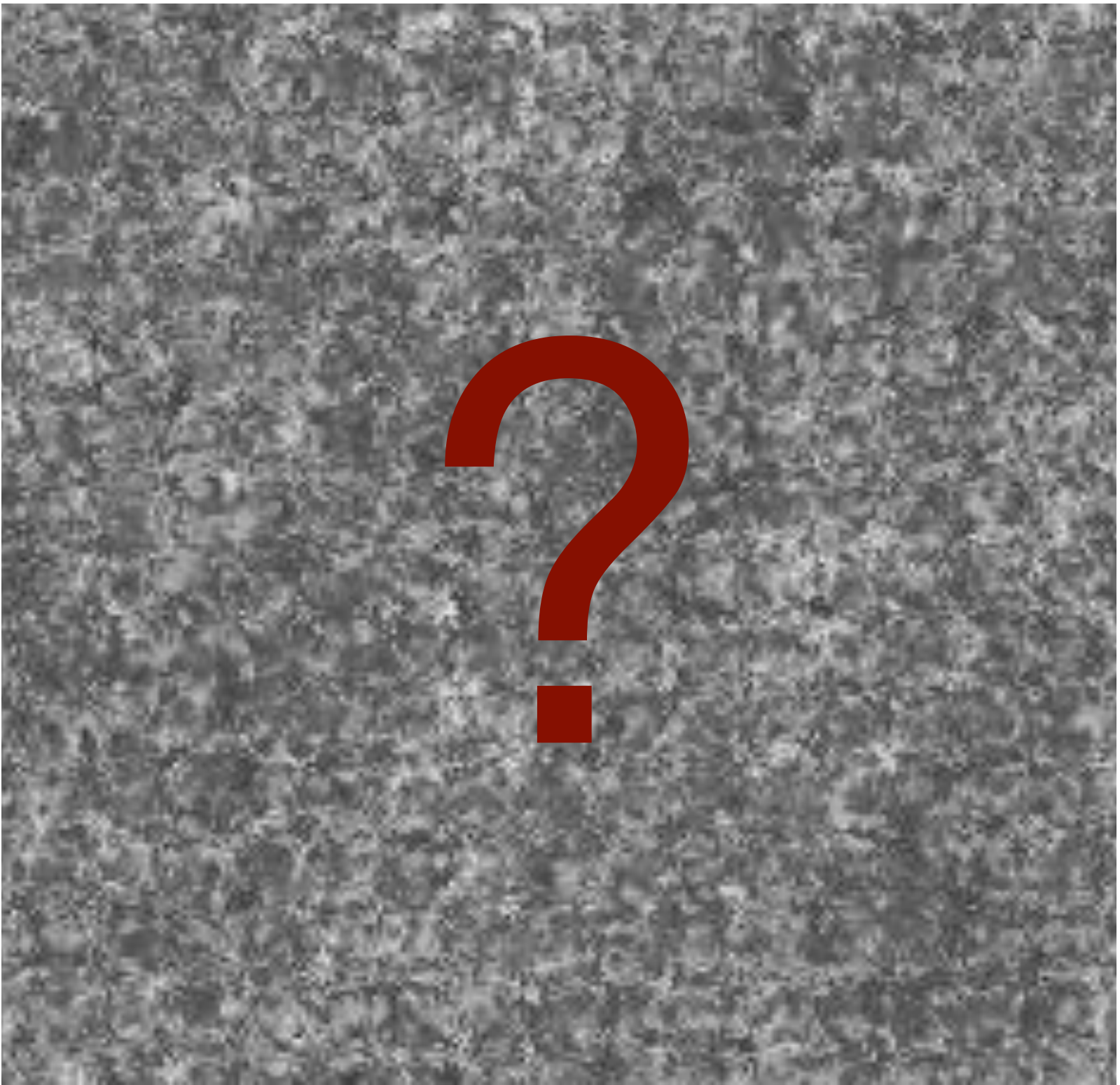
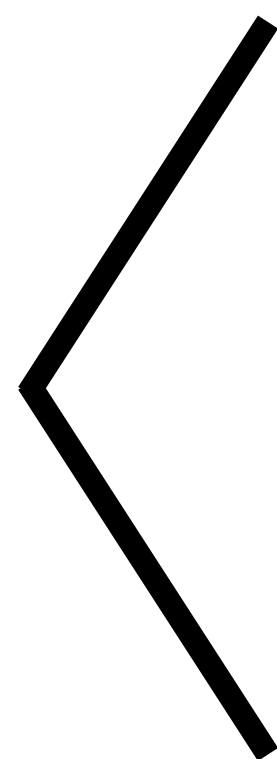
source with spec z

source, $p(z | \text{knowledge})$

overlapping sources

photon field

$$p(z | \text{photometry}, \delta_{3D})$$



(z)

sample with
unknown
redshifts

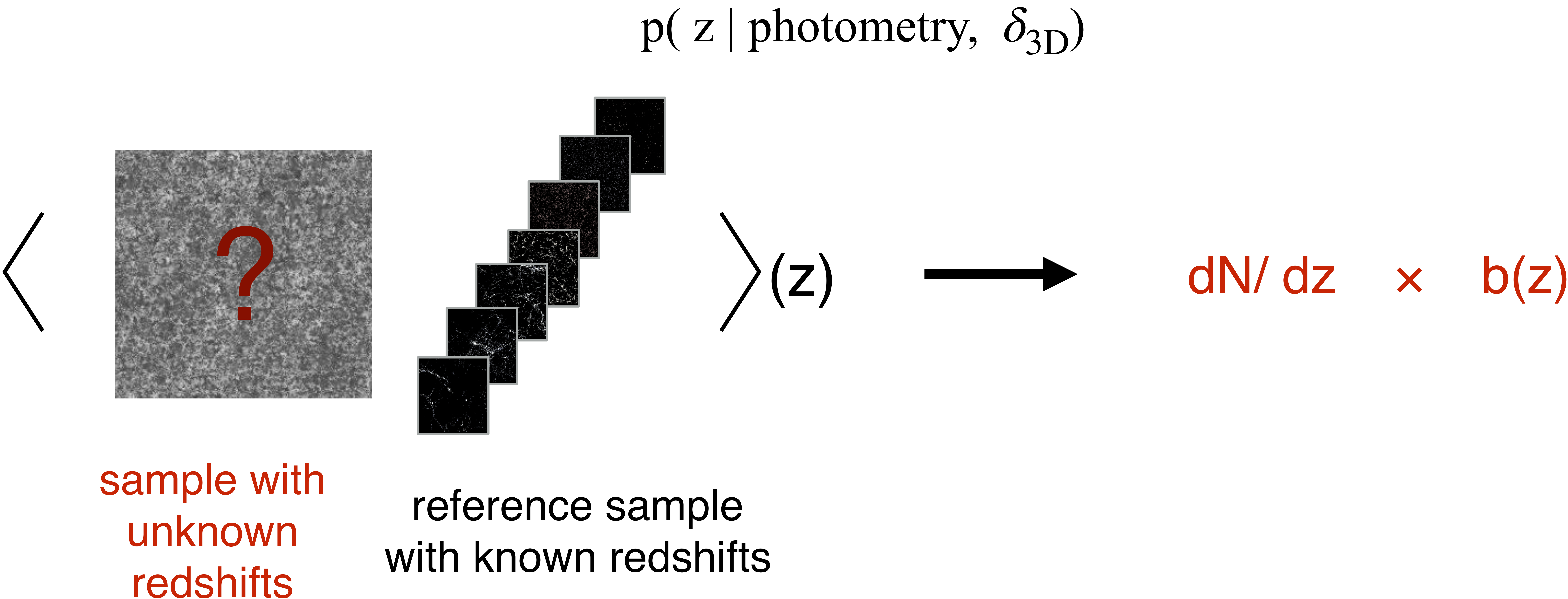
reference sample
with known redshifts



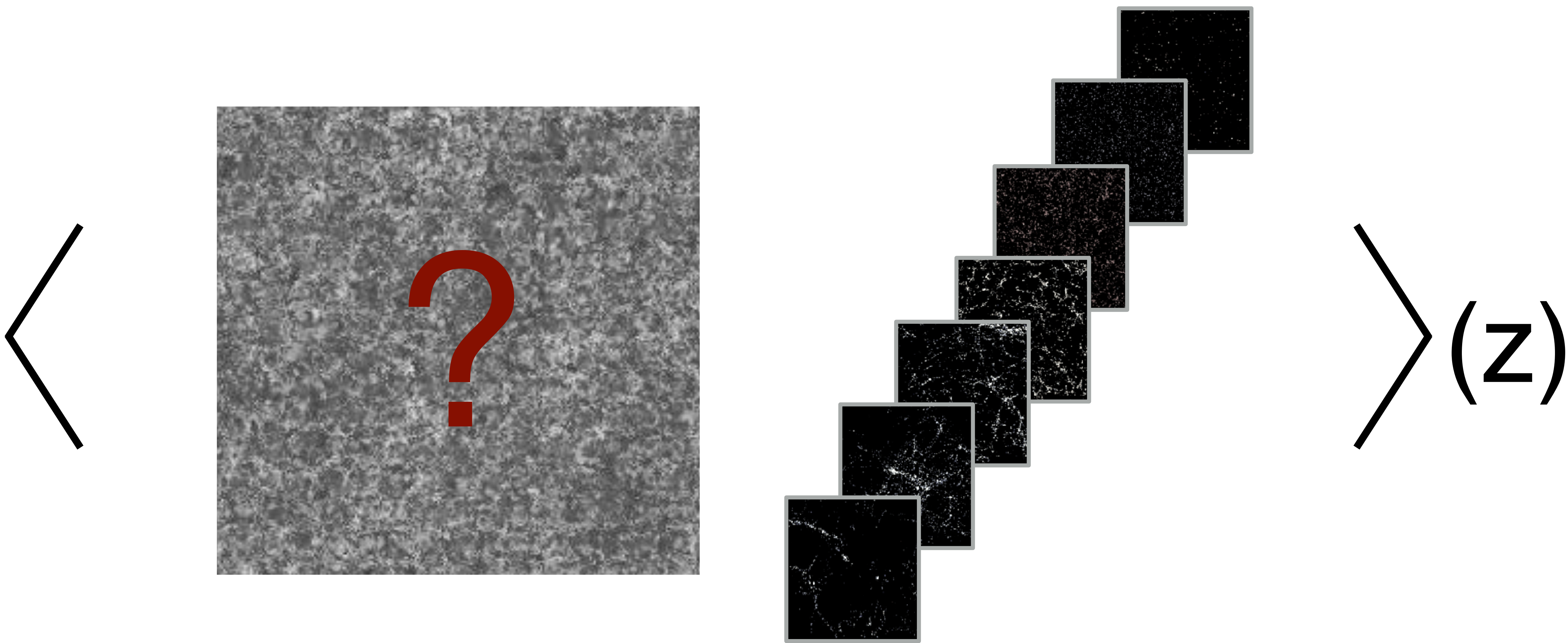
$$\frac{dN}{dz} \times b(z)$$

SPHEREx redshift estimation

redshift estimation

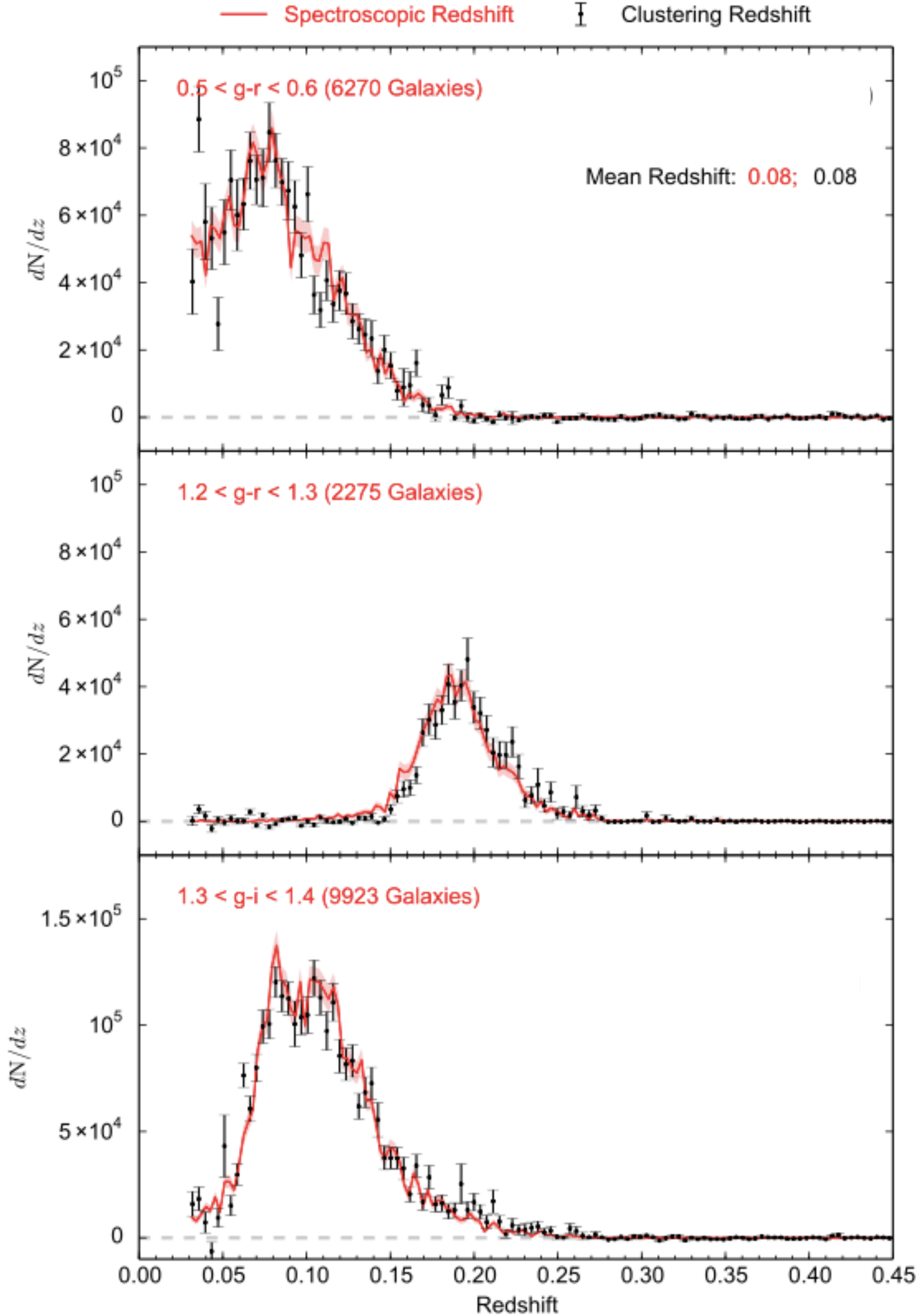


SPHEREx redshift estimation



sample with
unknown
redshifts

reference sample
with known redshifts



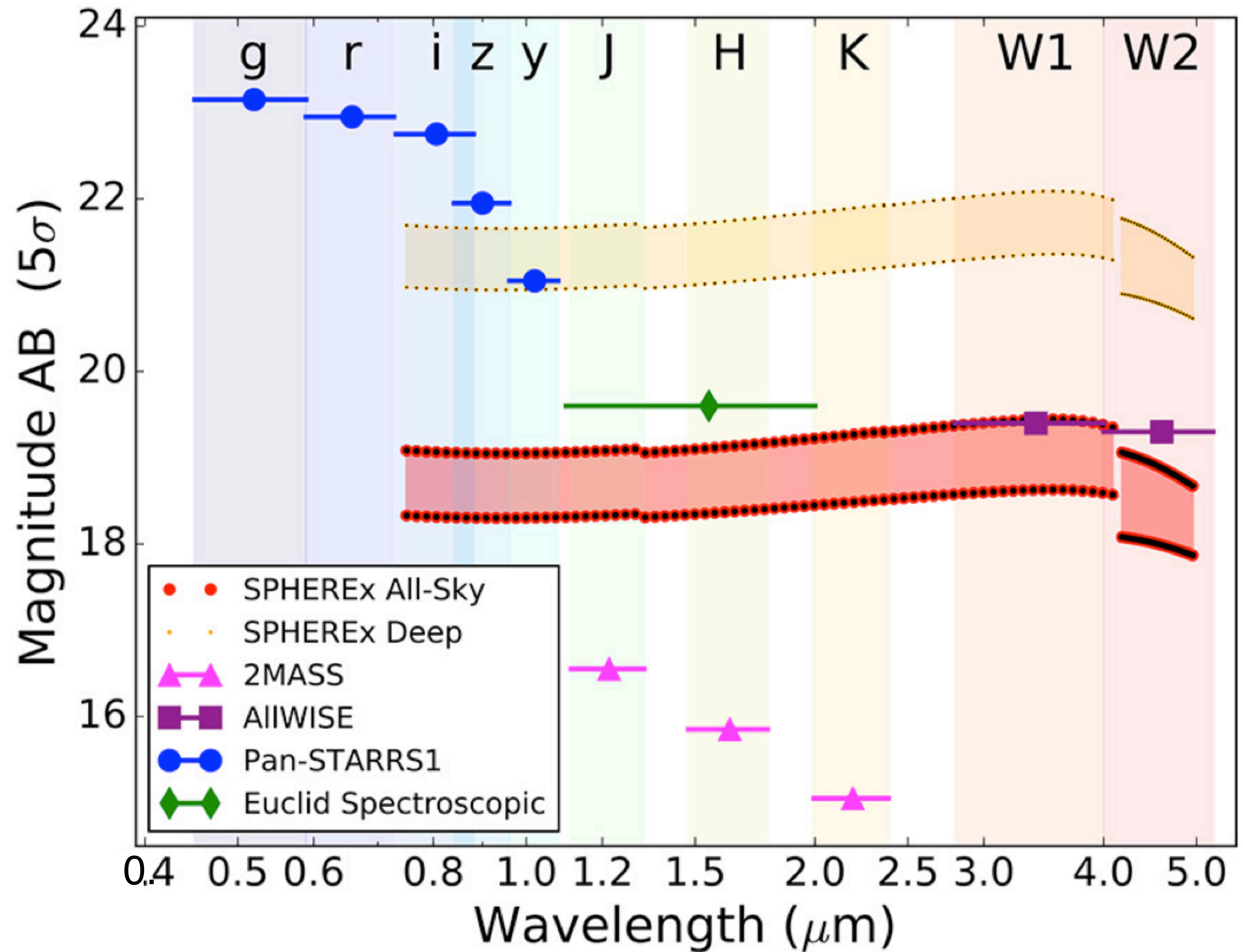
SPHEREx survey depth

source with spec z

source, $p(z)$

overlapping sources

photon field /
extra-galactic
background light



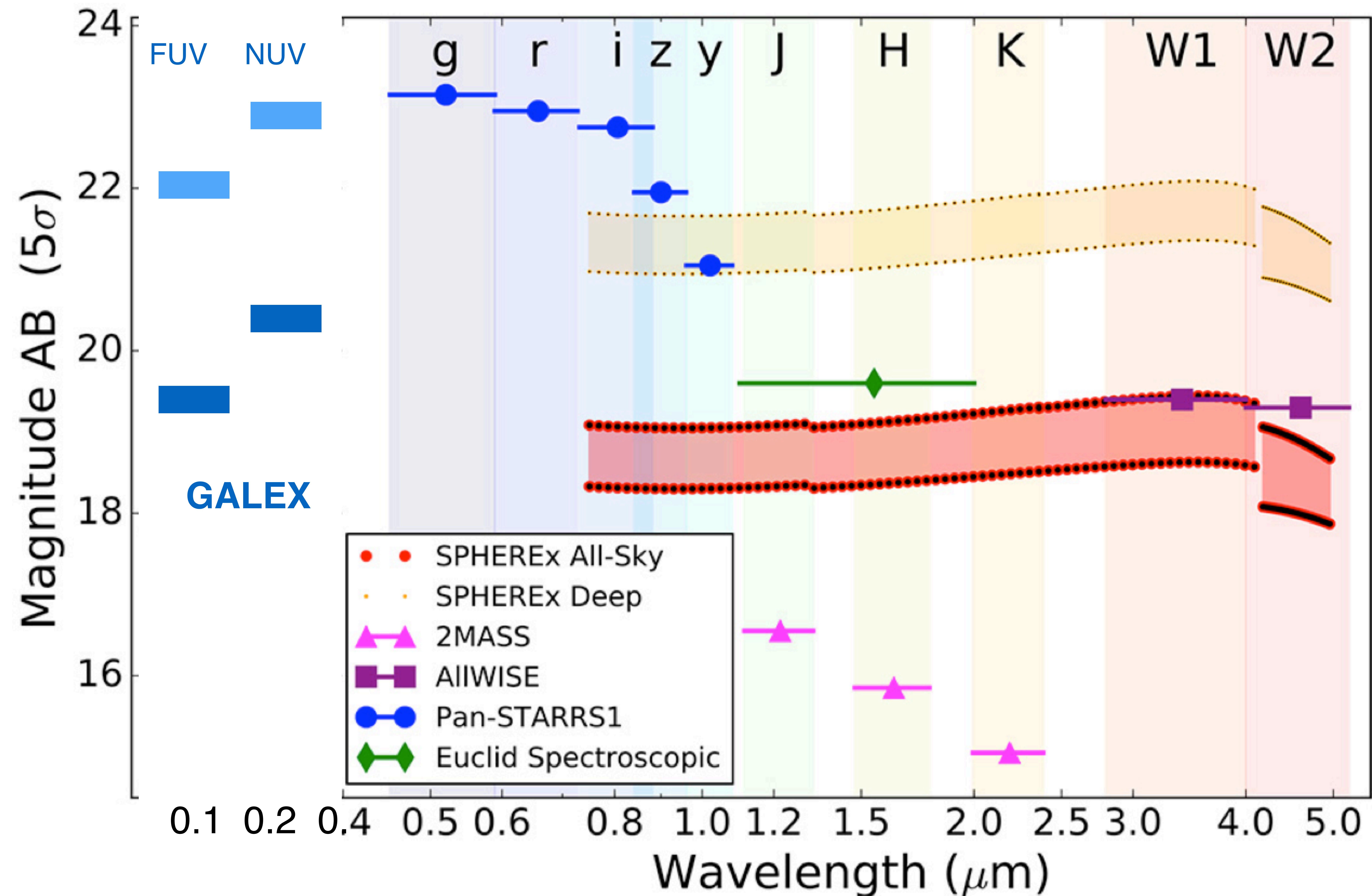
SPHEREx survey depth

source with spec z

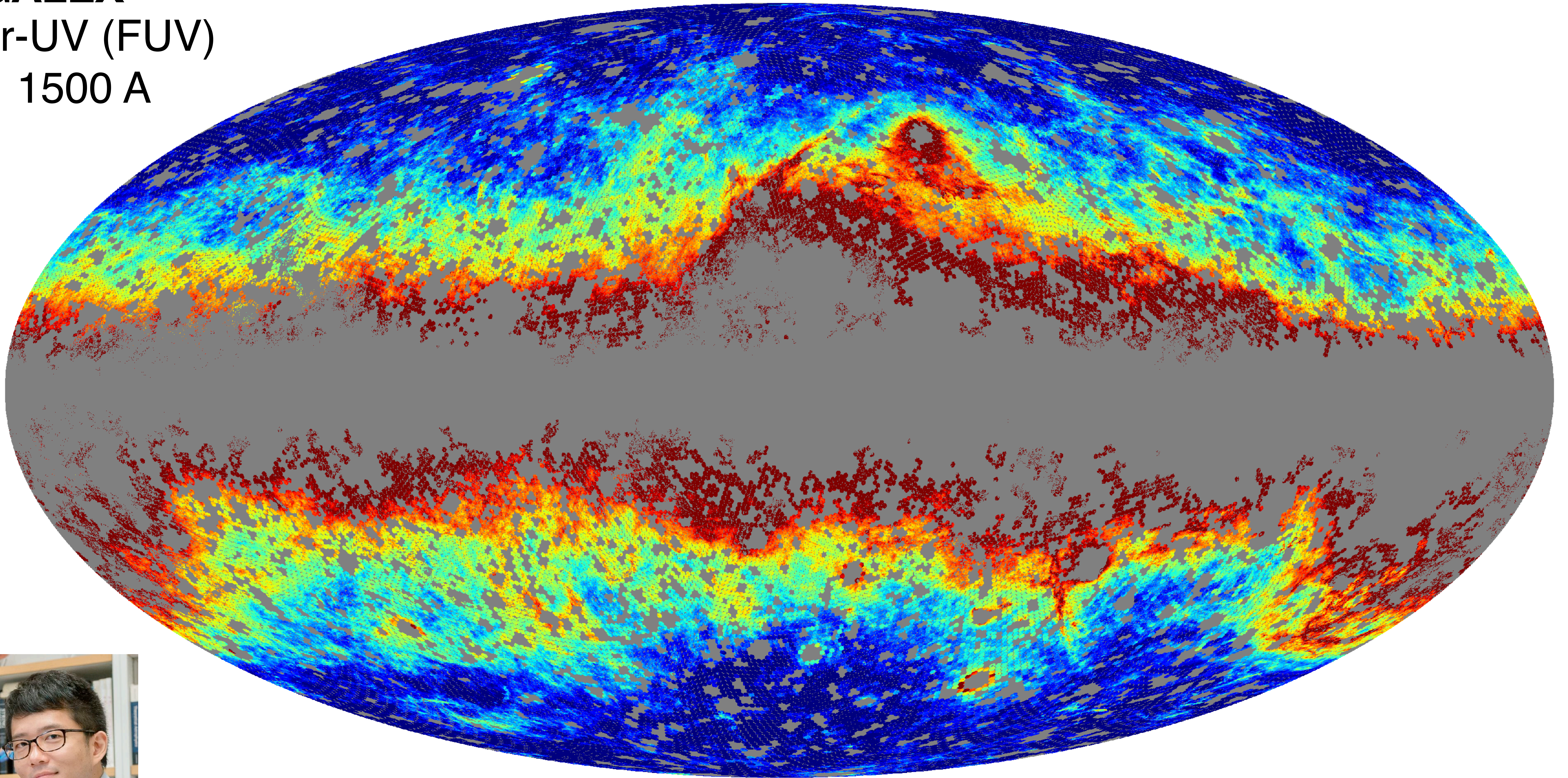
source, $p(z)$

overlapping sources

photon field /
extra-galactic
background light



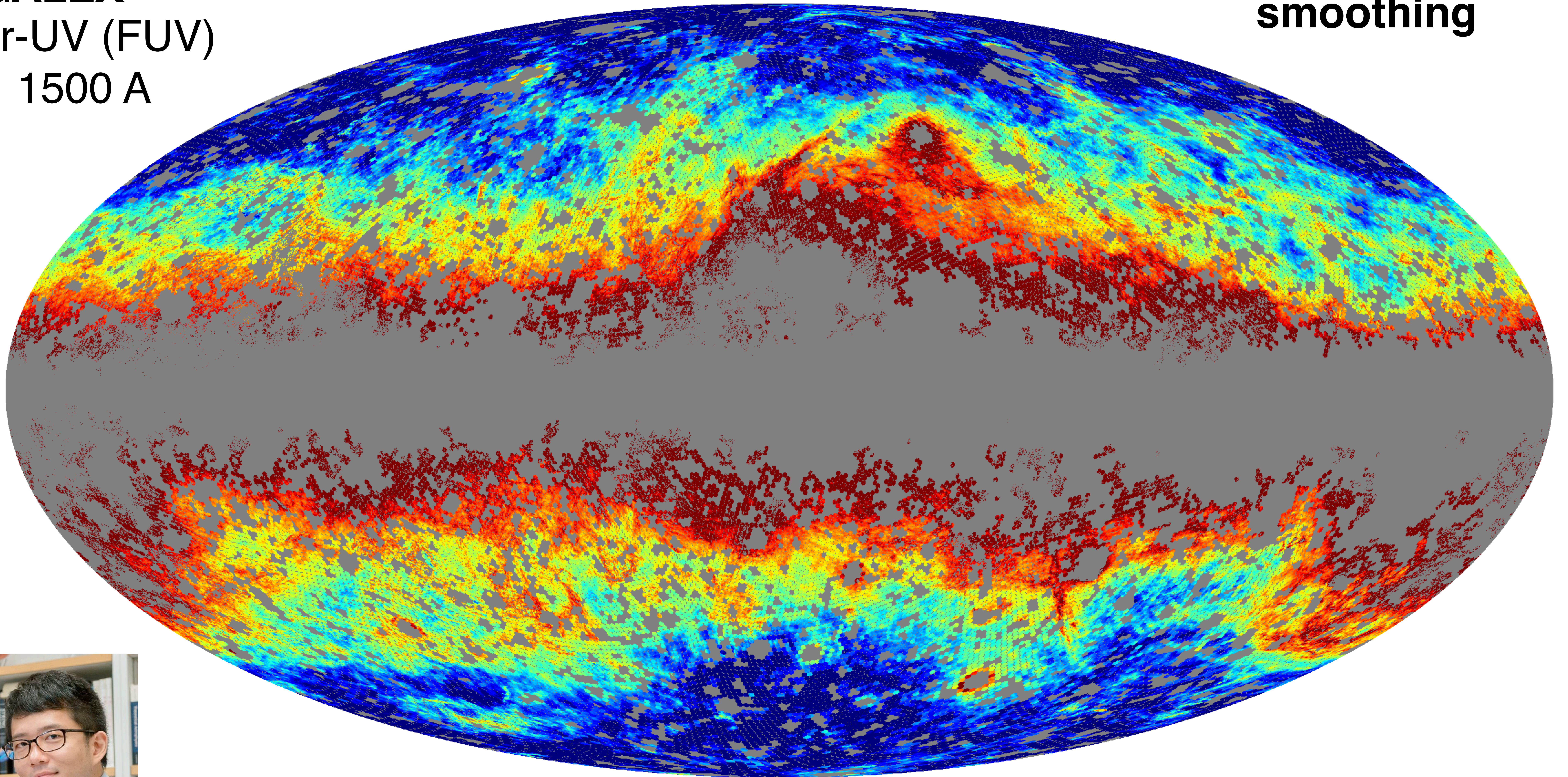
GALEX
Far-UV (FUV)
1500 Å



YK Chiang

GALEX
Far-UV (FUV)
1500 Å

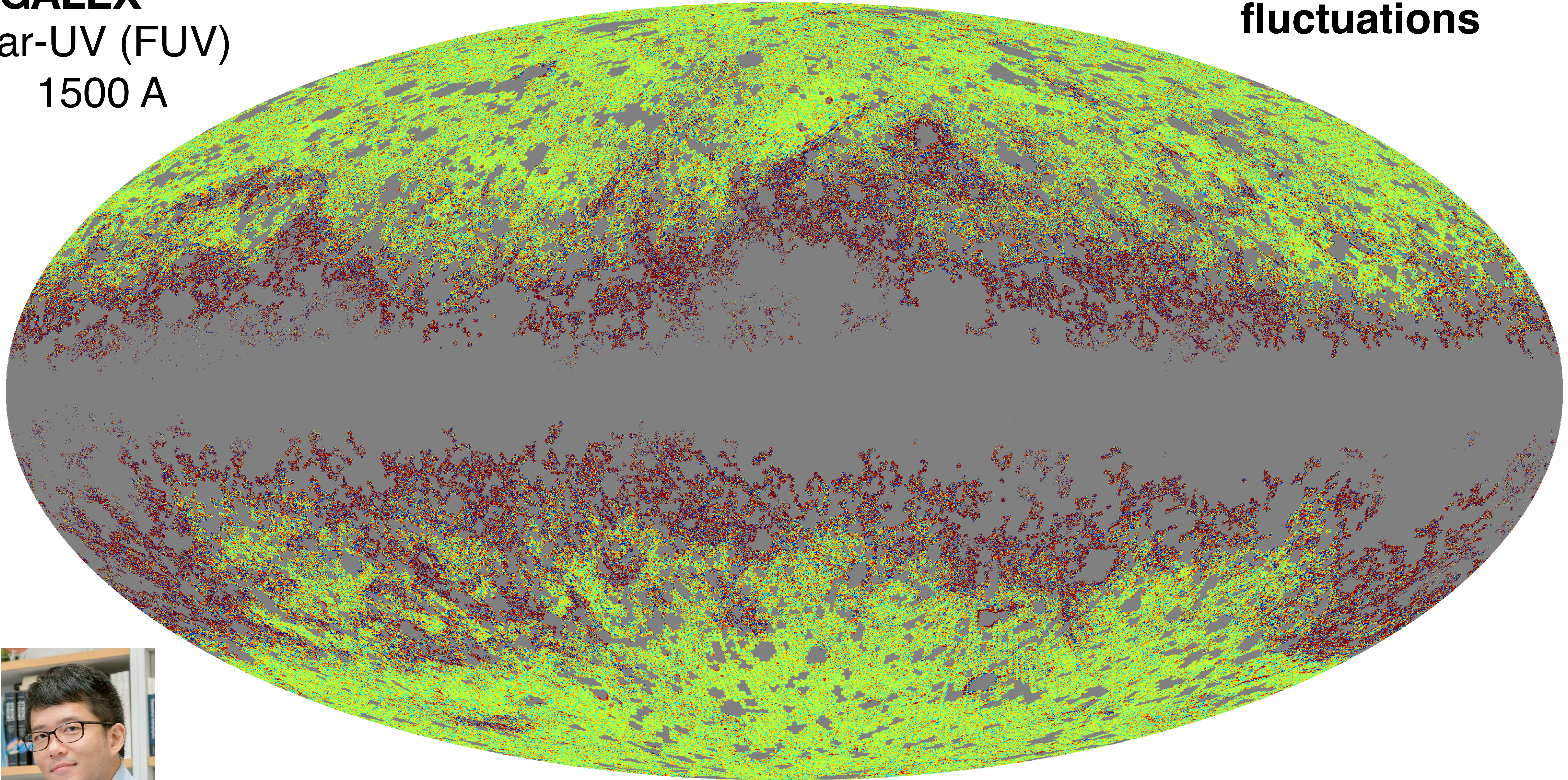
**one degree
smoothing**



YK Chiang

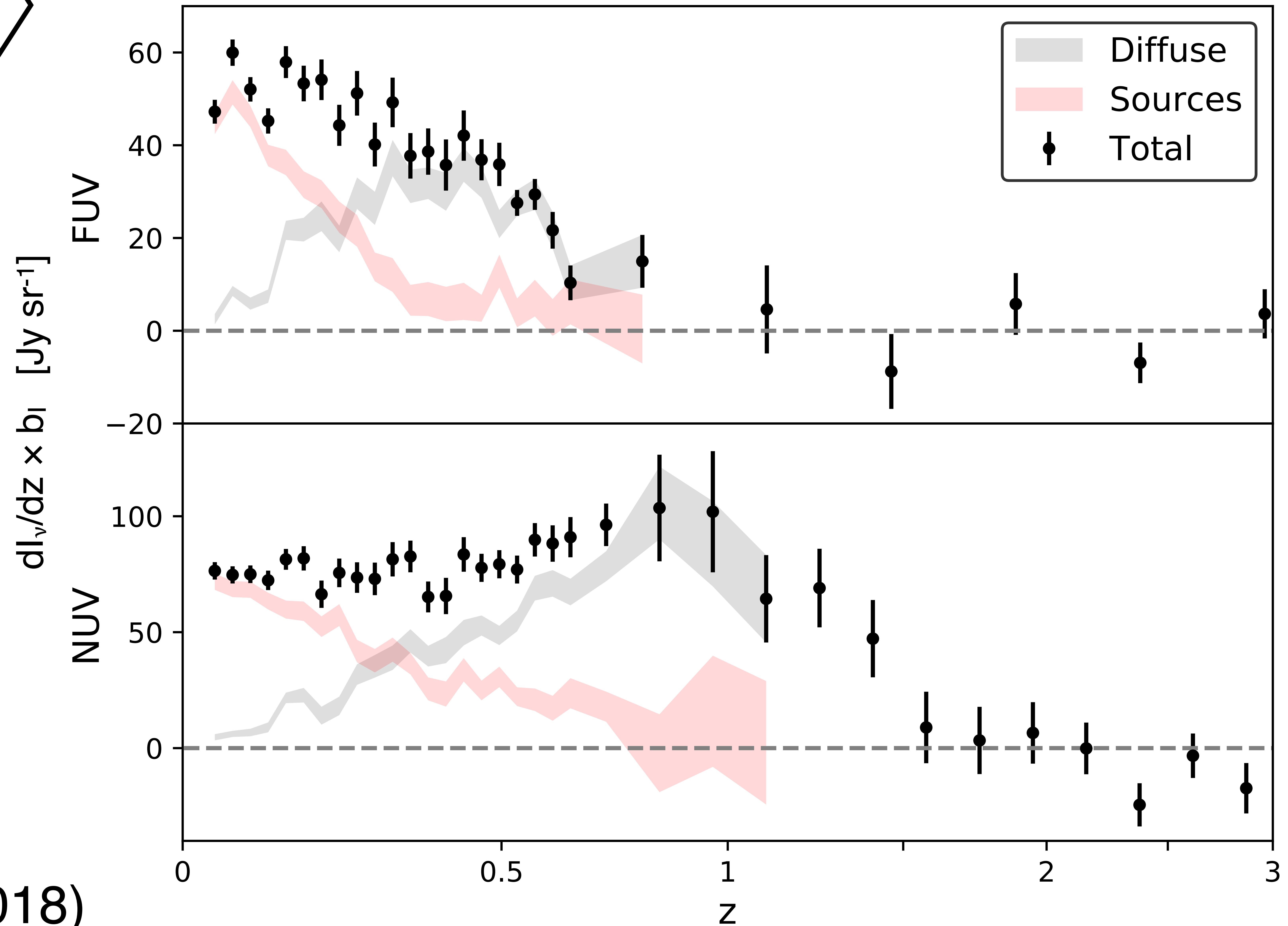
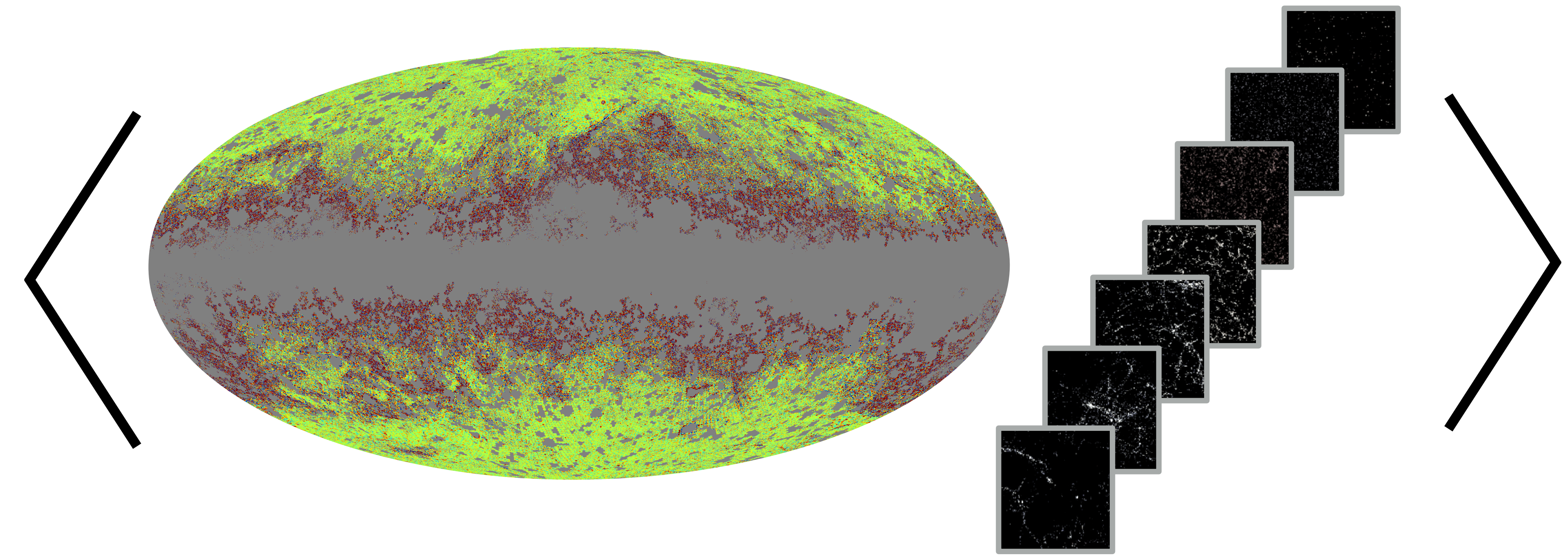
GALEX
Far-UV (FUV)
1500 Å

**small scale
fluctuations**



YK Chiang

redshift tomography of the UV sky



YK Chiang et al. (2018)

Extragalactic SPHEREx

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100 million high-quality redshifts

1 billion galaxy spectra

10 million blended sources

10 billion pixels

1 trillion spectral-spatial elements

redshift estimation

source with spec z

source with $p(z | \text{knowledge})$

overlapping sources

photon field



http://tomographer.org

Upload Healpix map or source catalog (Fits or CSV).

Download examples: [Healpix map](#) [Source catalog](#)

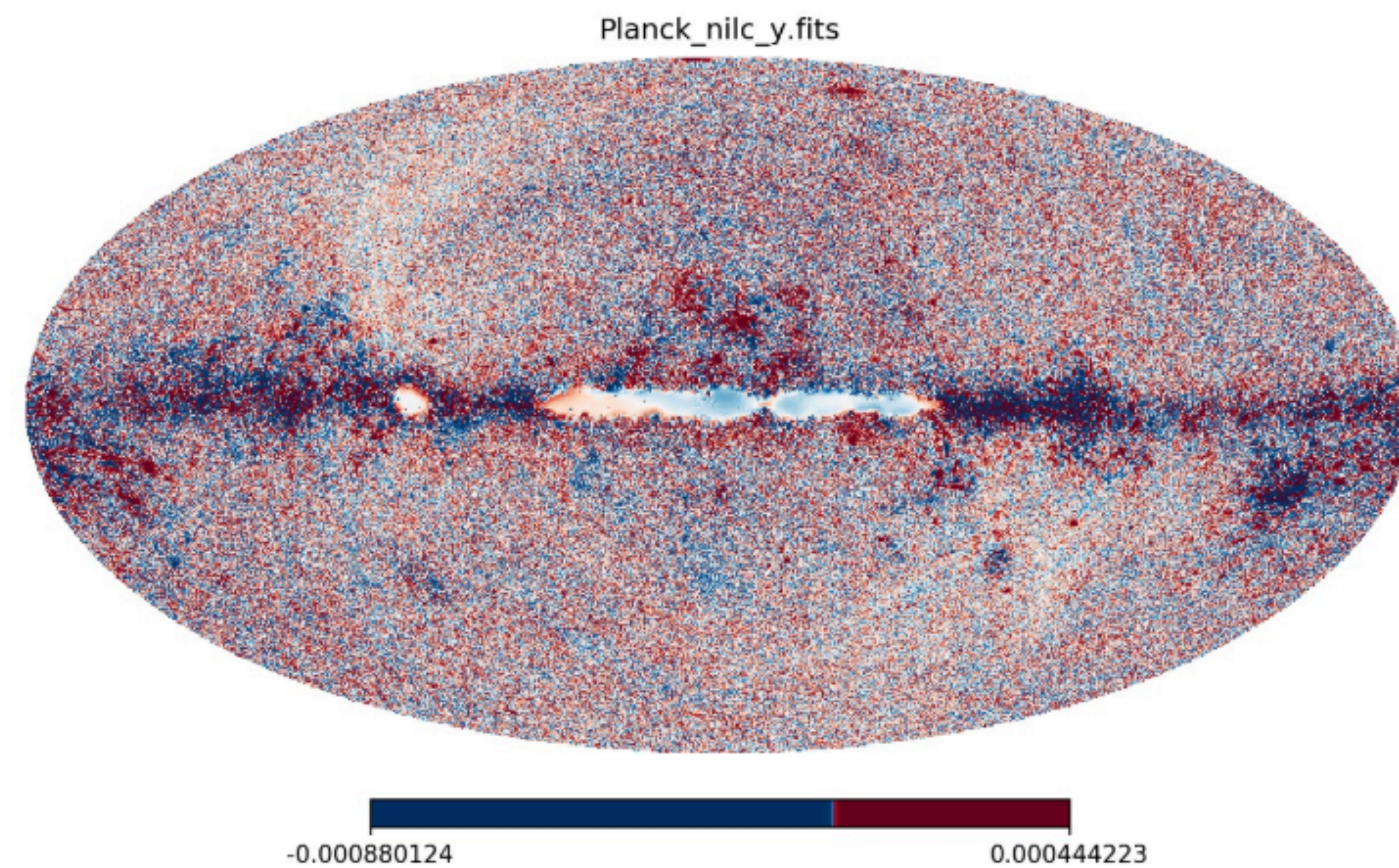
Choose File No file chosen

Get Tomography

Submission: 2020-01-14
16:14:06

Status: **FINISHED**

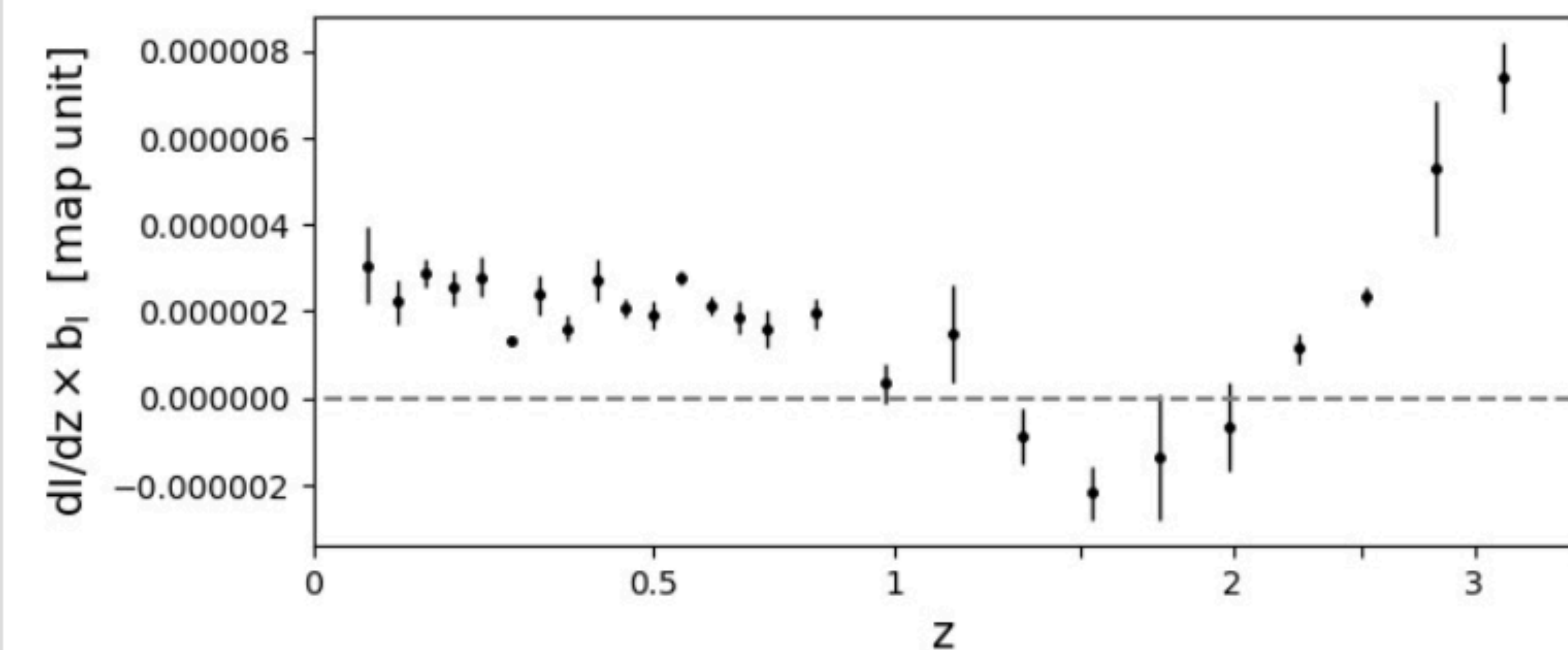
Duration: 5m, 49.451s.



Yi-Kuan Chiang
CCAPP fellow



Manu Taghizadeh
Software developer

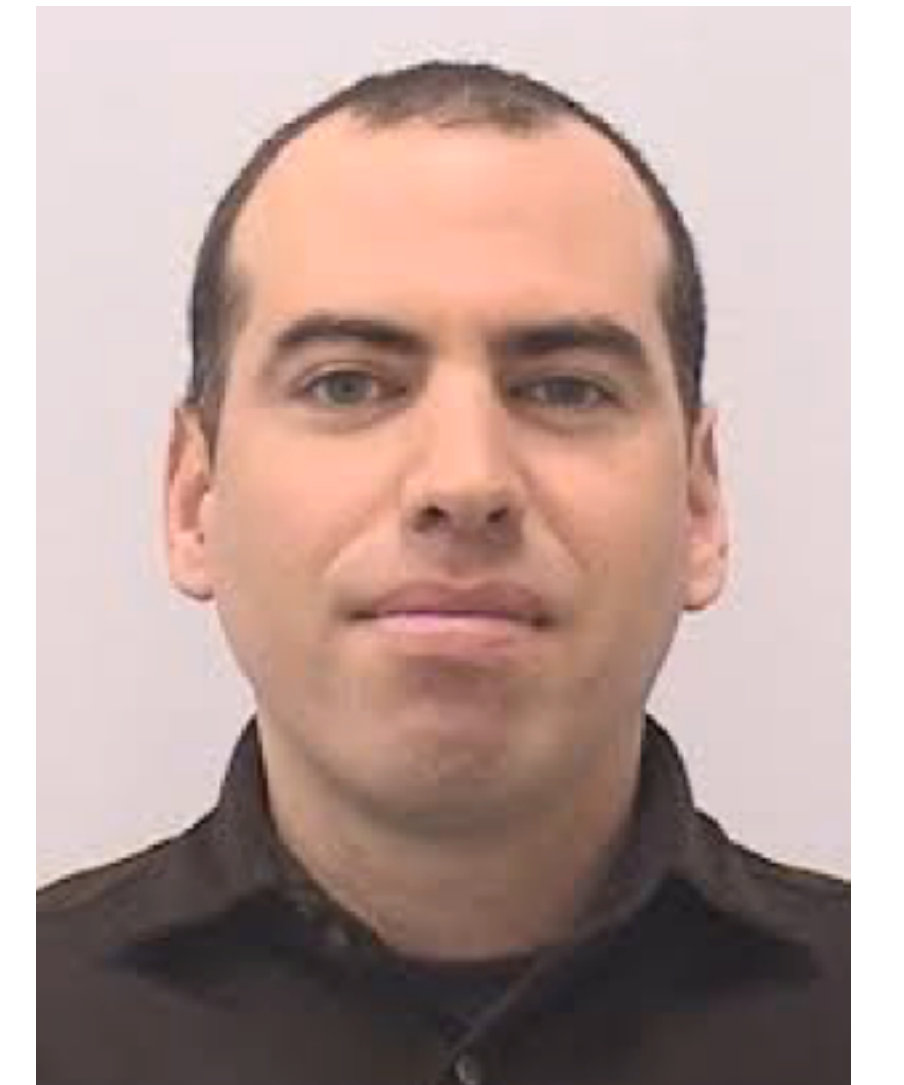


[download data](#)

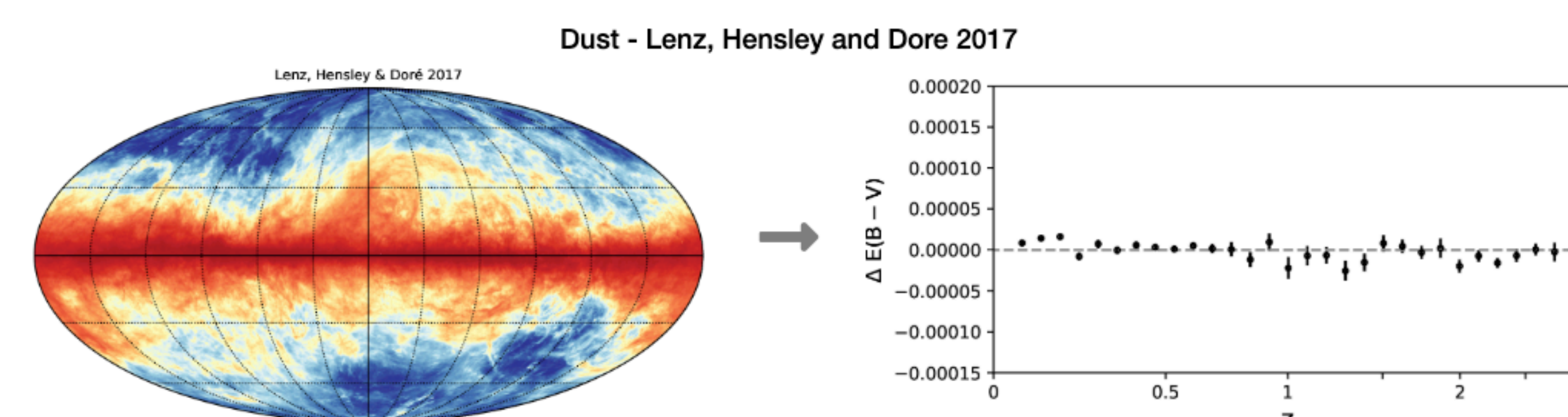
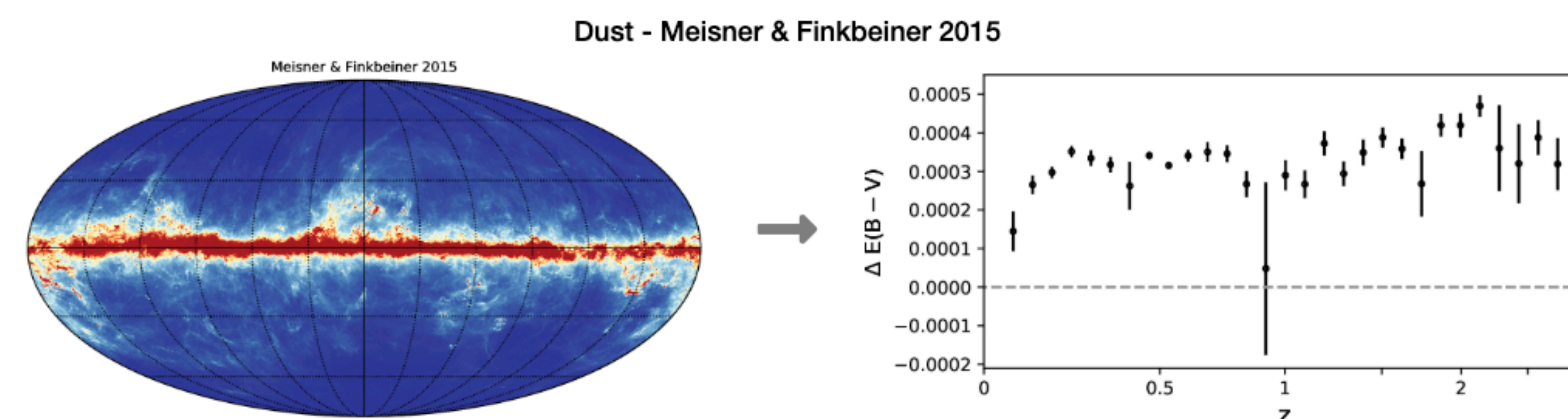
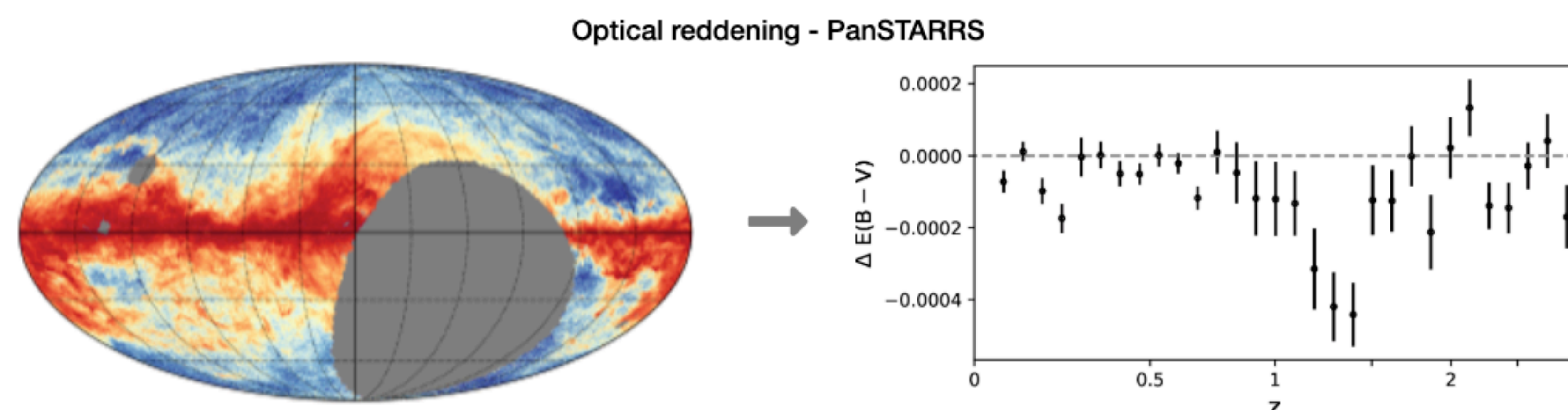
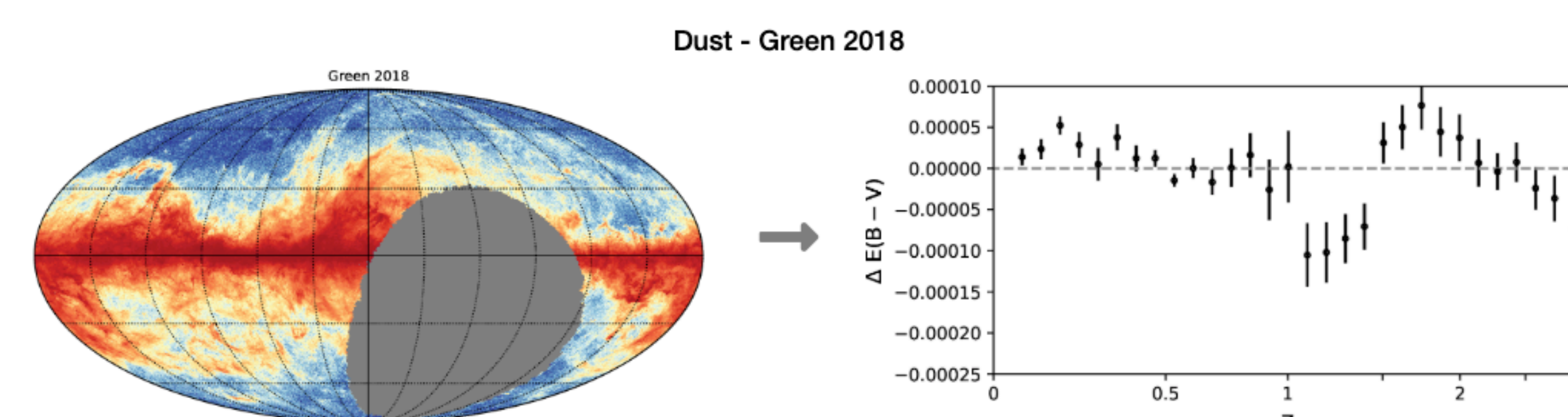
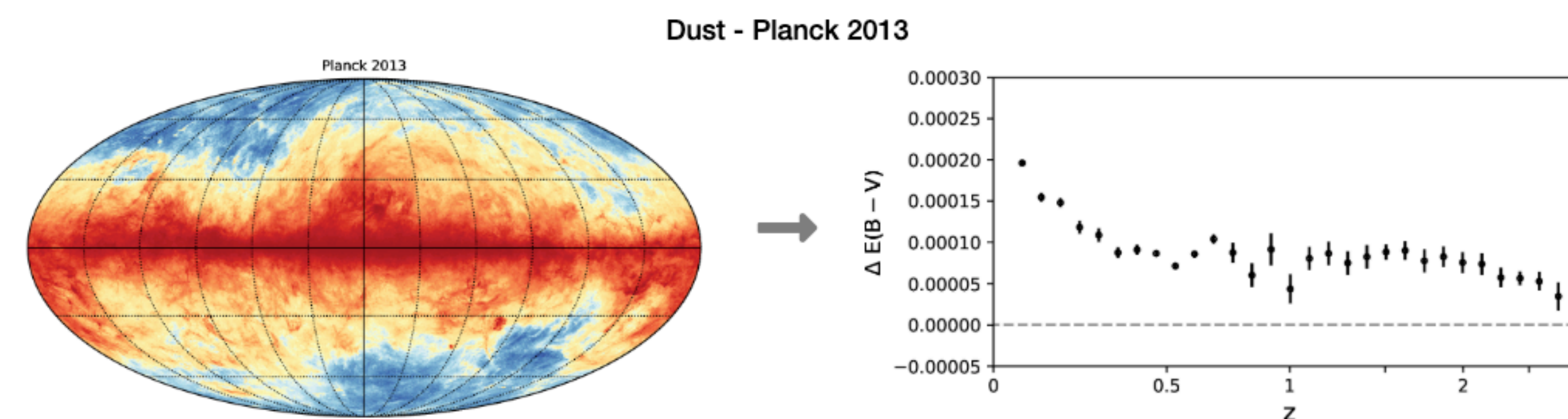
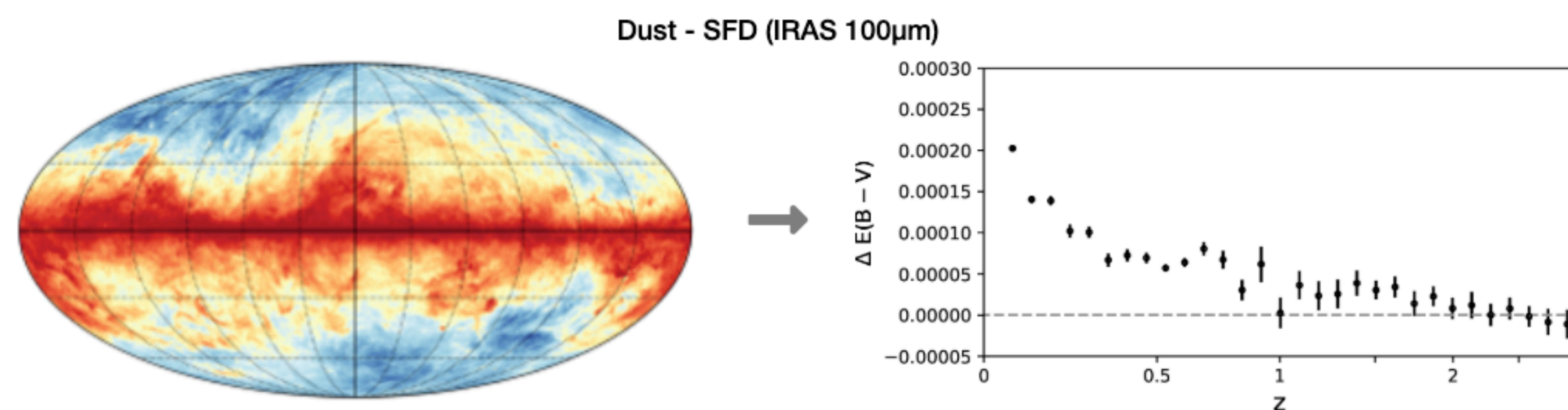
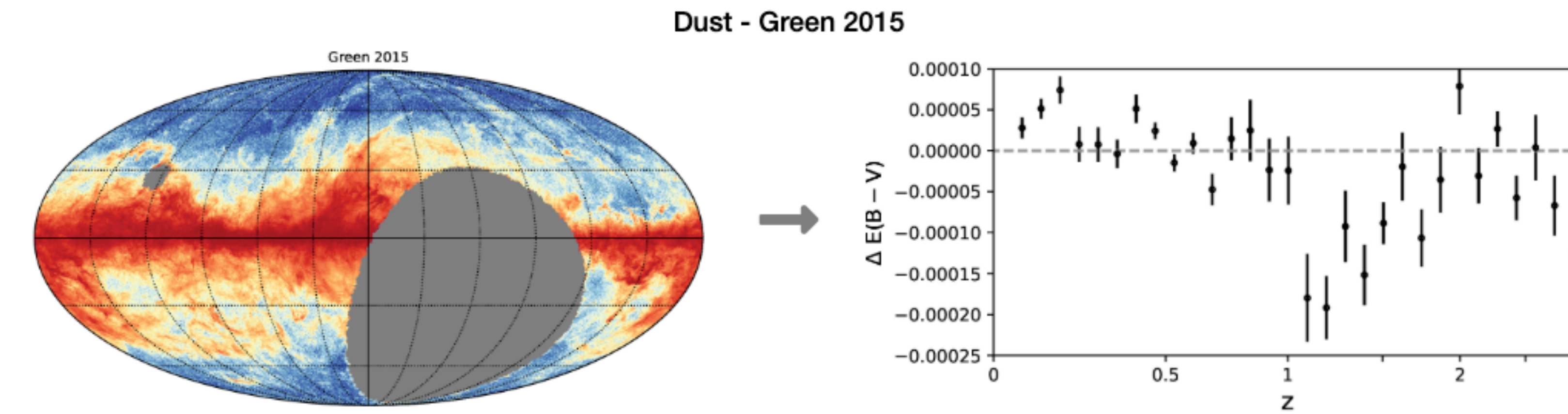
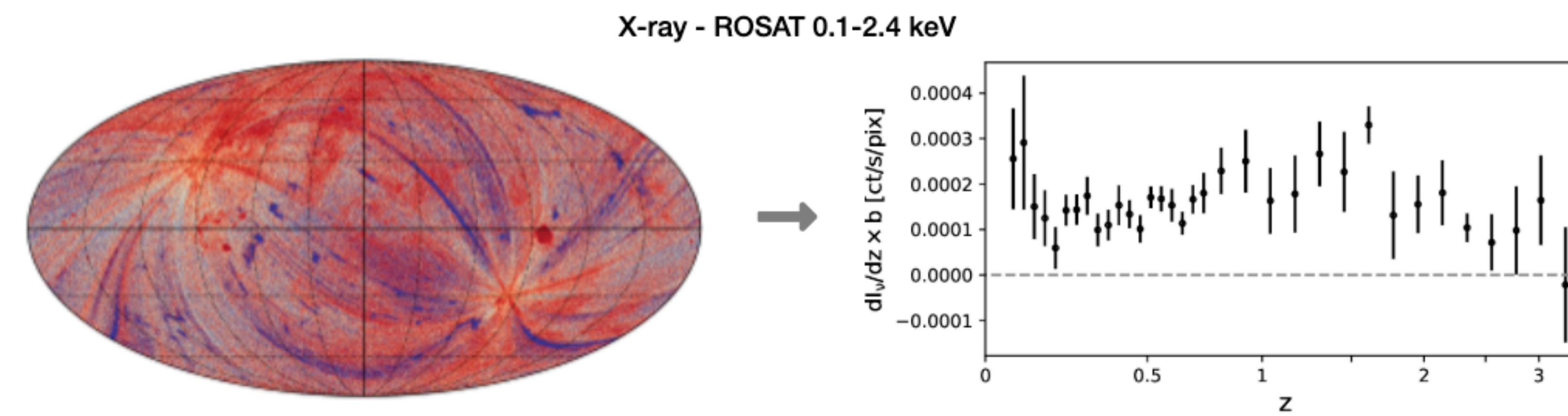
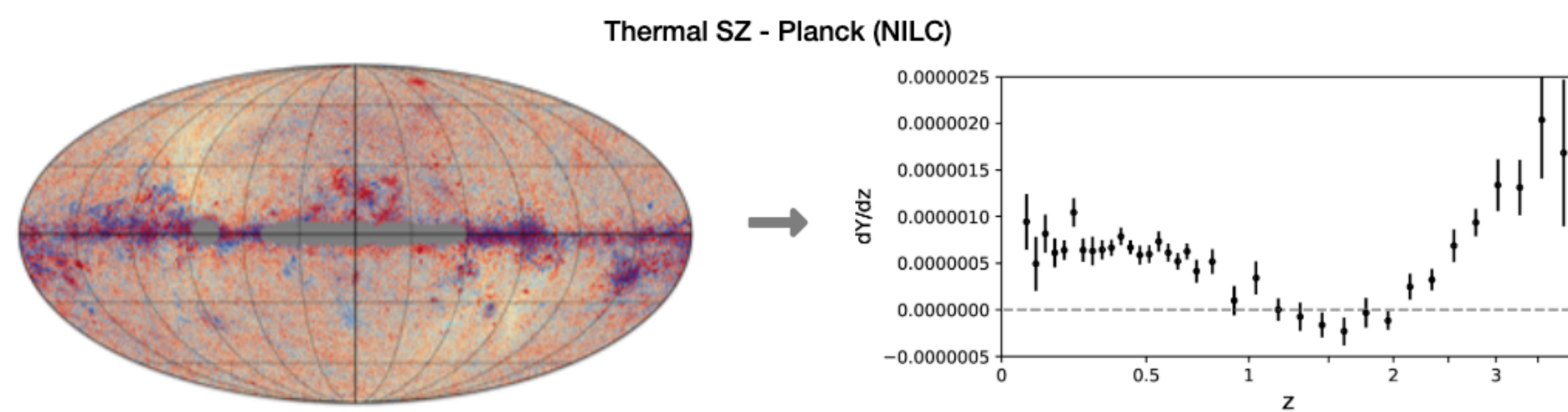
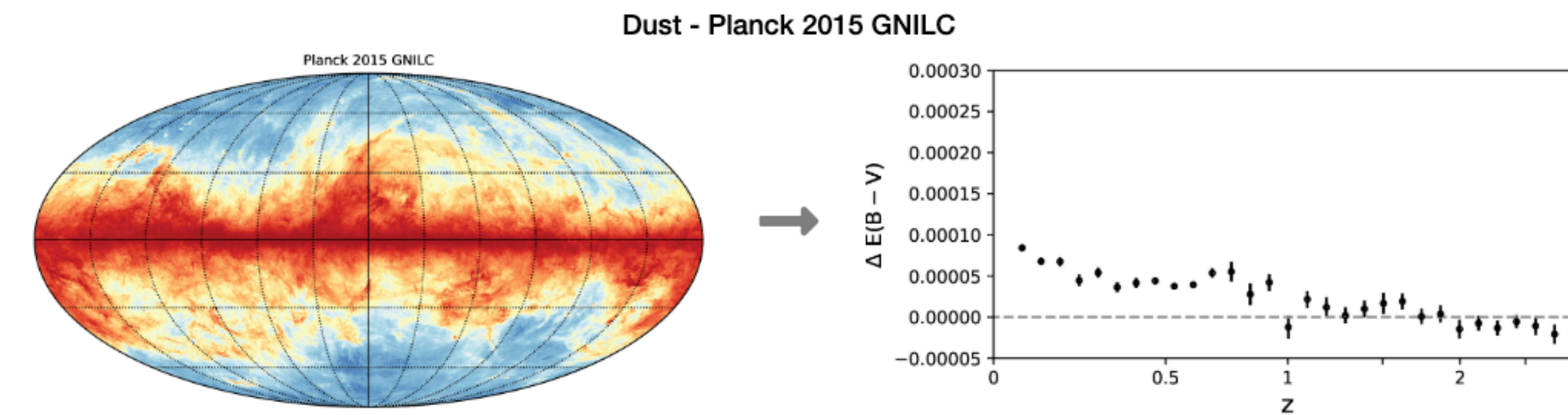
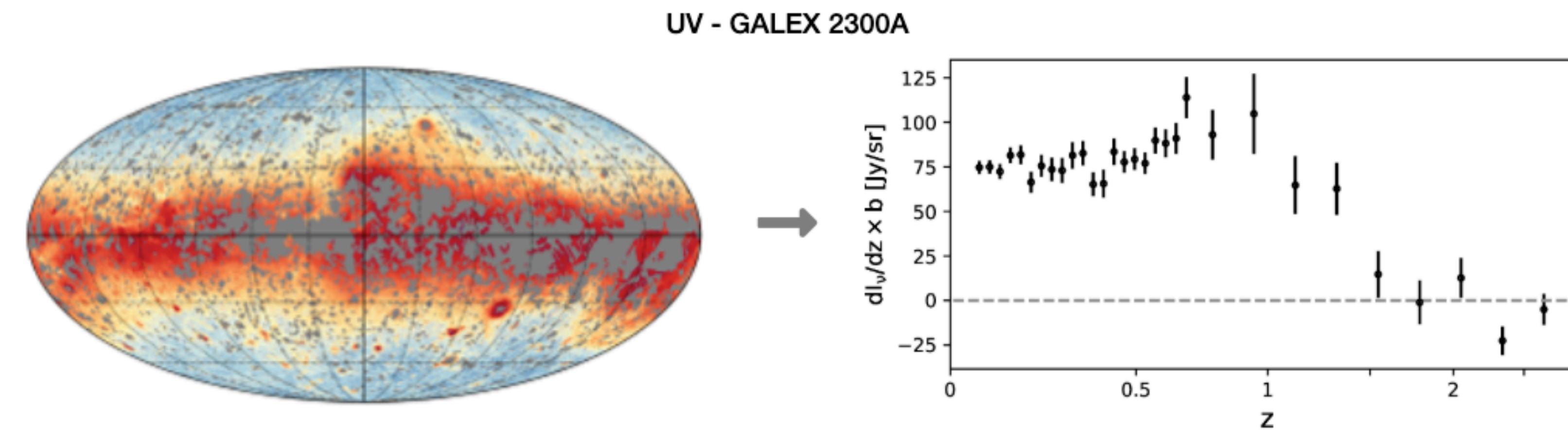
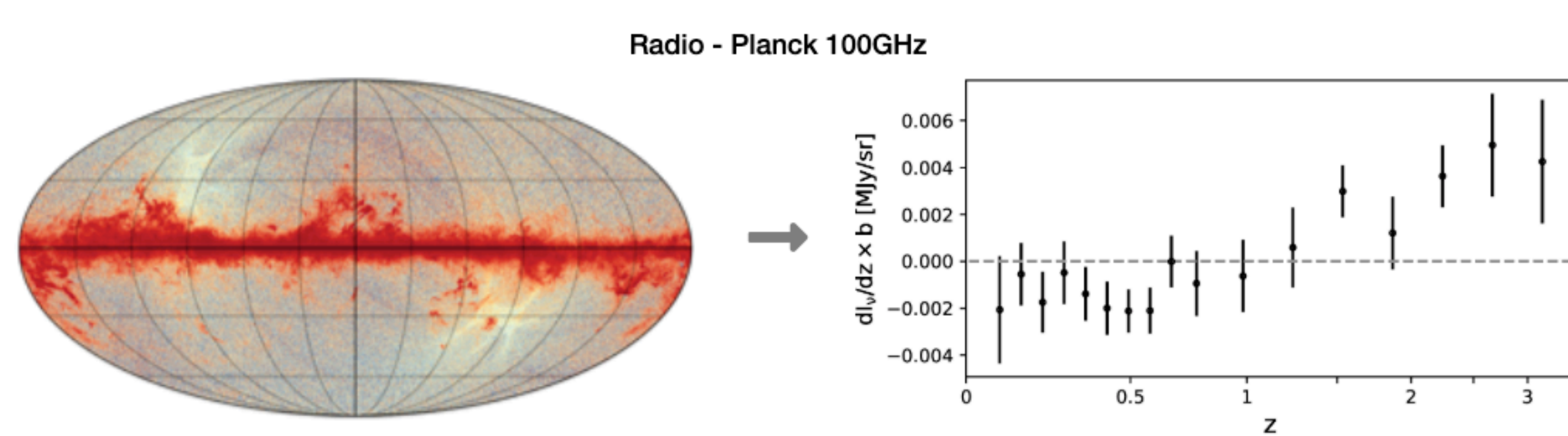
[http:// tomographer.org](http://tomographer.org)



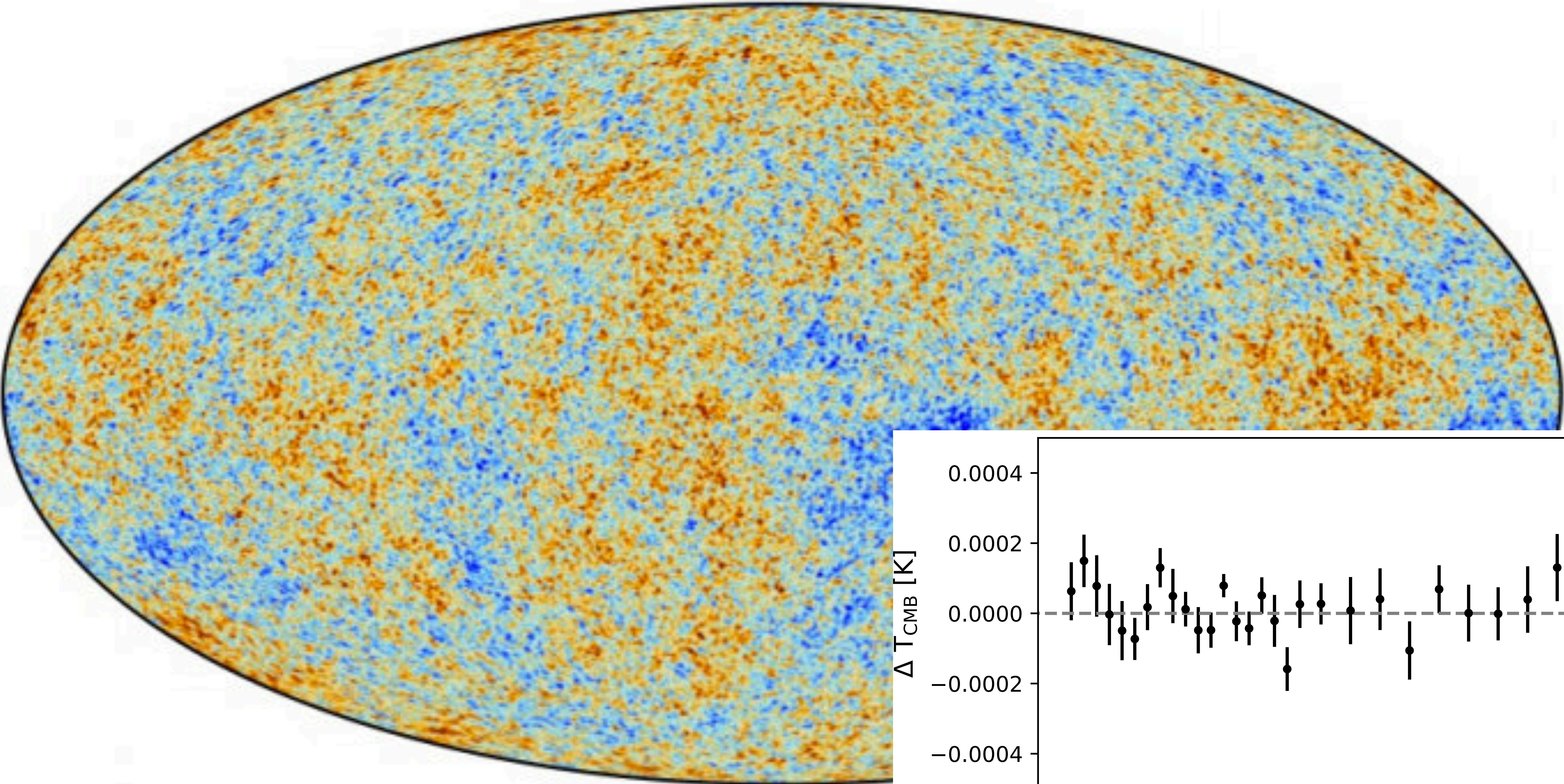
Yi-Kuan Chiang
CCAPP fellow

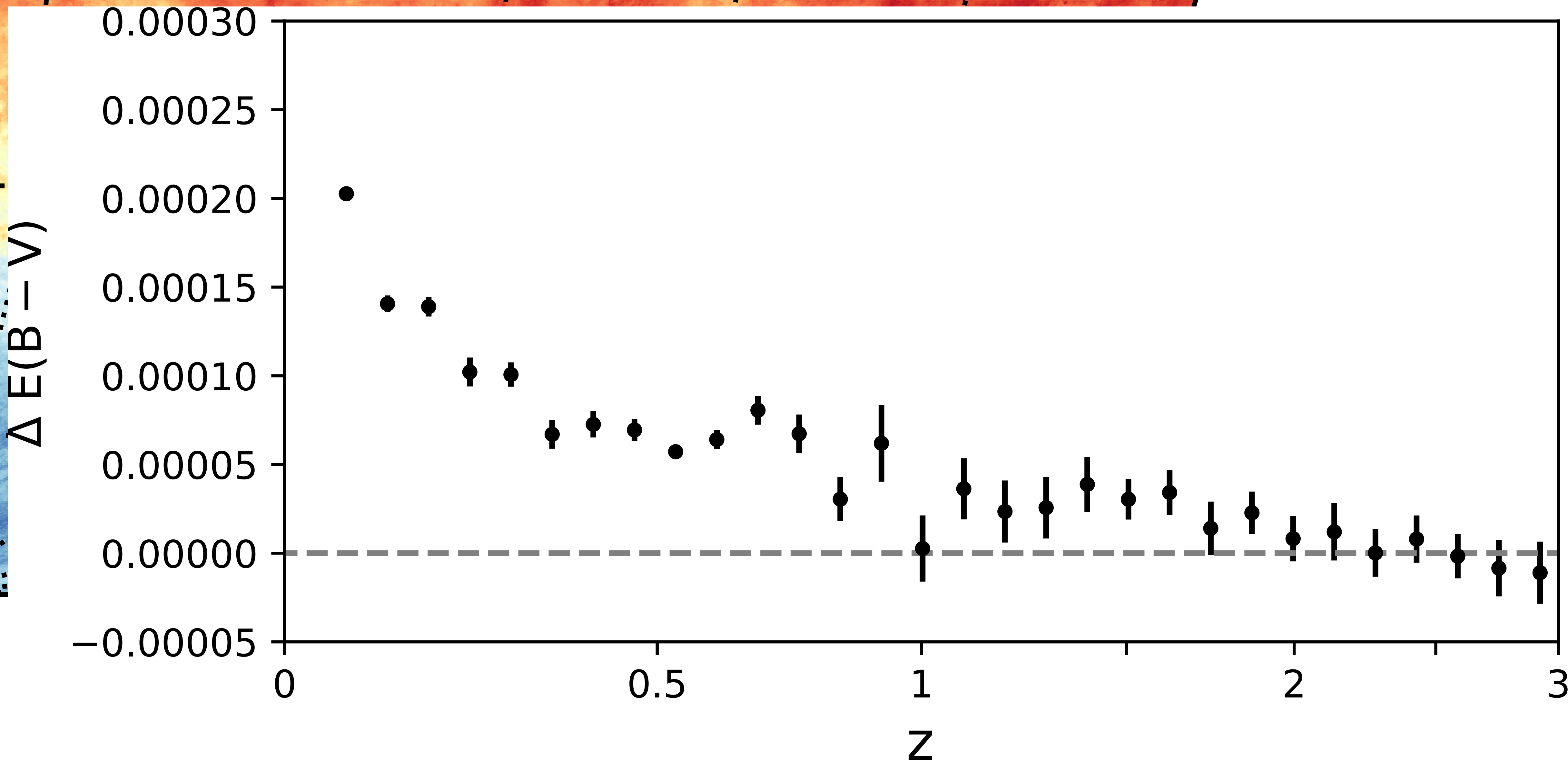
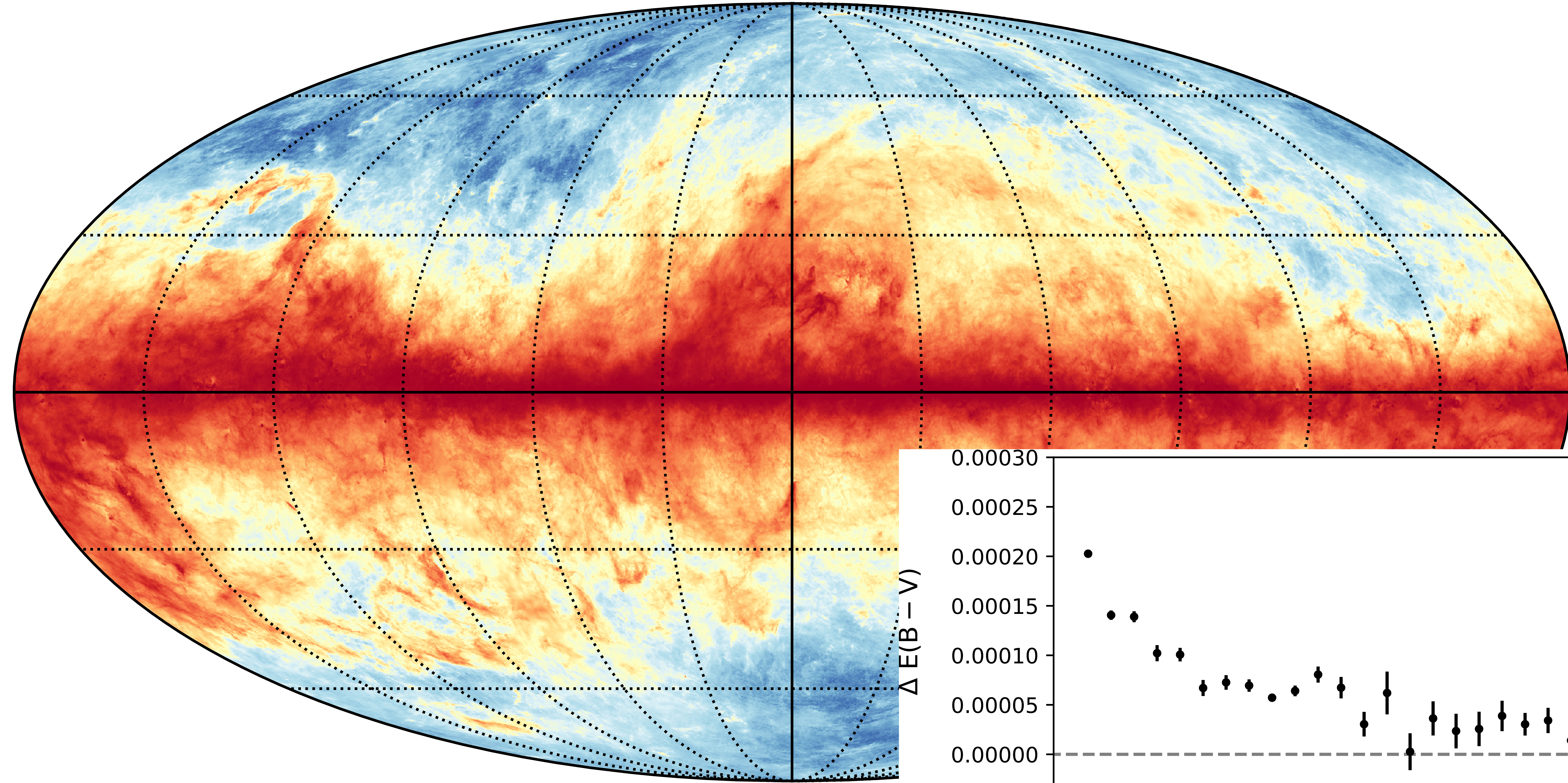


Manu Taghizadeh
Software developer

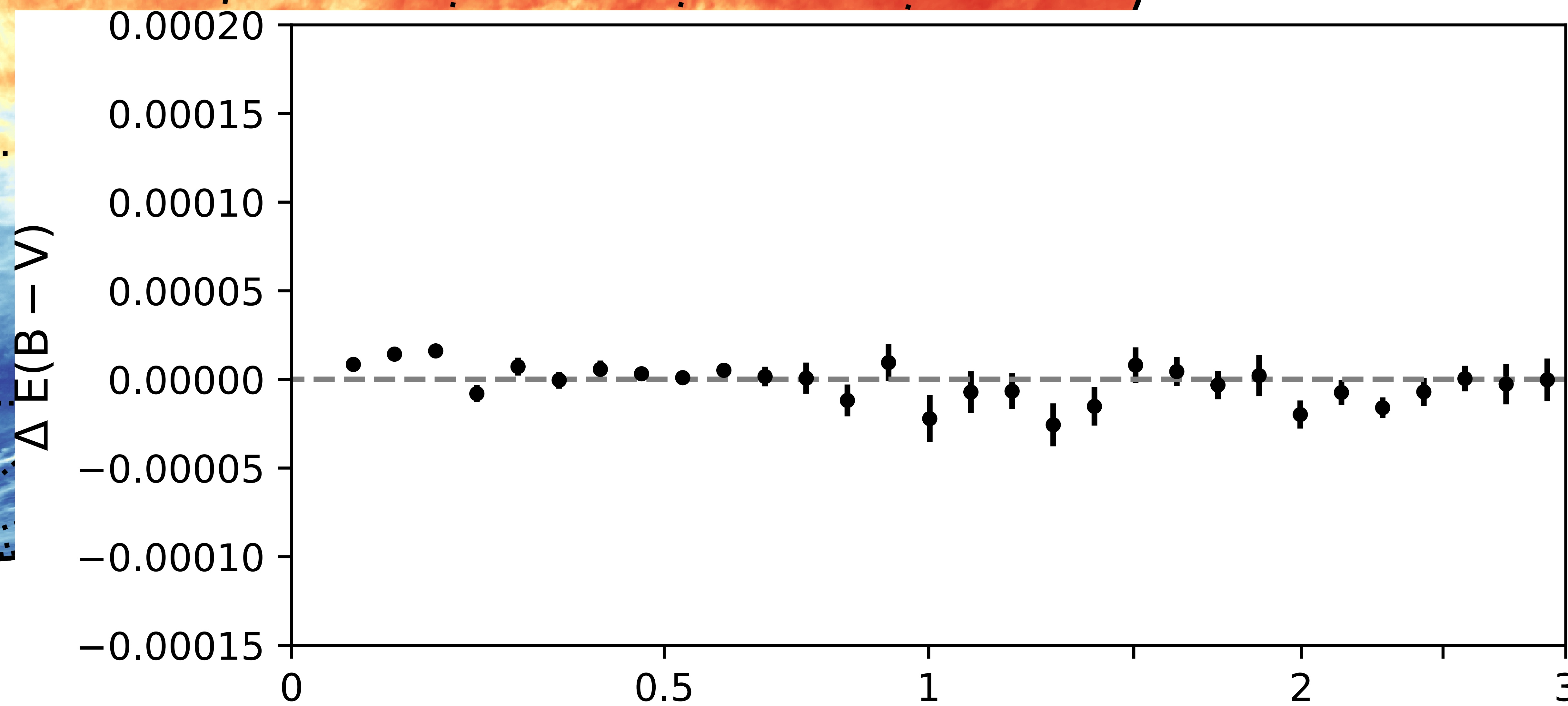
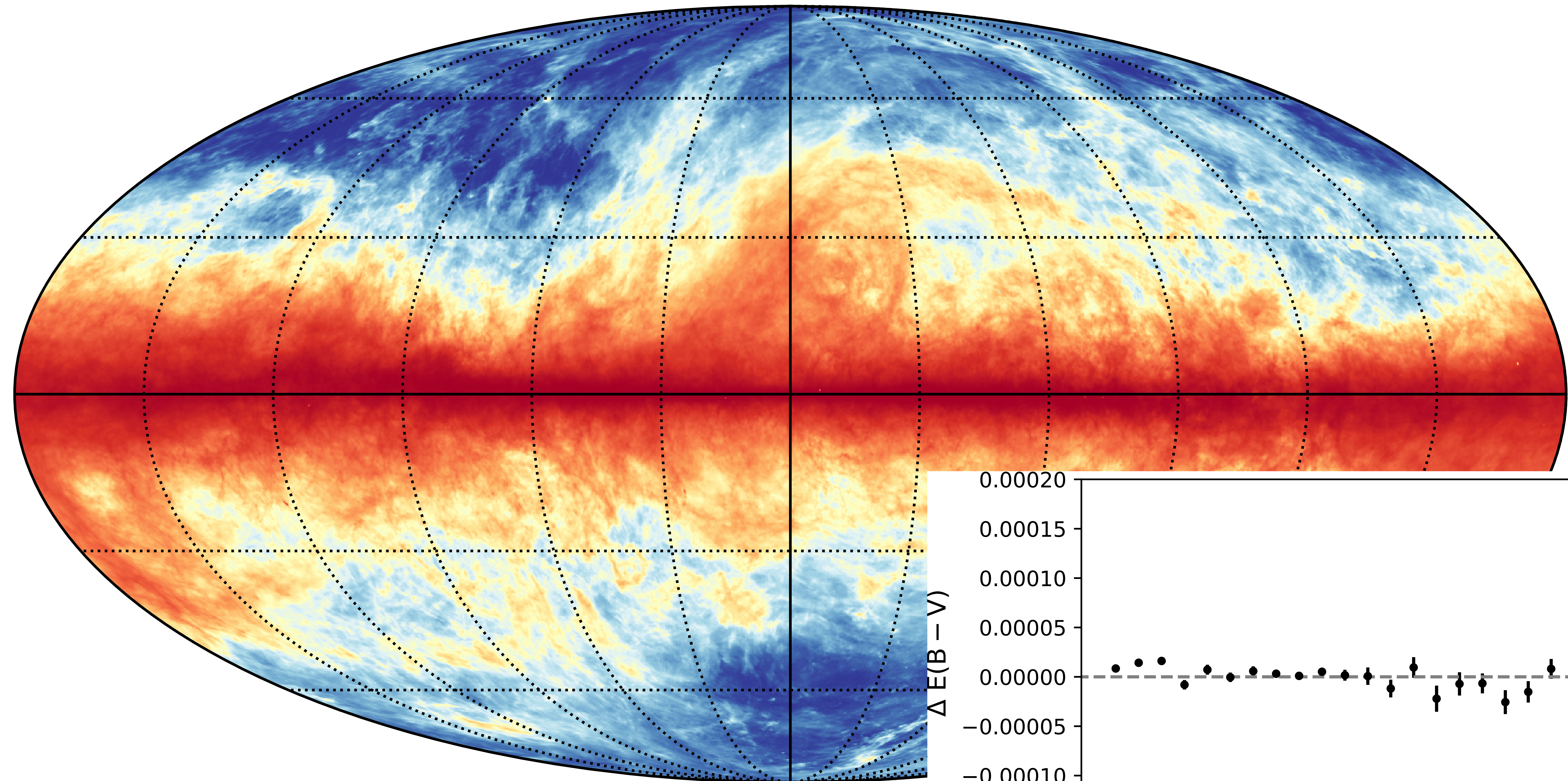


Planck Collaboration: The *Planck* mission

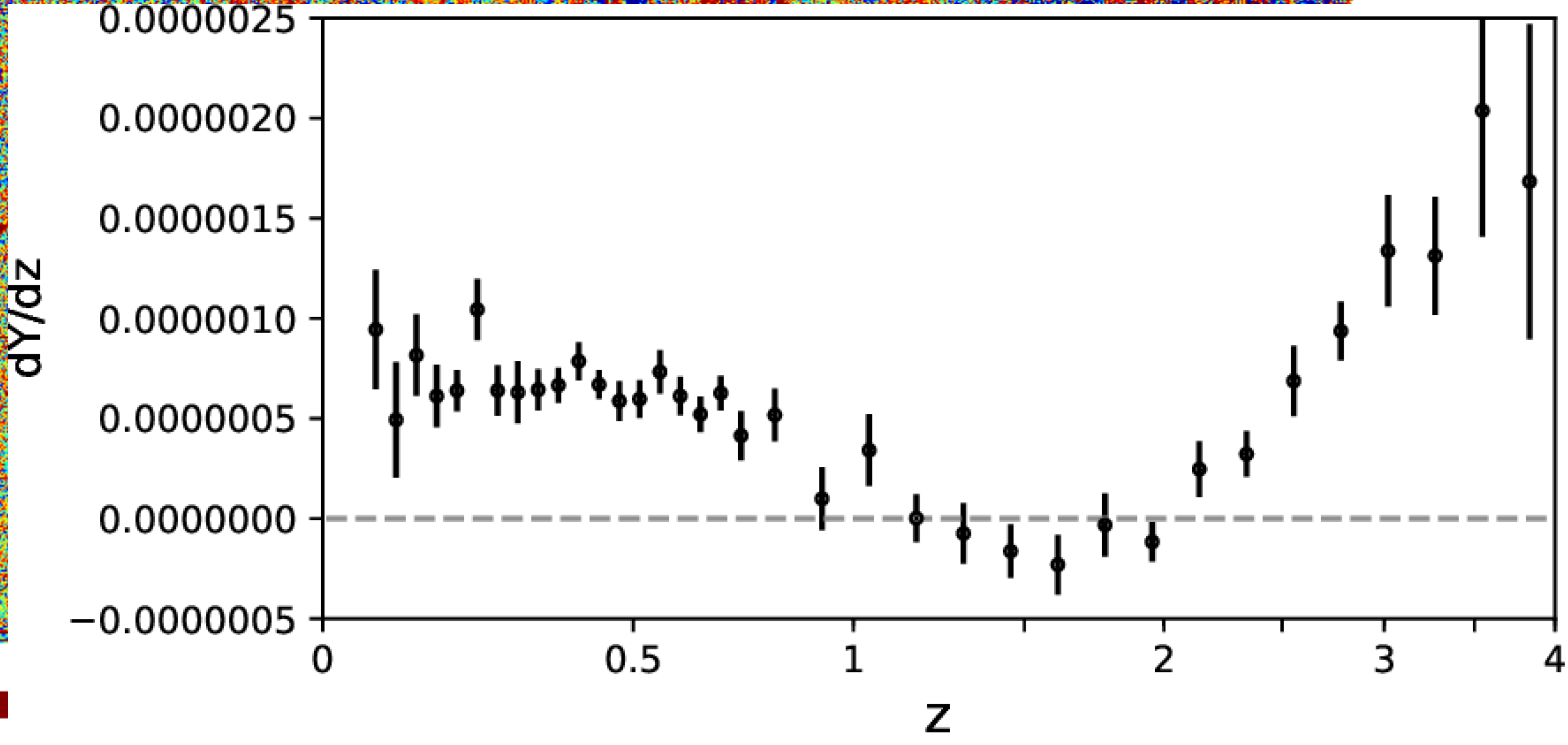
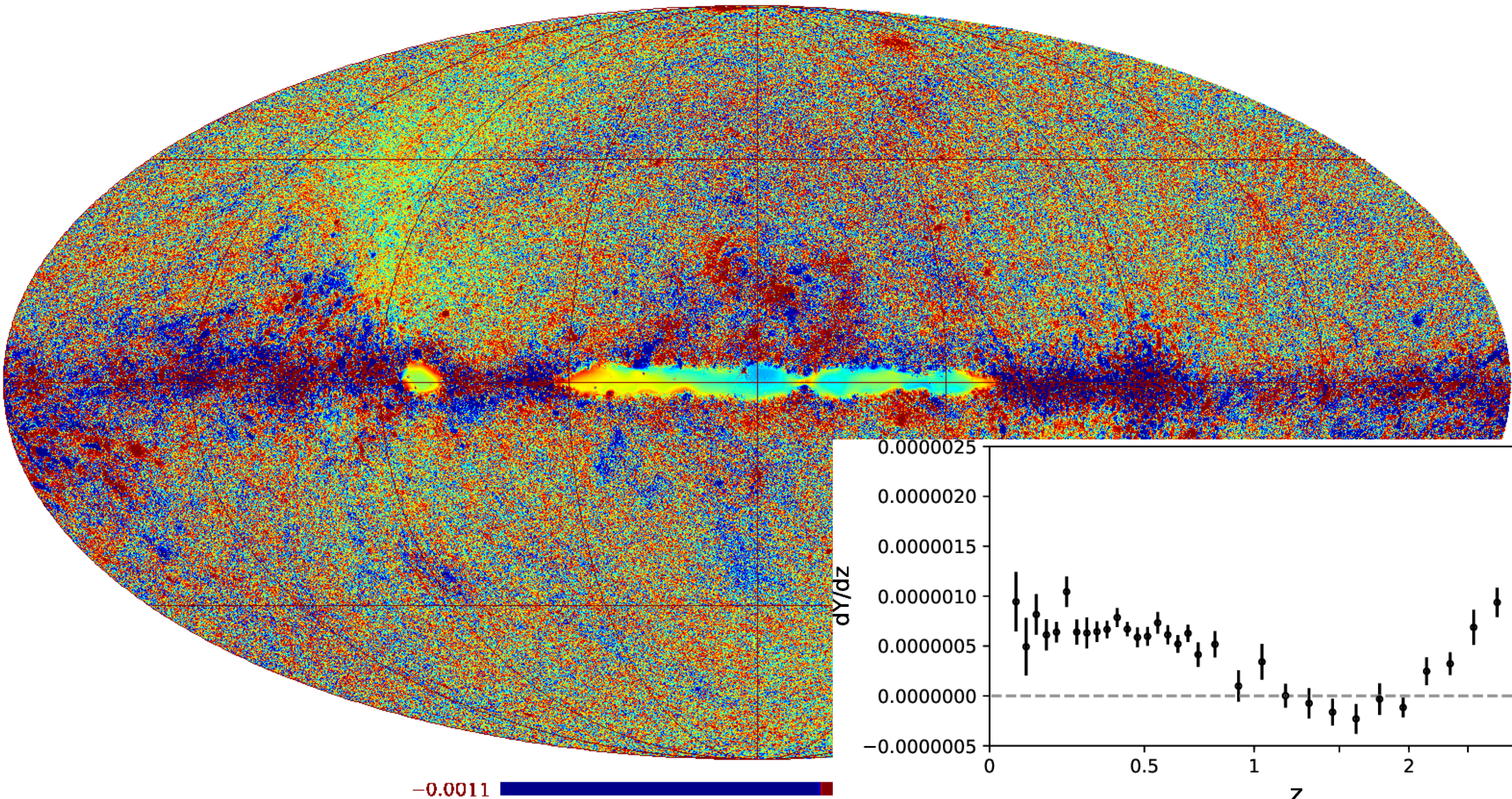




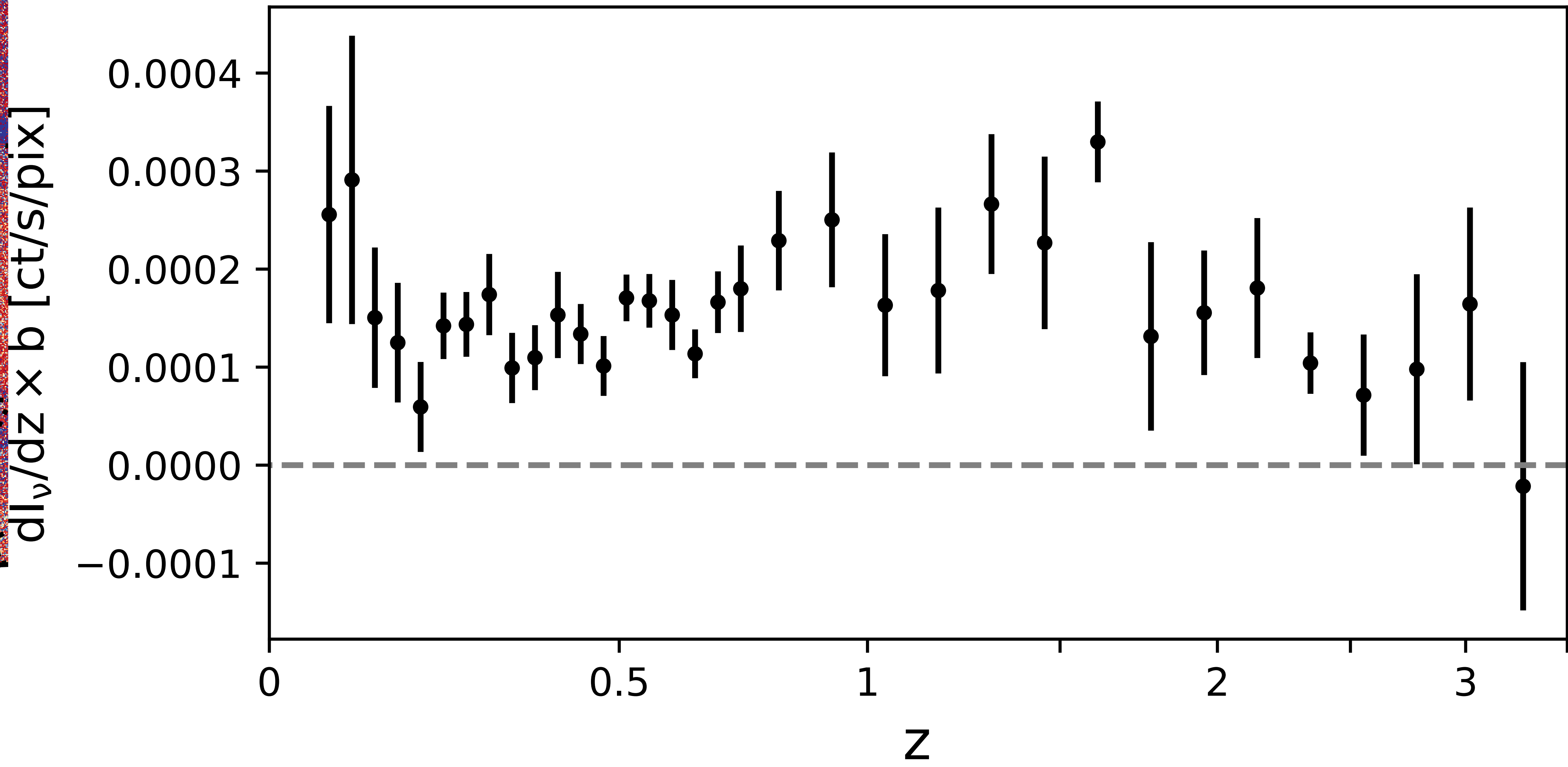
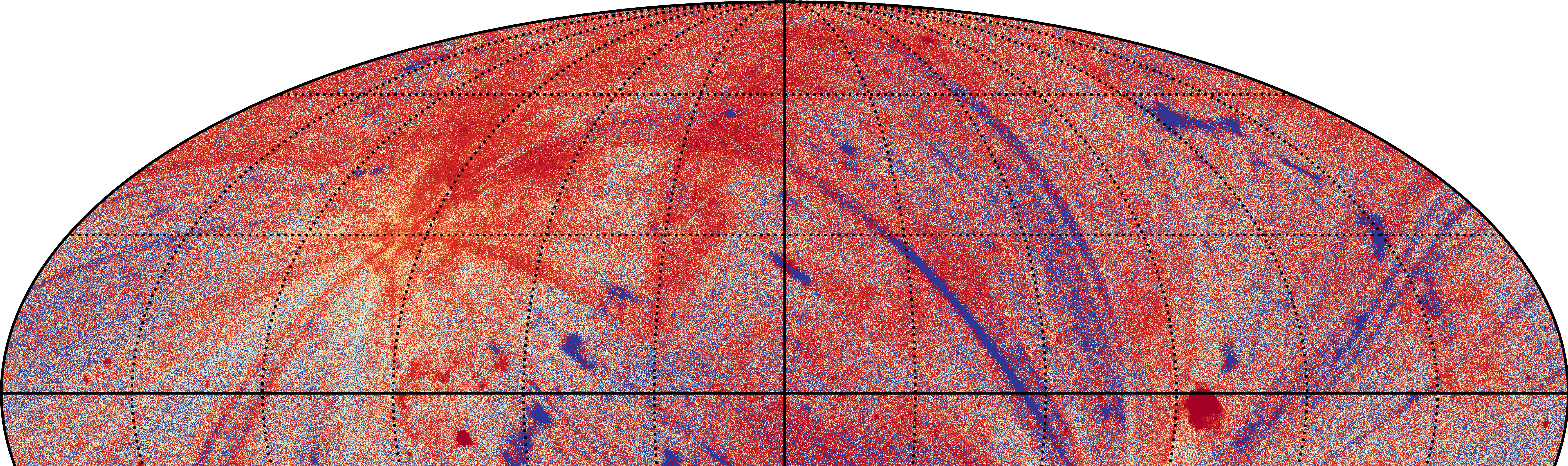
Lenz, Hensley & Doré 2017

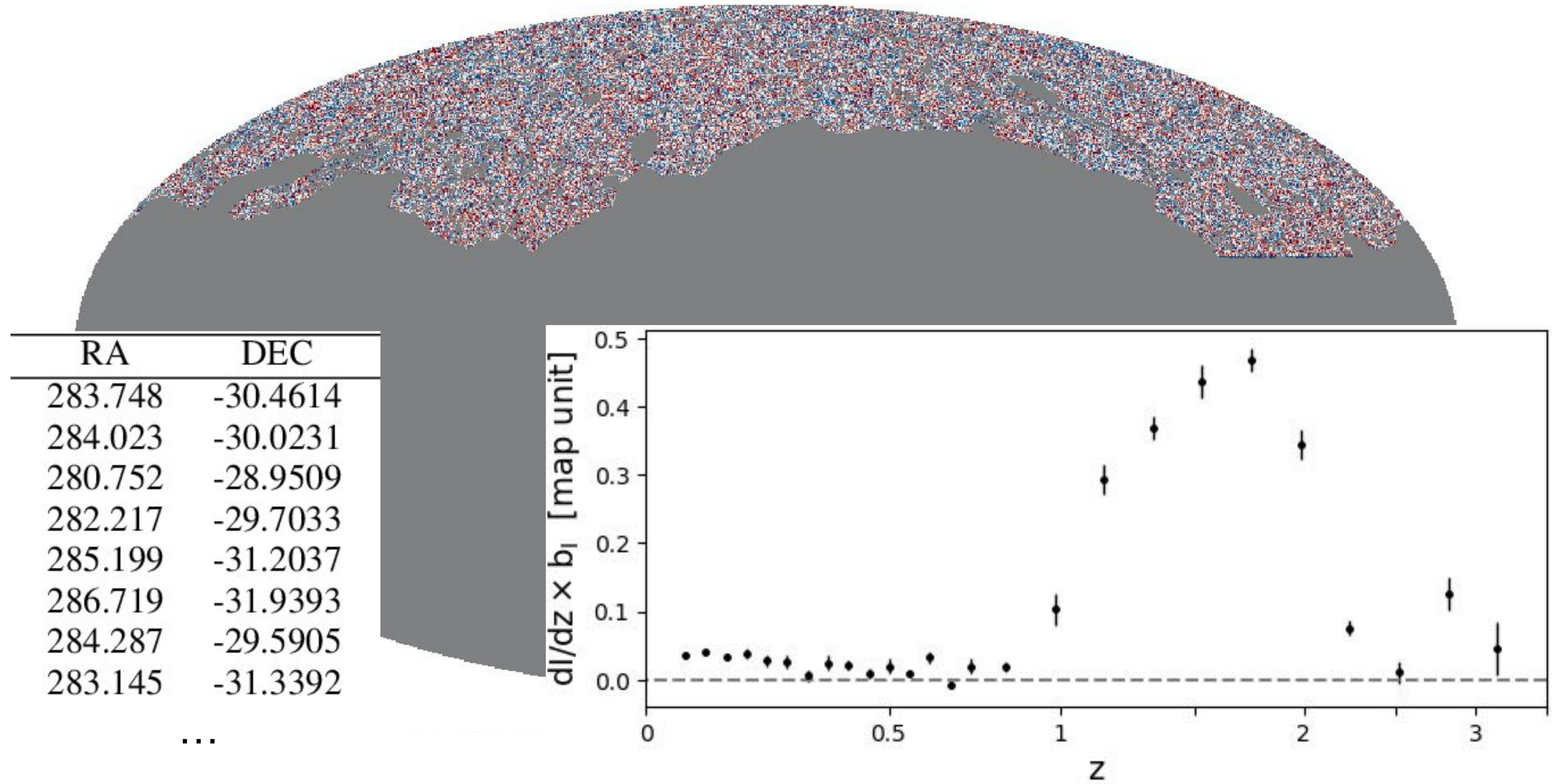


YK Chiang et al. (2019)



ROSAT 0.1-2.4 keV

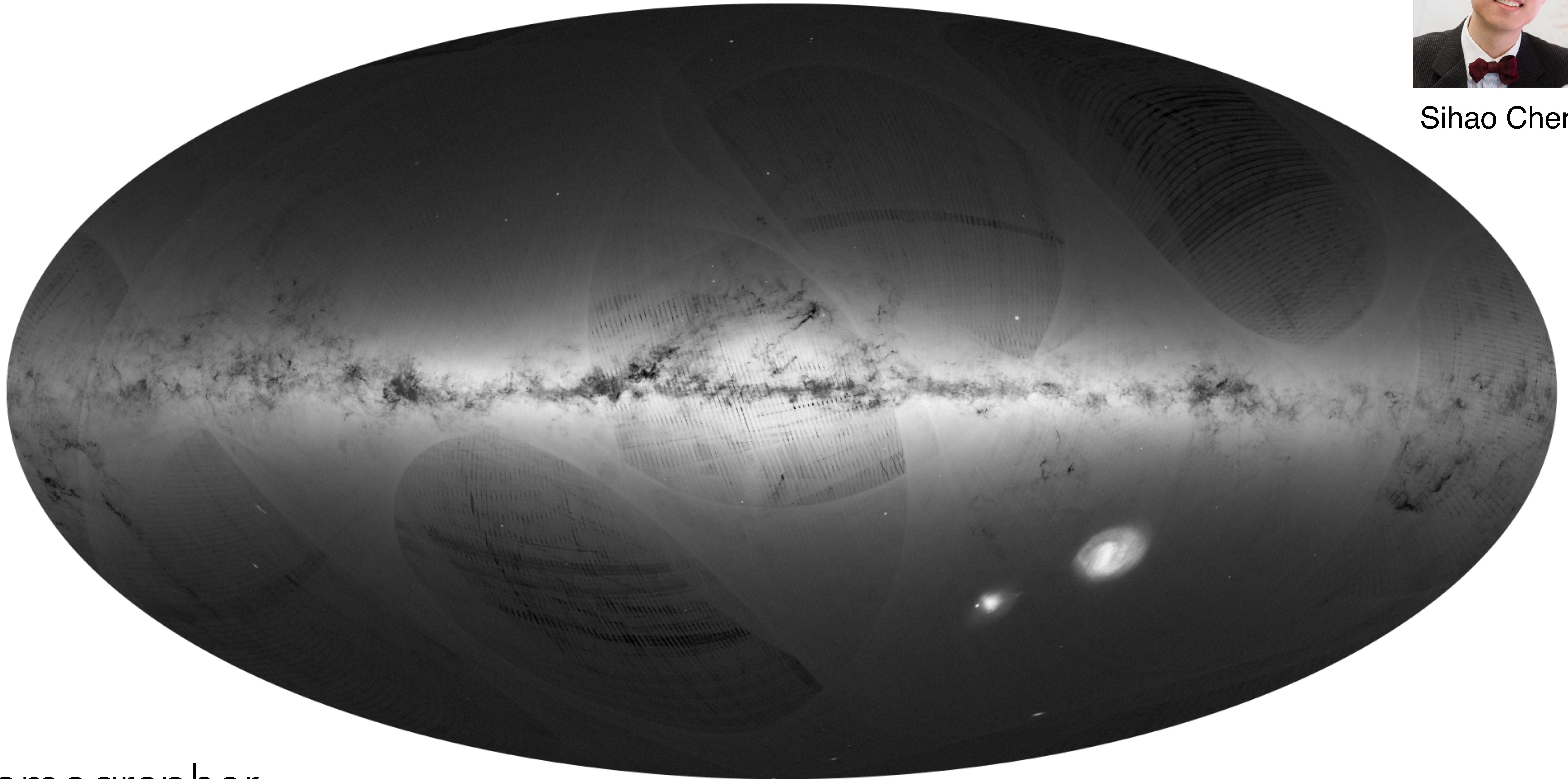




The Gaia dataset



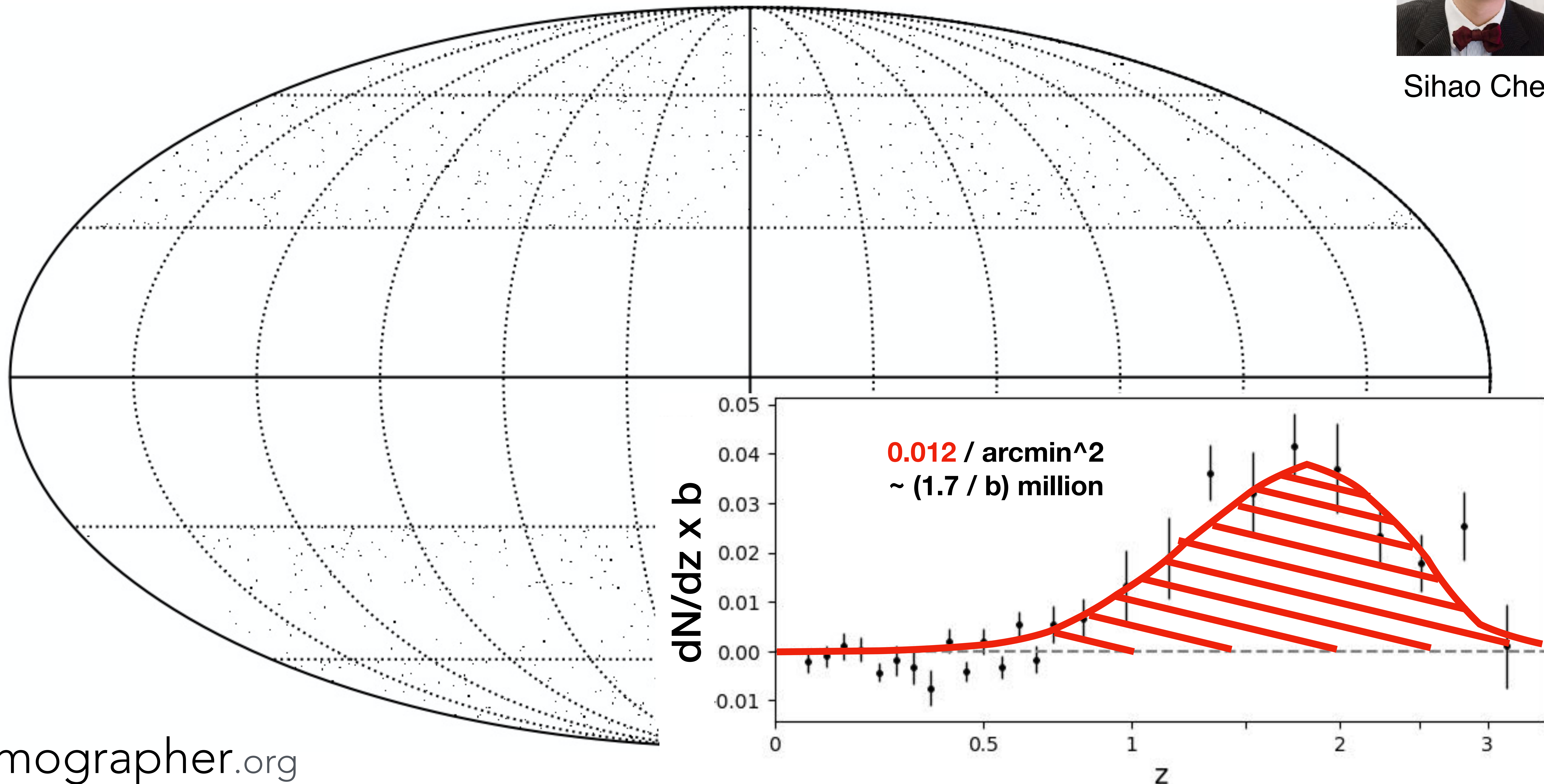
Sihao Cheng



Gaia blue point sources
with parallaxes consistent with zero



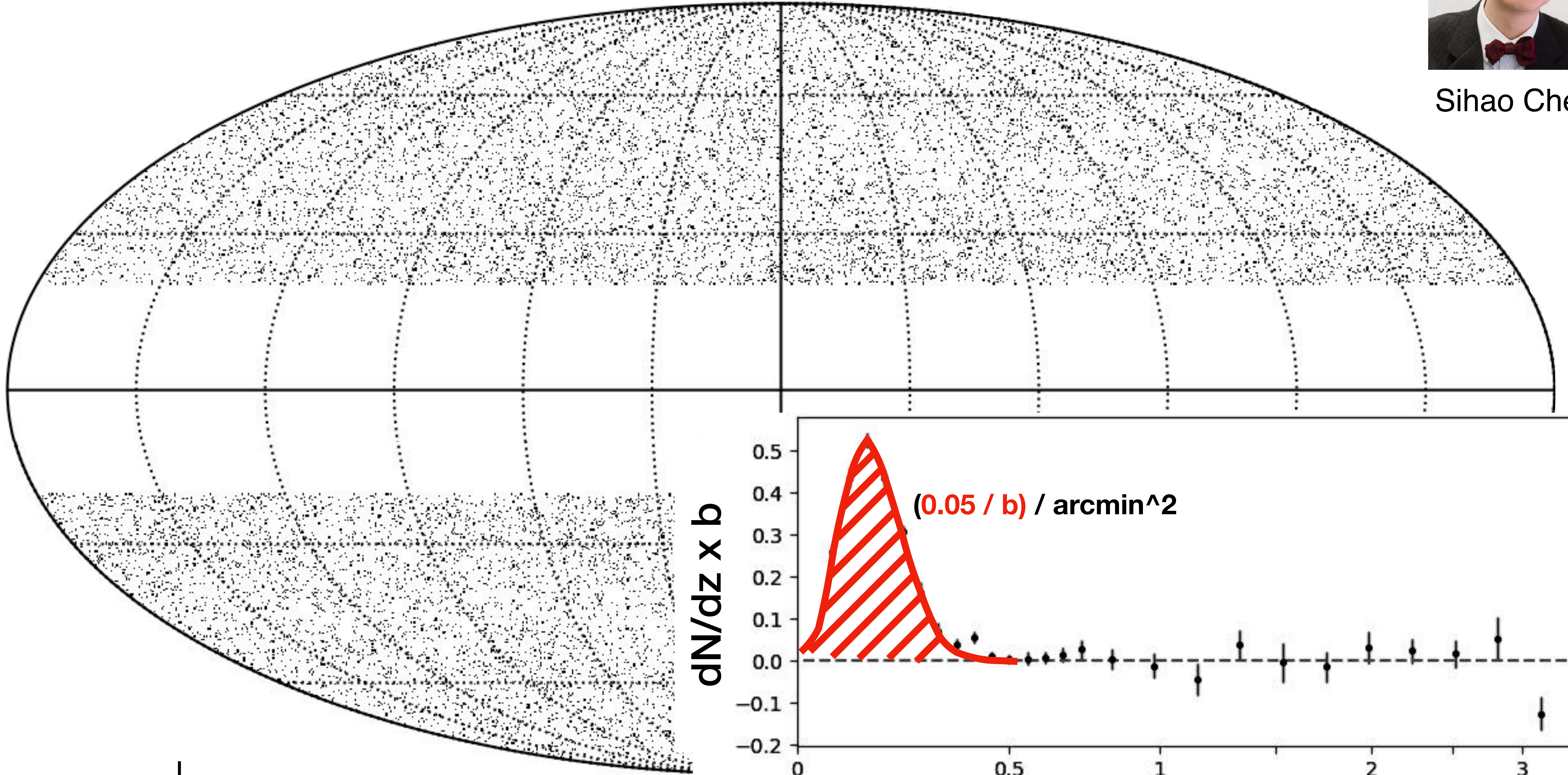
Sihao Cheng



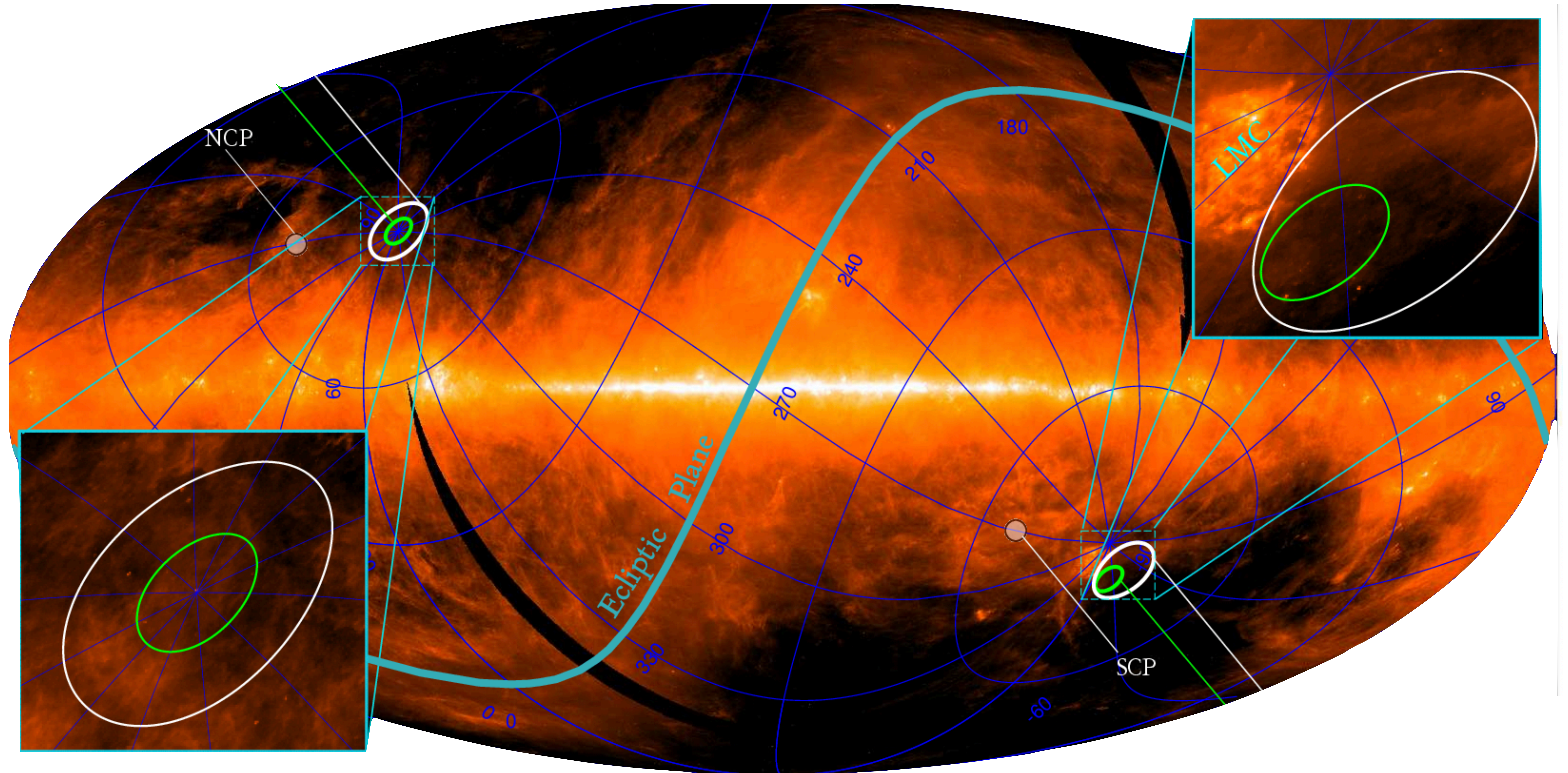
Gaia extended sources
(3 million)



Sihao Cheng



The SPHEREx sky

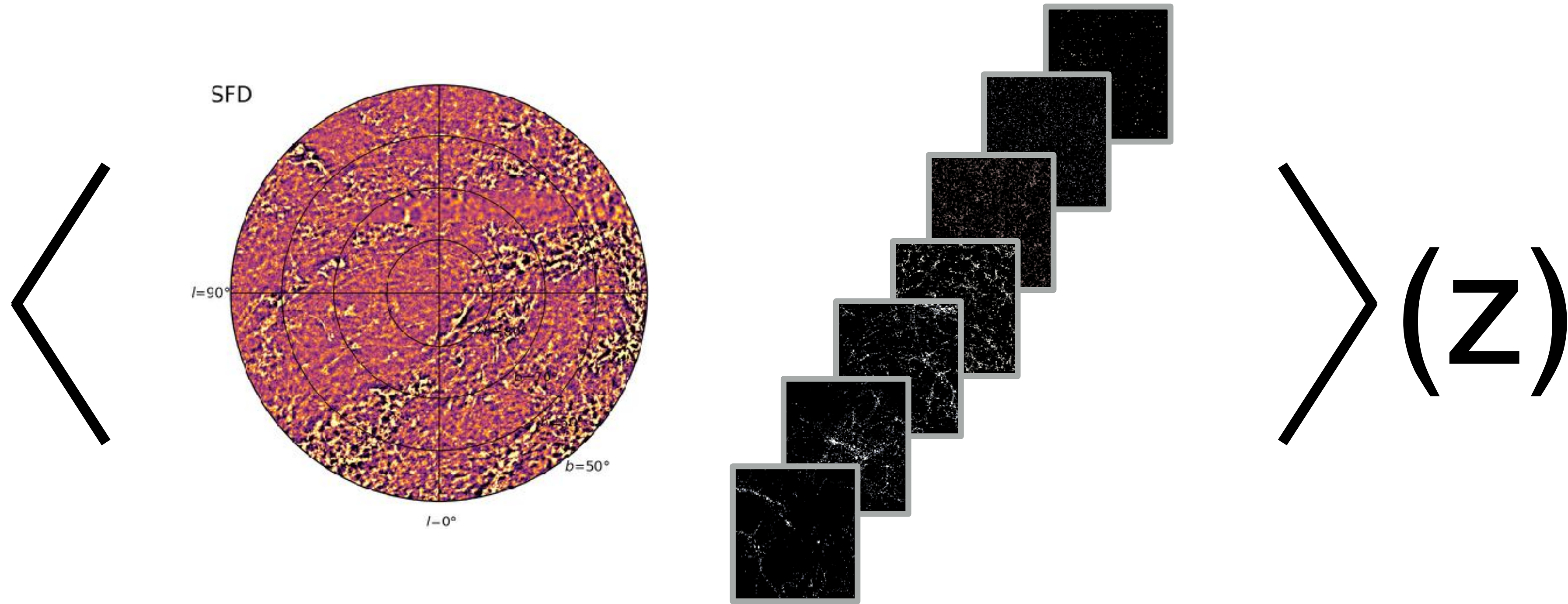


Extragalactic SPHEREx

millions of spectra

100 million photo-zs

10 billions of pixels



LSST
Euclid
WFIRST...

SPHEREx

redshift estimation

source with spec z

source with $p(z | \text{knowledge})$

photon field

tomographer.org