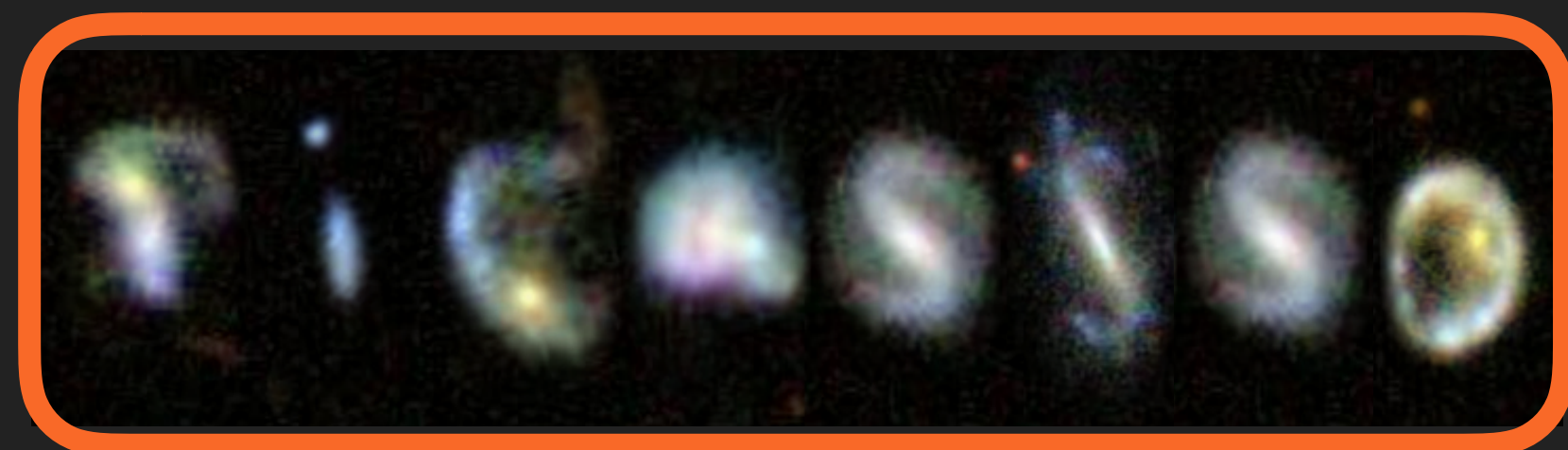




Visage dans étoile,
Pablo Picasso (1947)

TOBIAS BUCK & STEFFEN WOLF



PAINTING INTRINSIC ATTRIBUTES ONTO SDSS OBJECTS

LEIBNIZ-INSTITUT FÜR ASTROPHYSIK POTSDAM (AIP),
tbuck@aip.de

LARGE SCALE SURVEYS: CHALLENGE FOR CONVENTIONAL ANALYSIS / MODELLING

PHOTOMETRIC DATA FOR MILLIONS OF GALAXIES,
(EUCLID, LSST, DES, COSMOS, DEEP2, BUT ALSO LEGACY DATA LIKE SDSS)

CLASSICAL ANALYSIS/CLASSIFICATION (VISUAL OR GALAXY ZOO LIKE) NOT
FEASIBLE

DATA EXPLORATION BEYOND (SIMPLE) MORPHOLOGICAL CLASSIFICATION

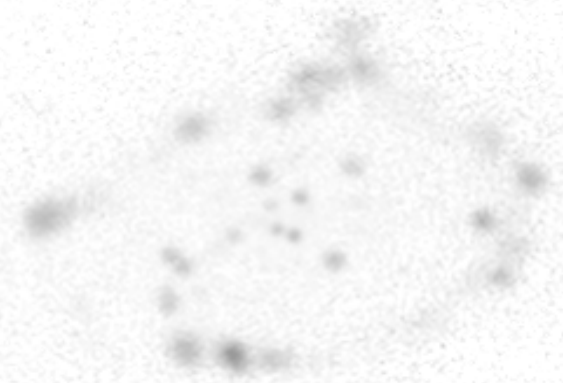
- ▶ RESOLVED GALAXY PROPERTIES

**HOW MUCH INFORMATION
IS ENCODED IN BROAD
BAND GALAXY
IMAGES?**

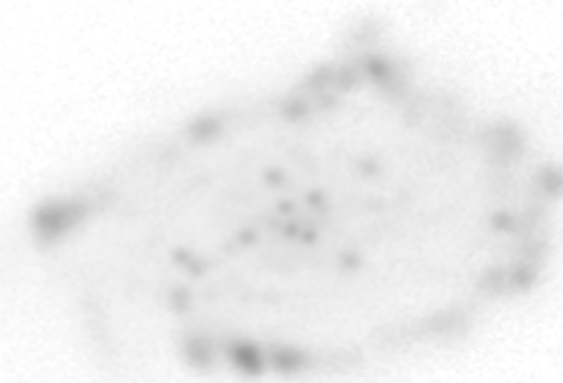


IMAGING DATA TO PHYSICAL PROPERTIES

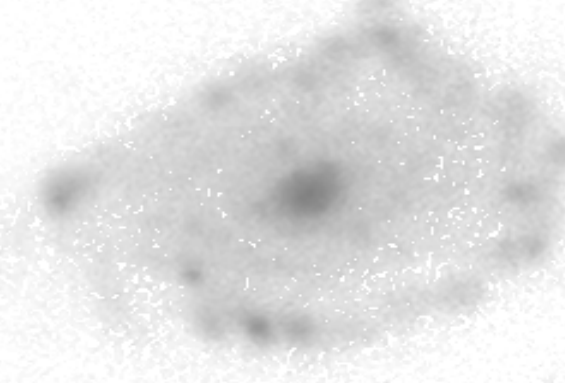
u-band



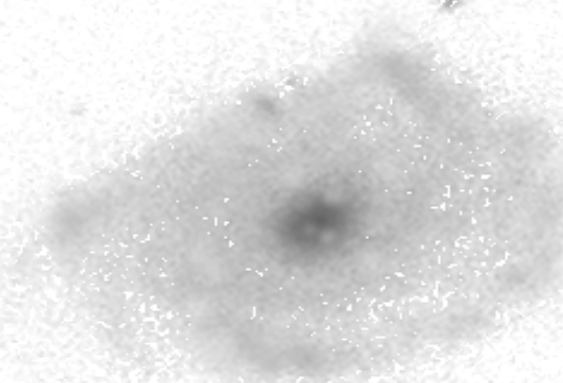
g-band



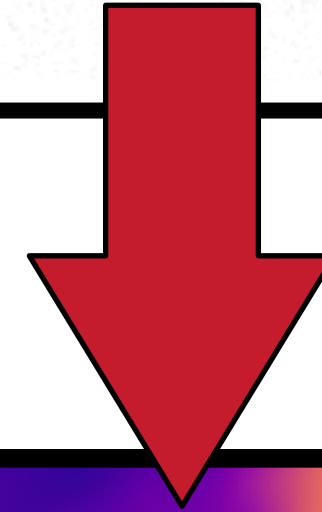
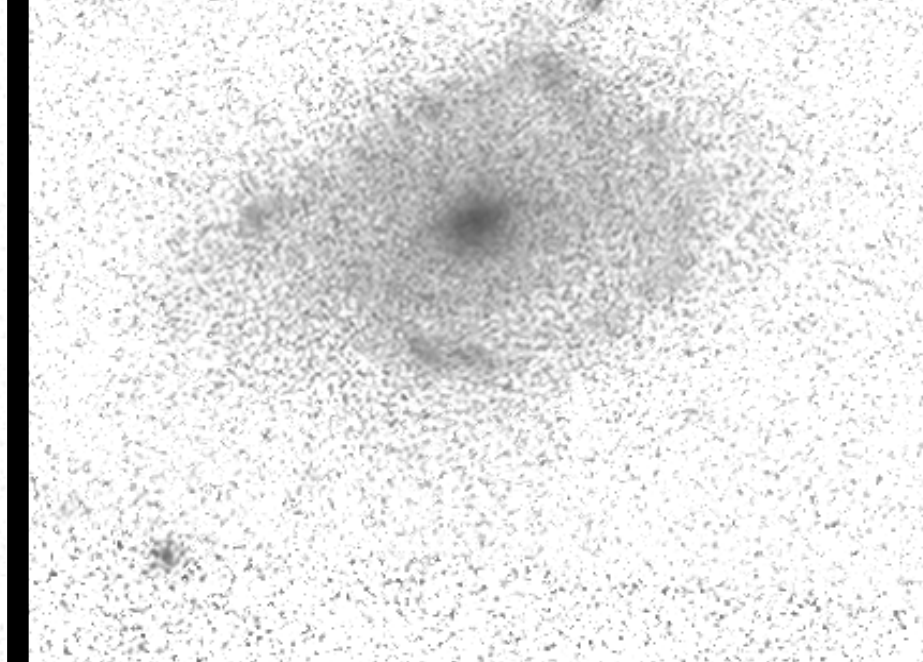
r-band



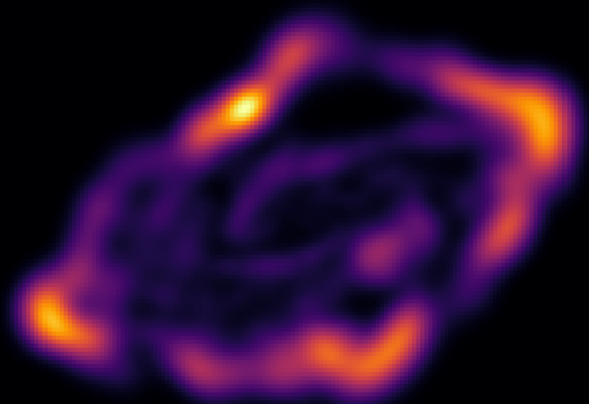
i-band



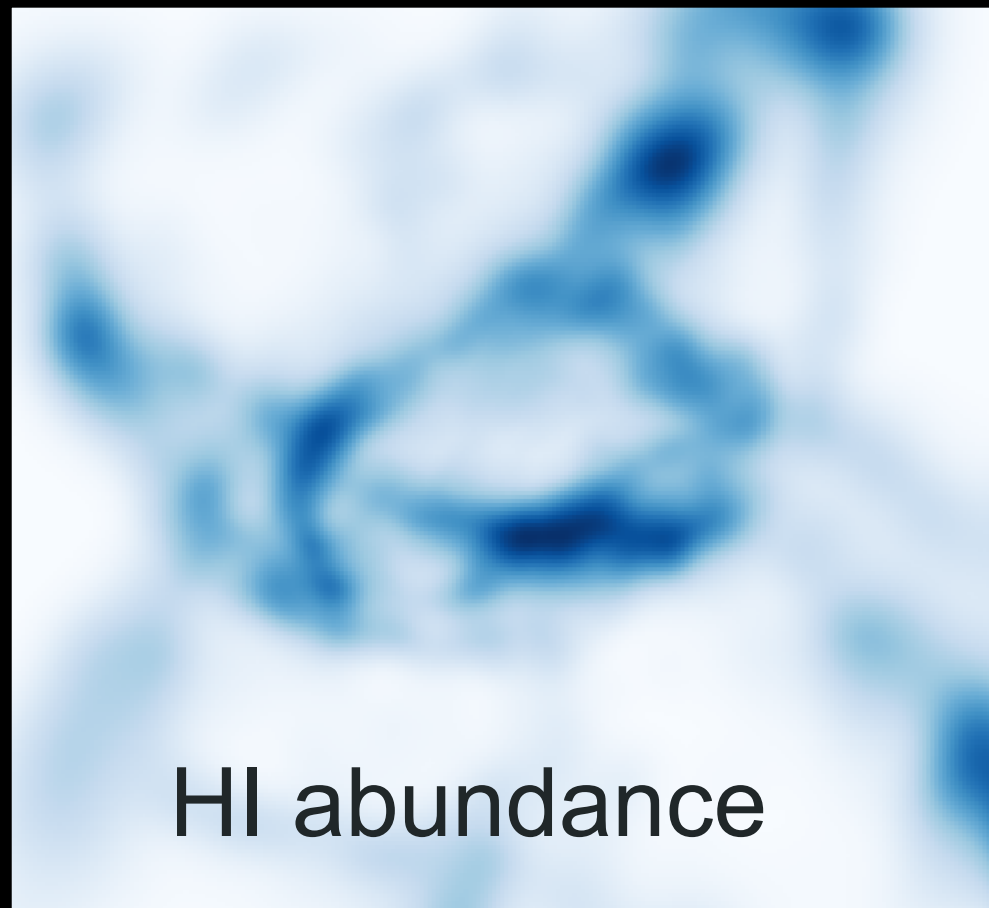
z-band



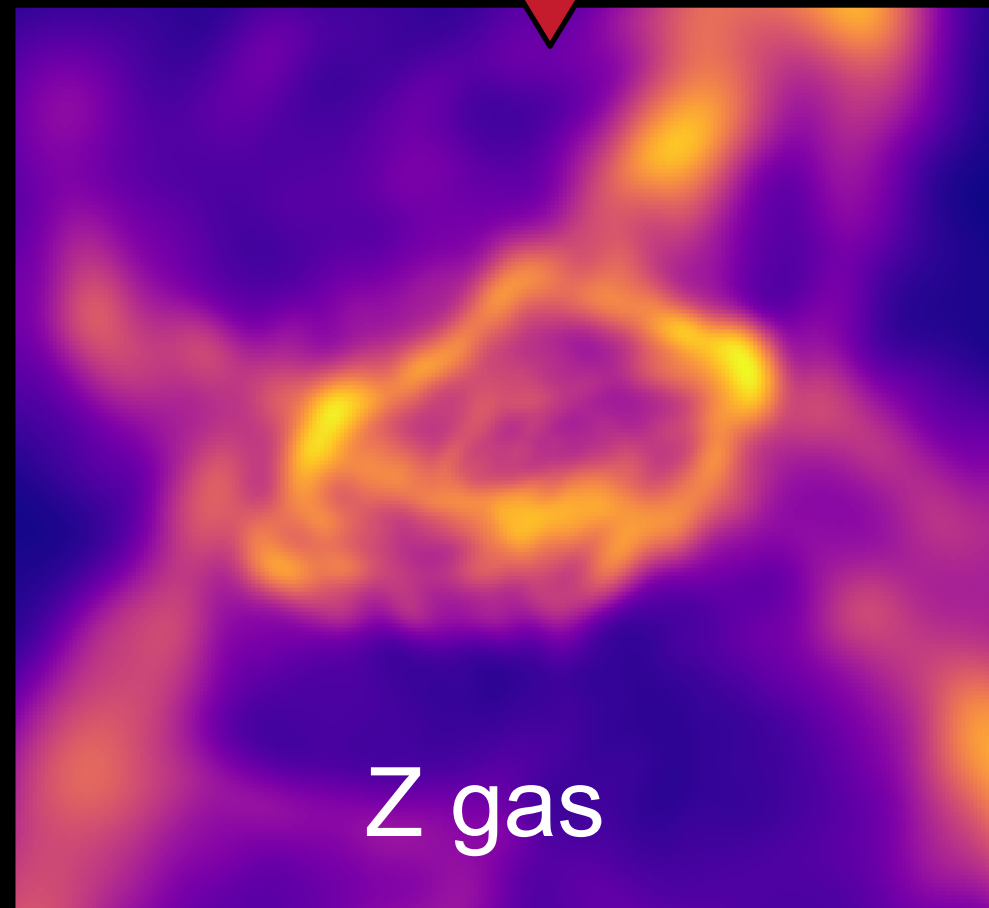
SFR



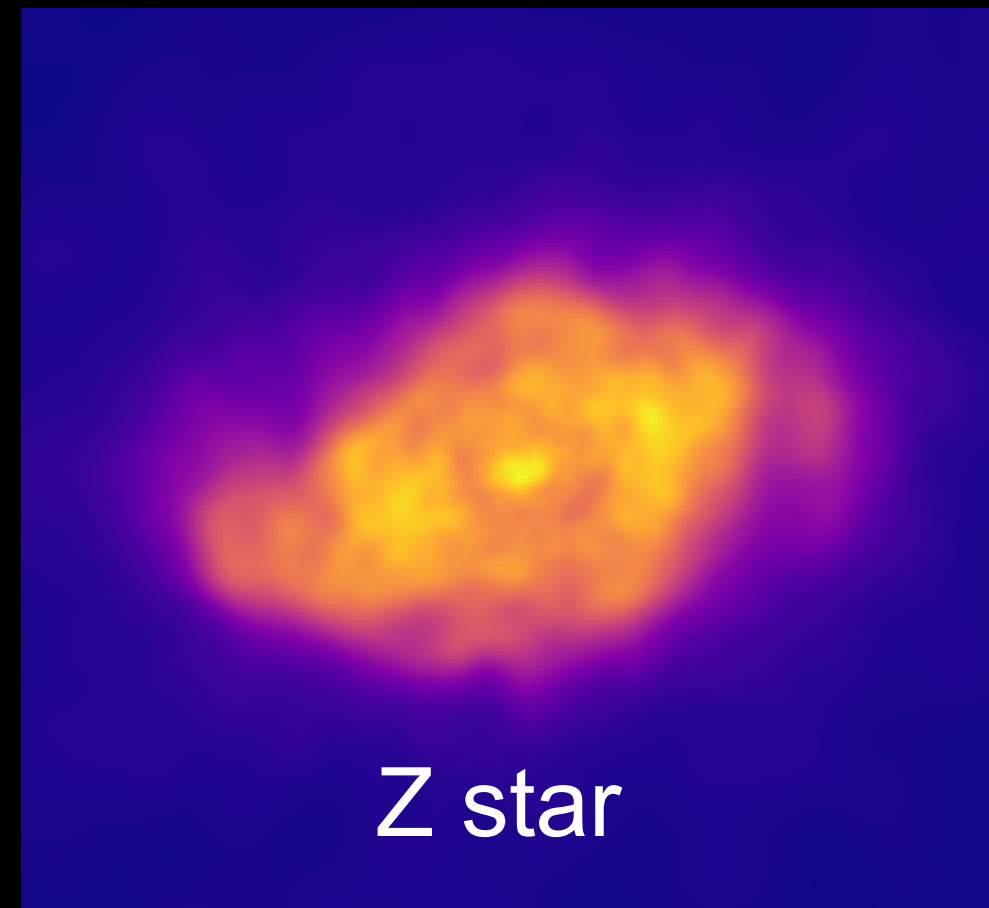
HI abundance



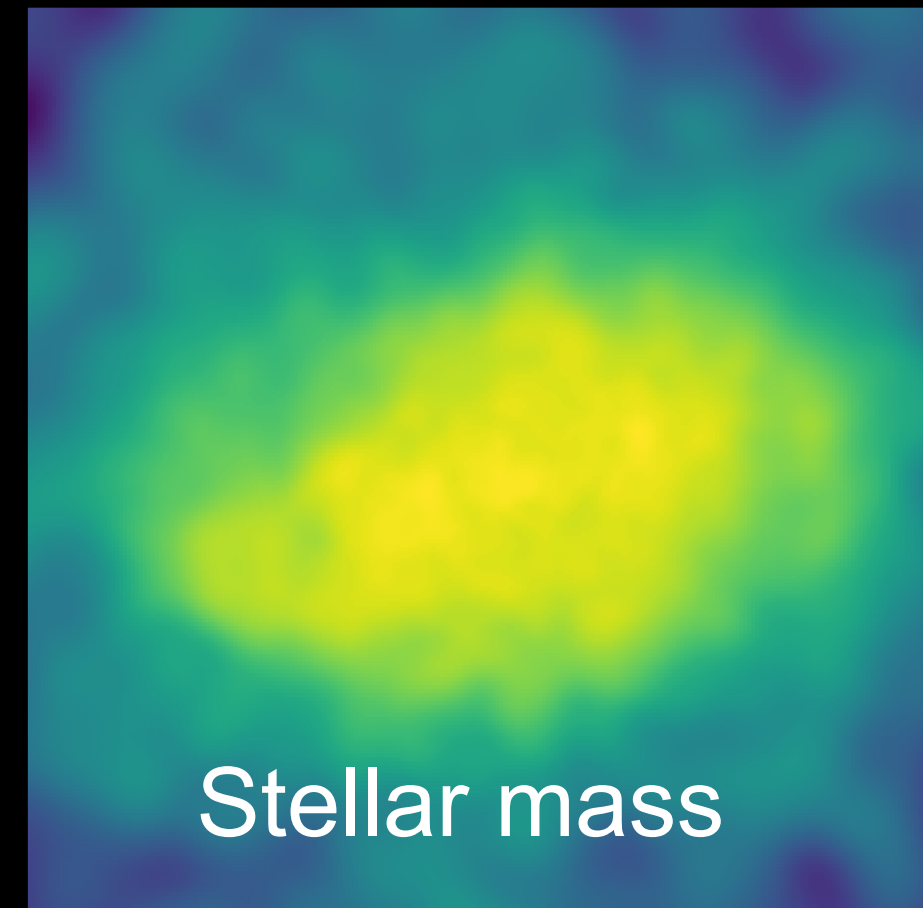
Z gas



Z star



Stellar mass



IMAGING DATA TO PHYSICAL PROPERTIES

u-band

g-band

r-band

i-band

z-band

- ▶ SDSS MOCK IMAGES 256X256 PIXELS TORREY+2014, SNYDER+2015
- ▶ RADIATIVE TRANSFER, BACKGROUND STARS, PSF, NOISE, SURFACE BRIGHTNESS CUT
- ▶ PHYSICAL PROPERTIES ON SAME SCALE

SFR

HI abundance

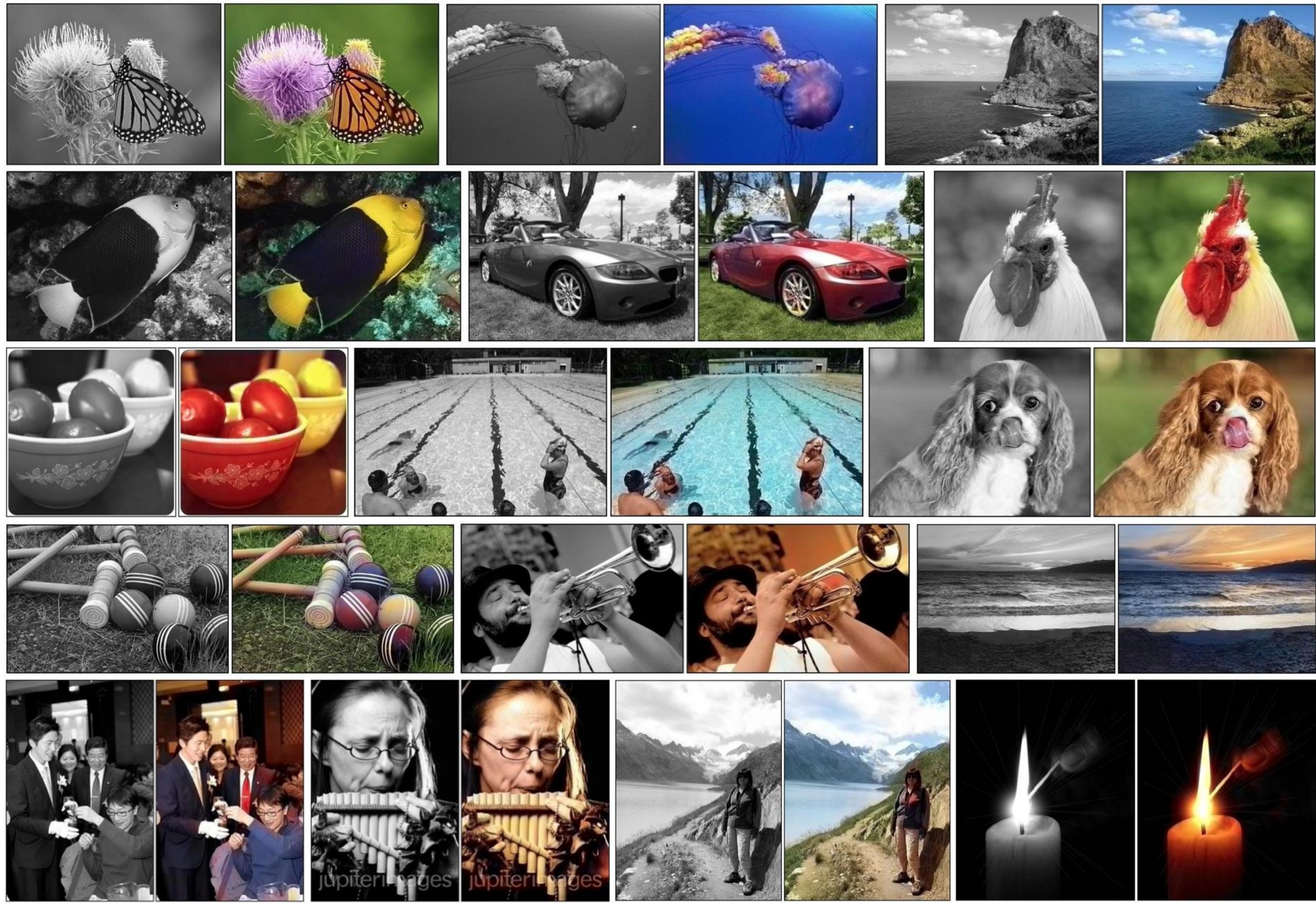
Z gas

Z star

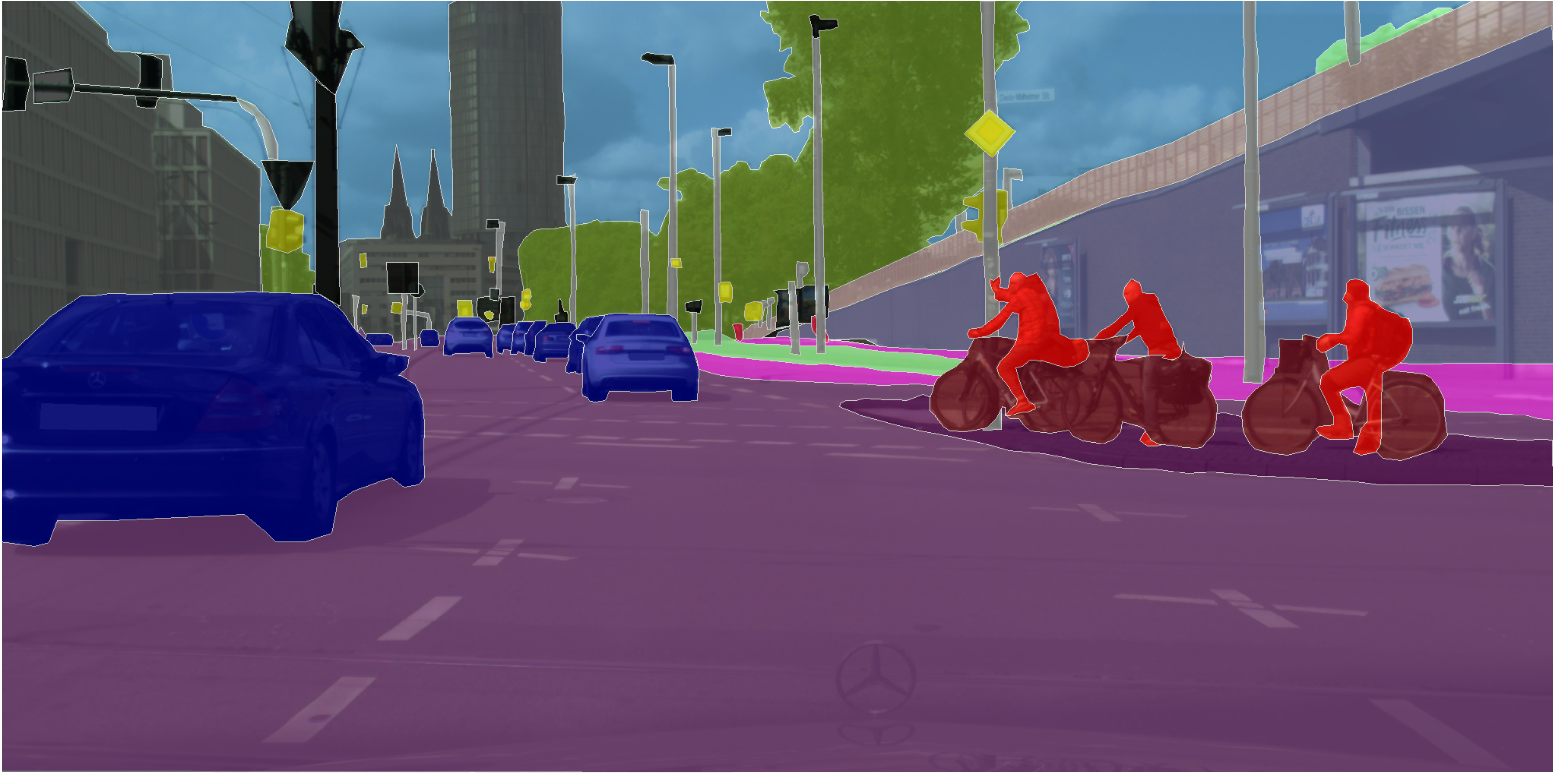
Stellar mass

SIMILAR APPLICATIONS

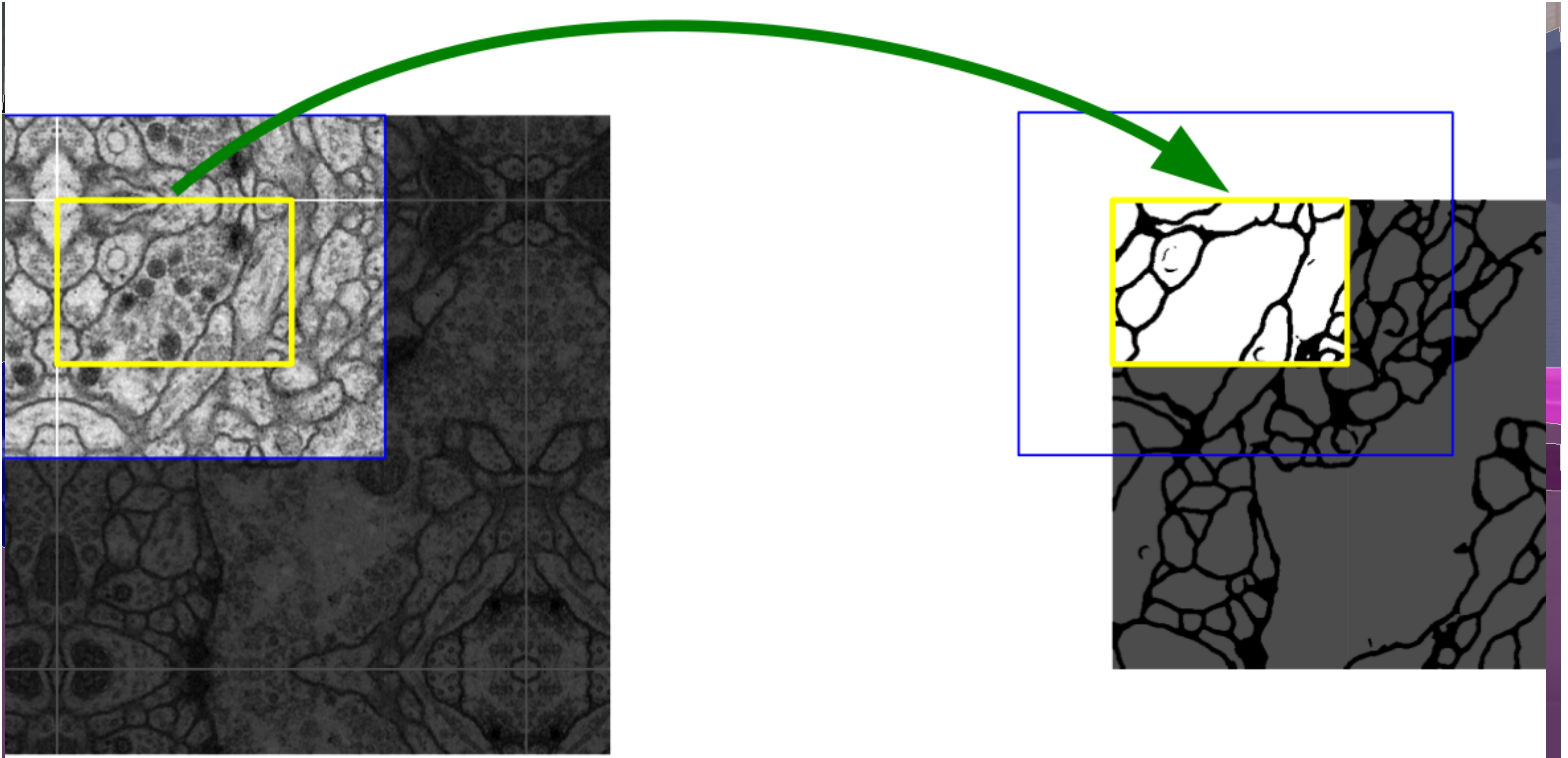
SIMILAR APPLICATIONS



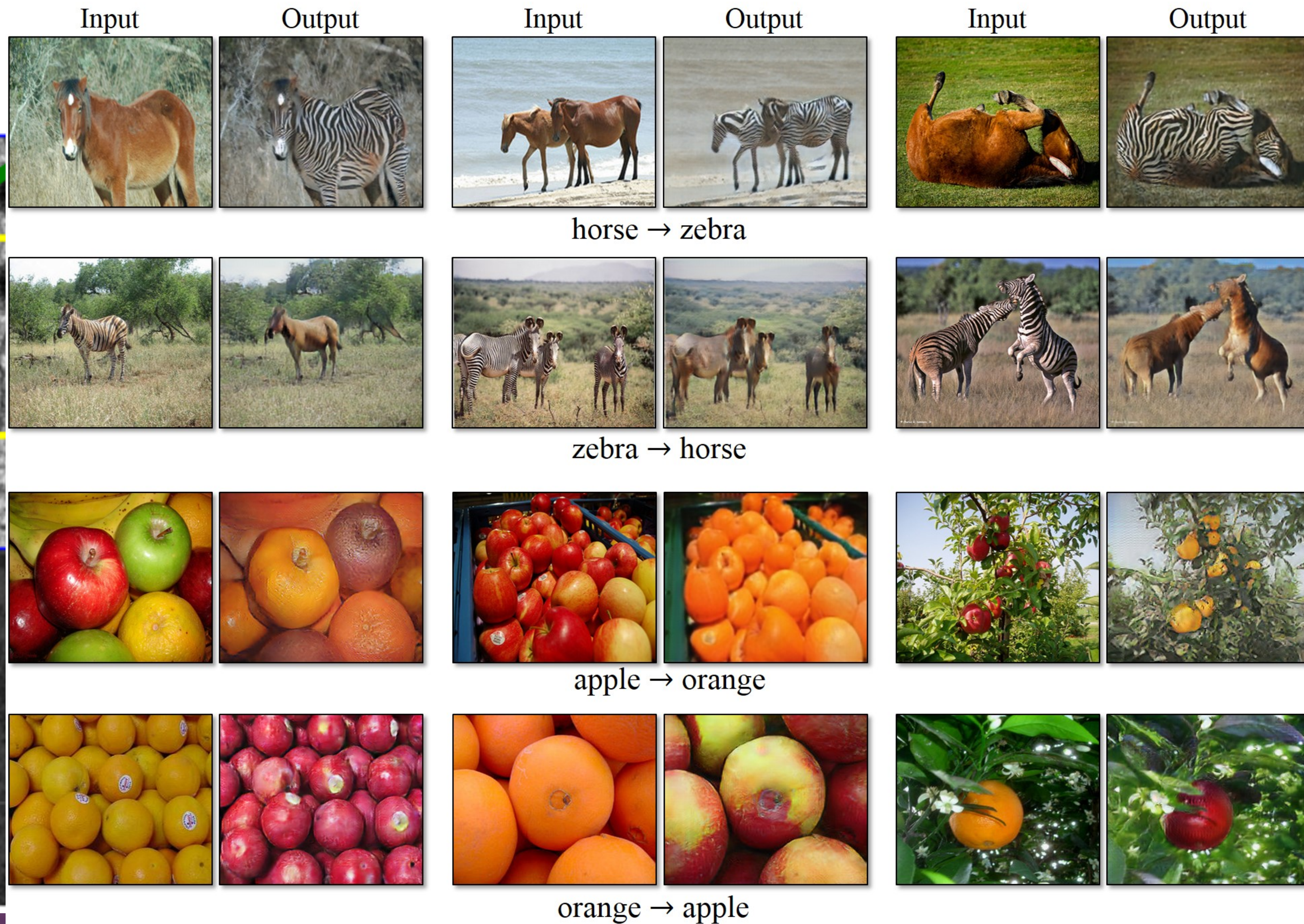
SIMILAR APPLICATIONS



SIMILAR APPLICATIONS



SIMILAR APPLICATIONS

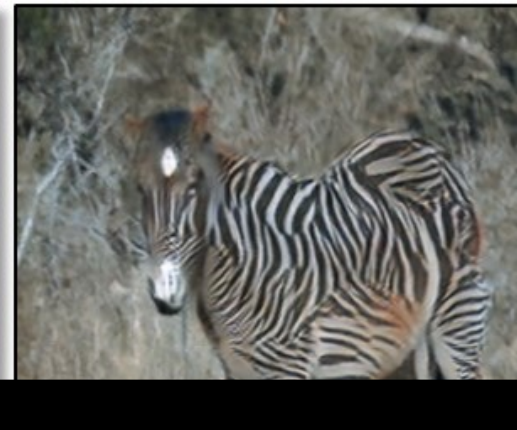


SIMILAR APPLICATIONS

Input



Output



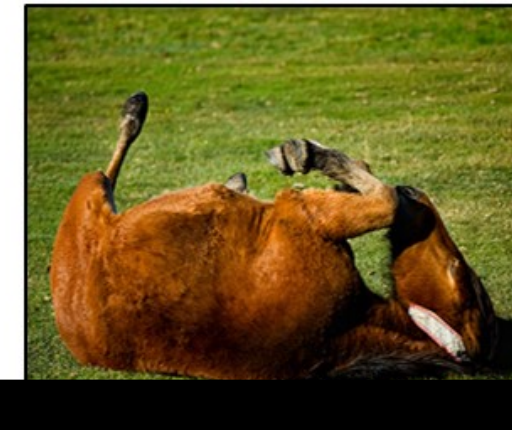
Input



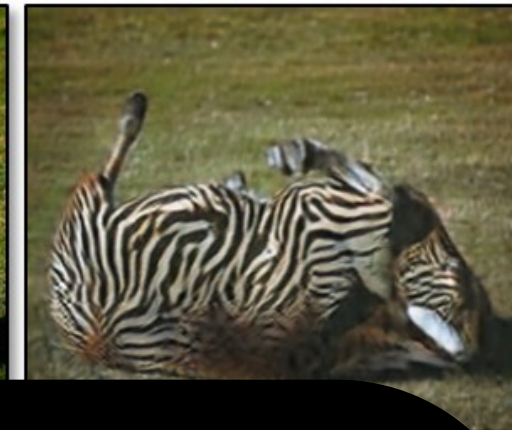
Output



Input



Output



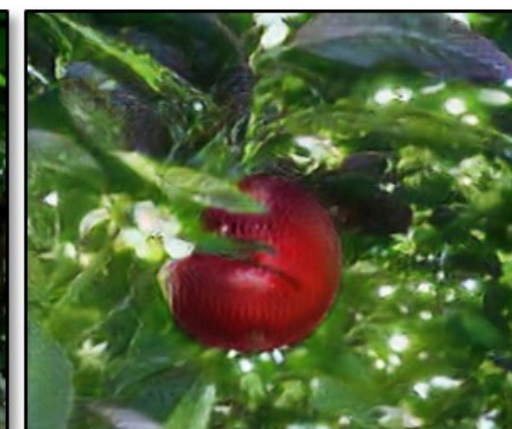
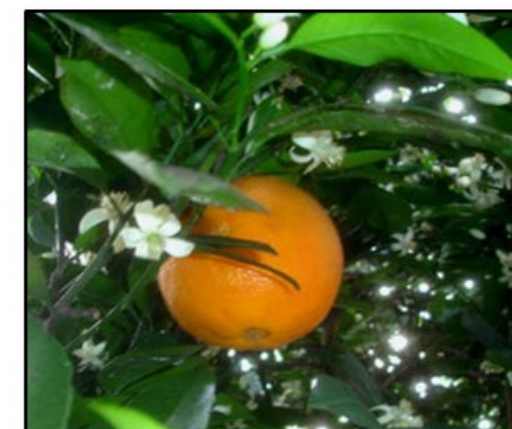
Share a common Architecture:

UNet (Ronneberger+2015)

apple → orange



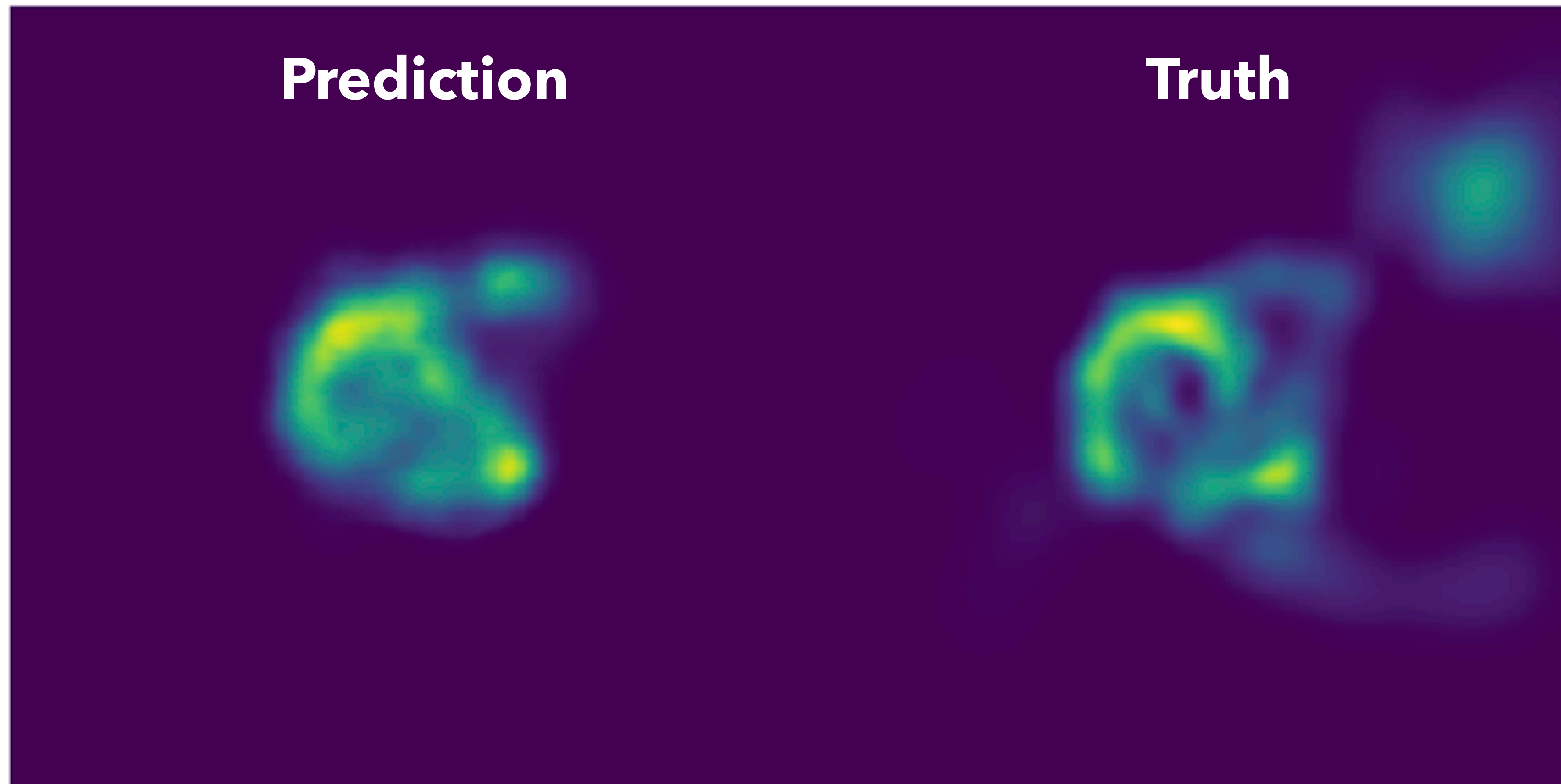
orange → apple



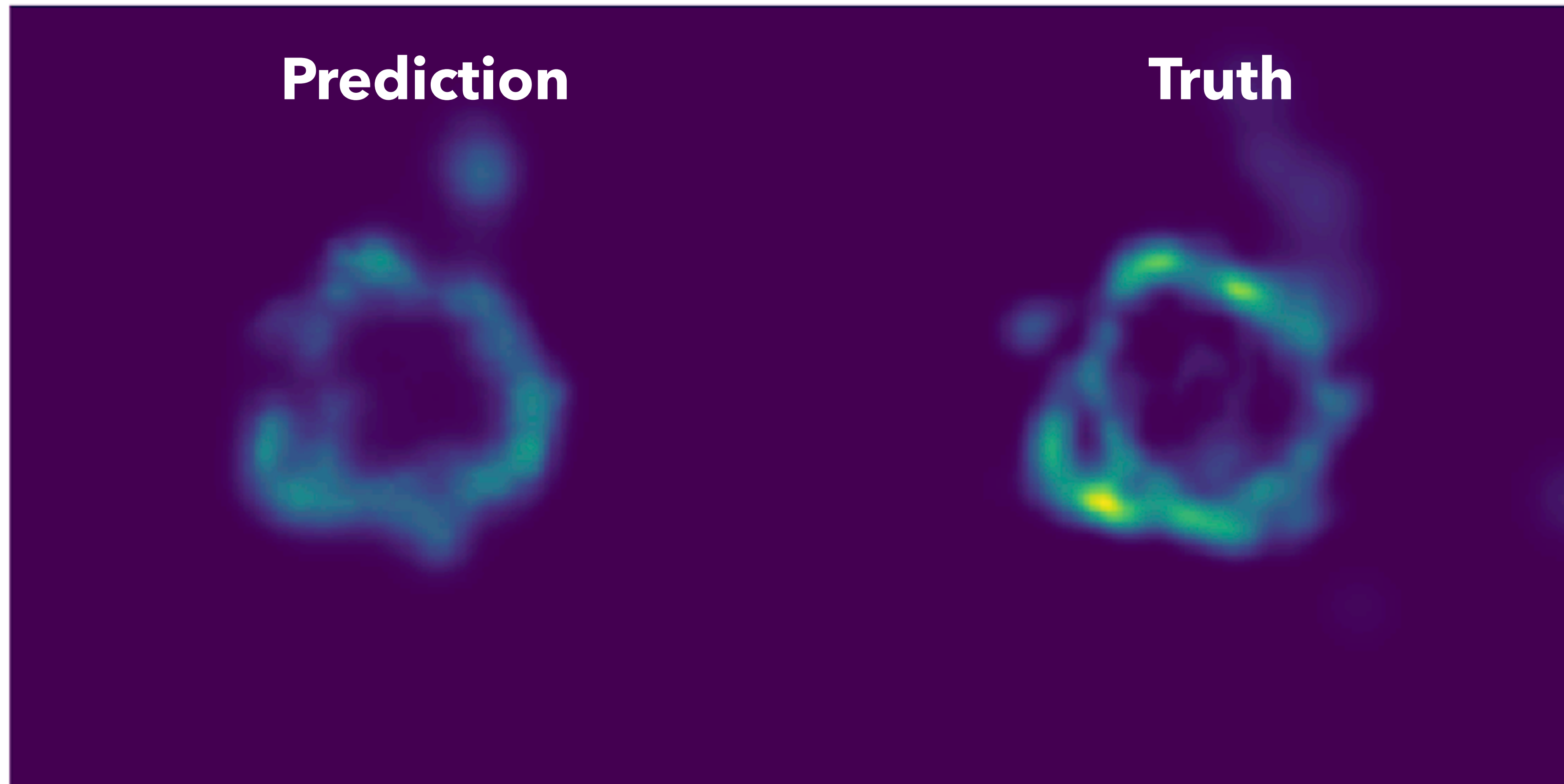
RESULTS



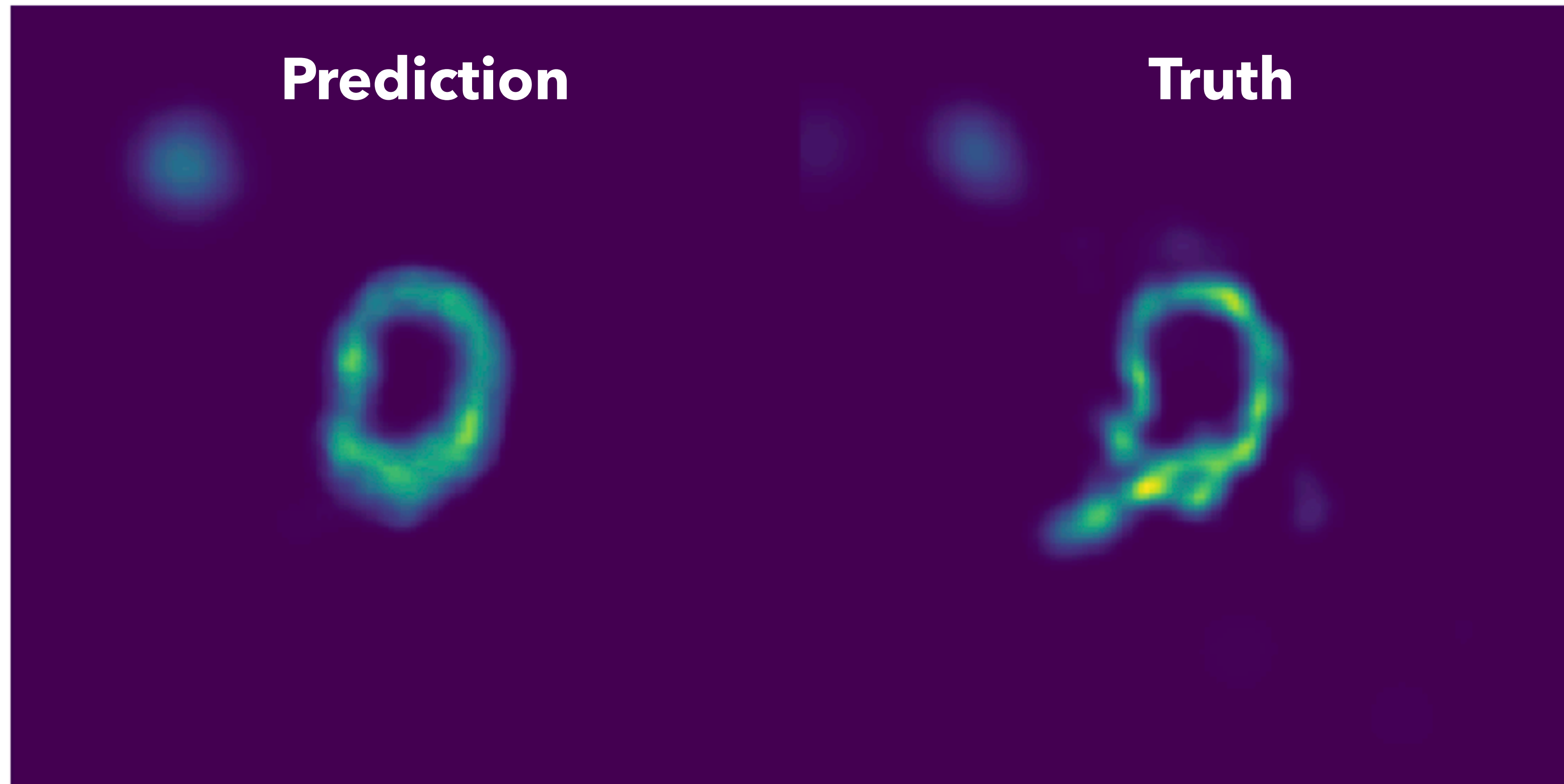
COMPARING TRUE AND PREDICTED SFR – 100TH QUANT.



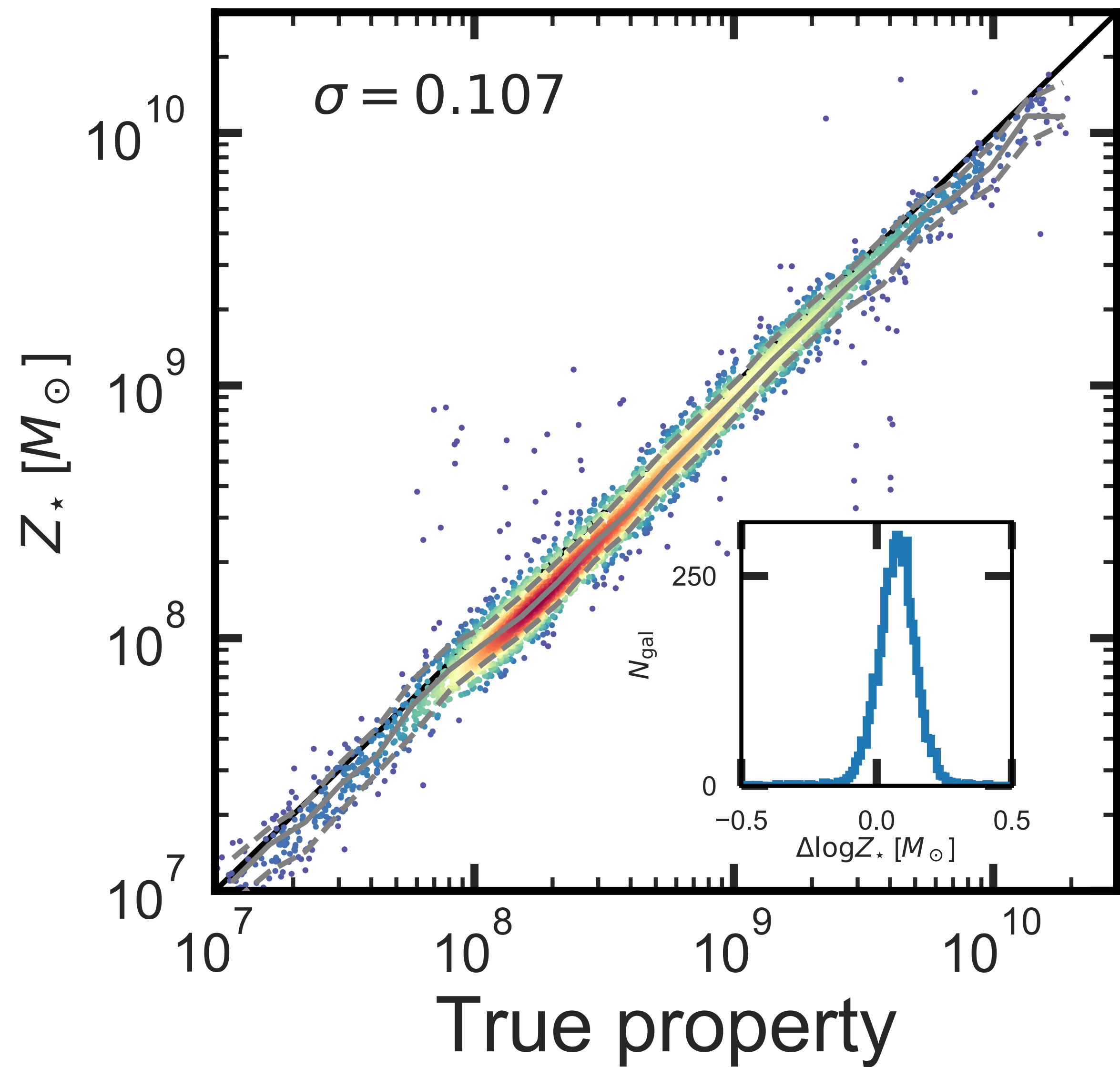
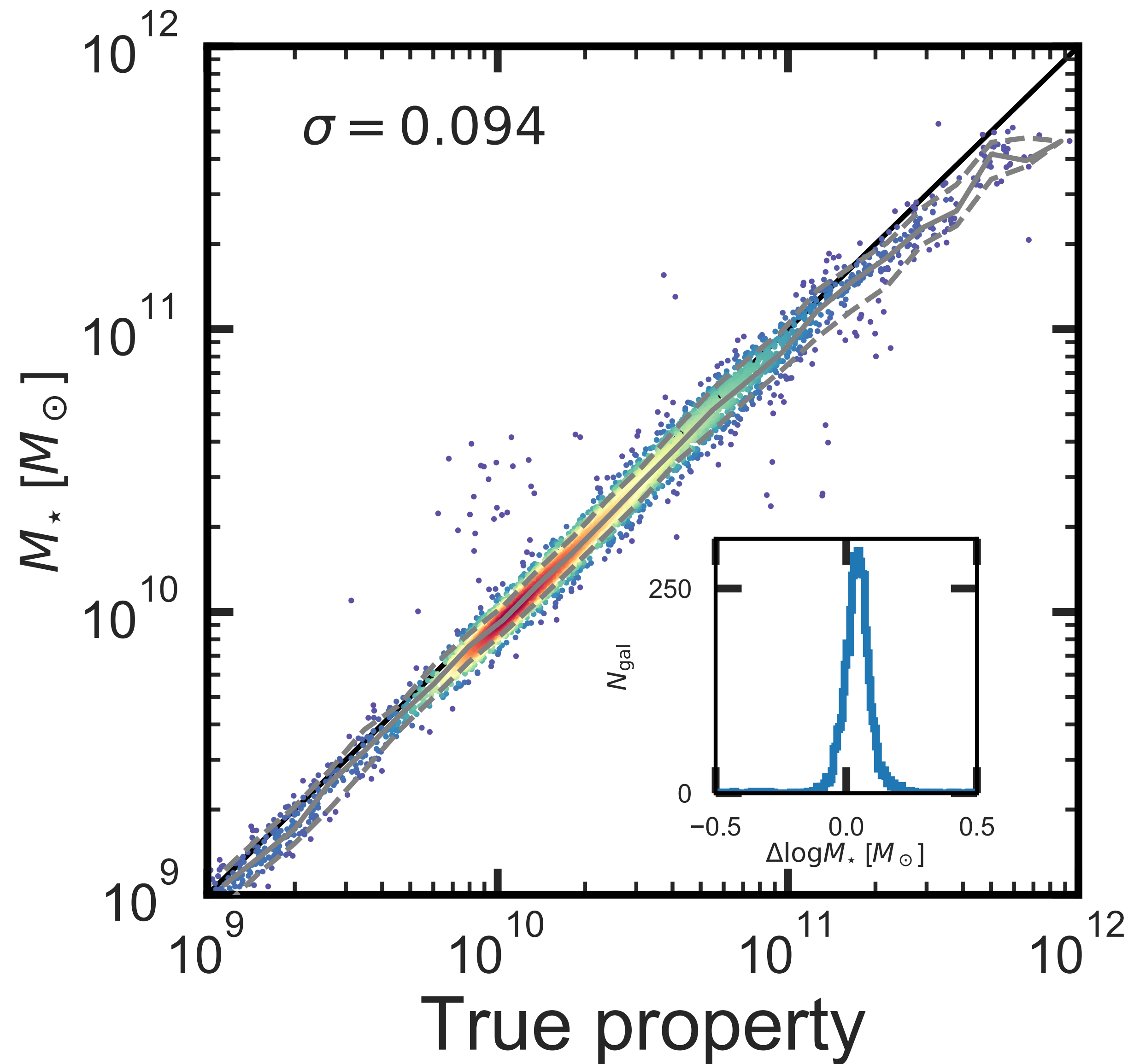
COMPARING TRUE AND PREDICTED SFR – 70TH QUANT.



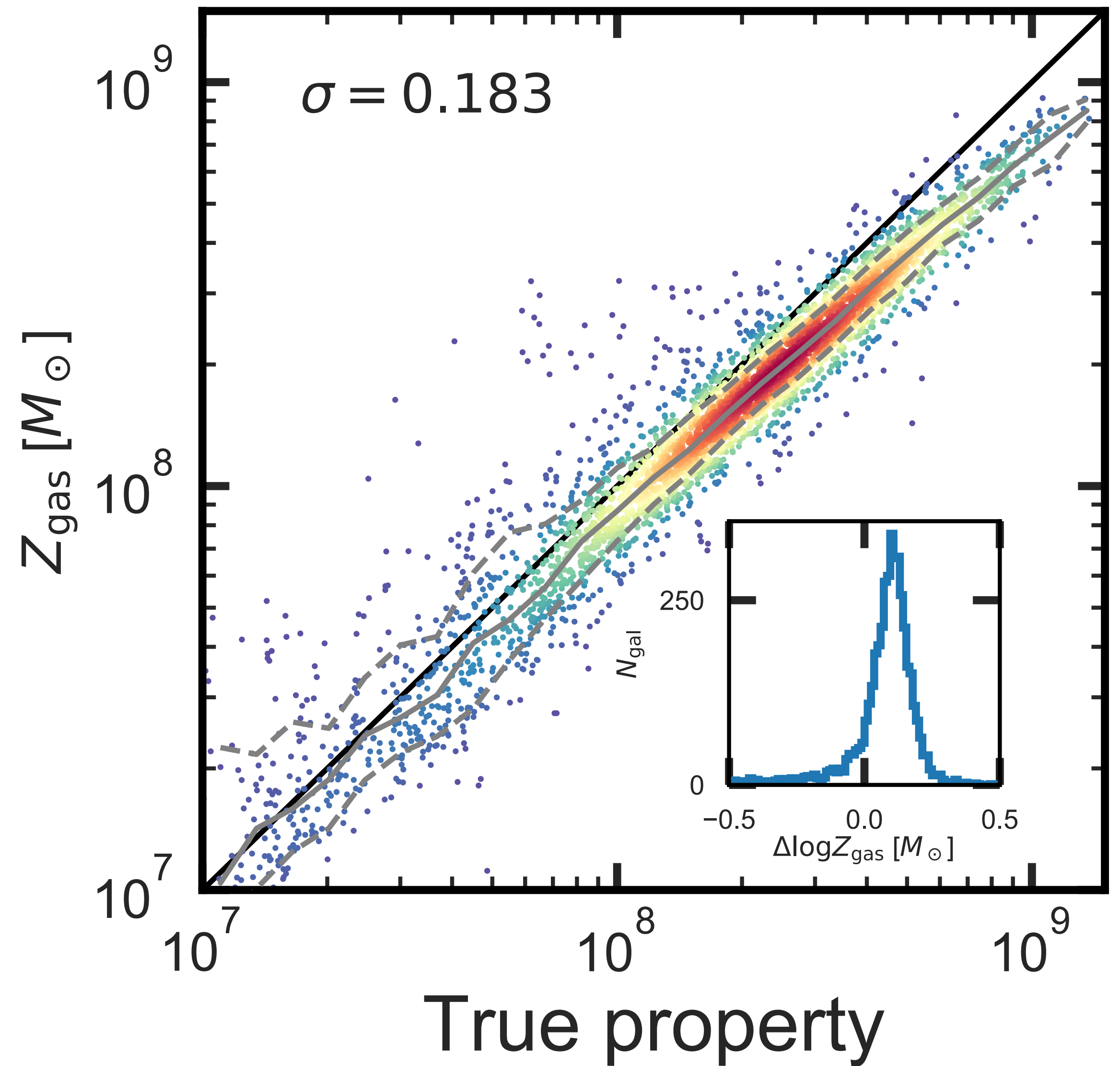
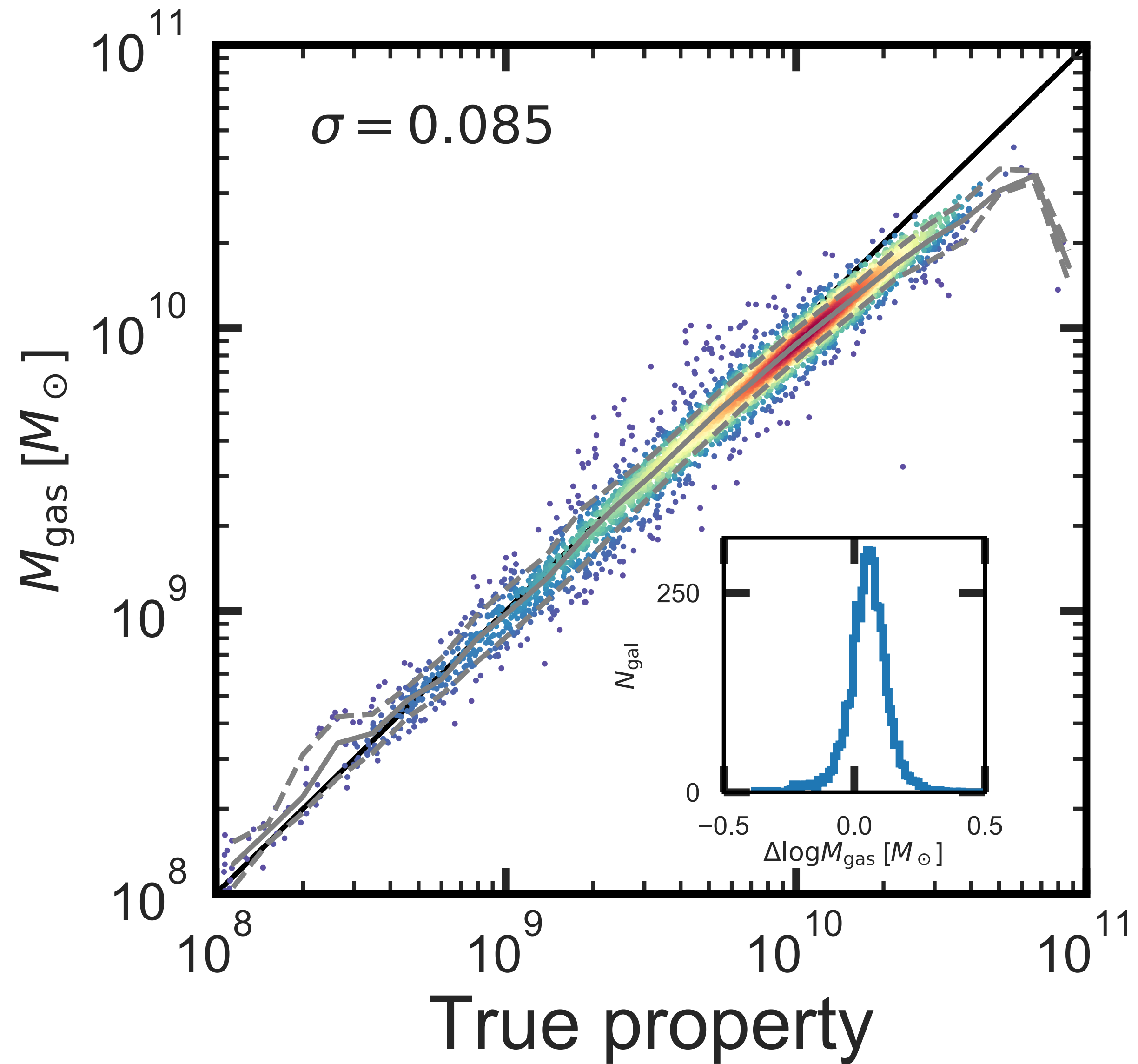
COMPARING TRUE AND PREDICTED SFR – 40TH QUANT.



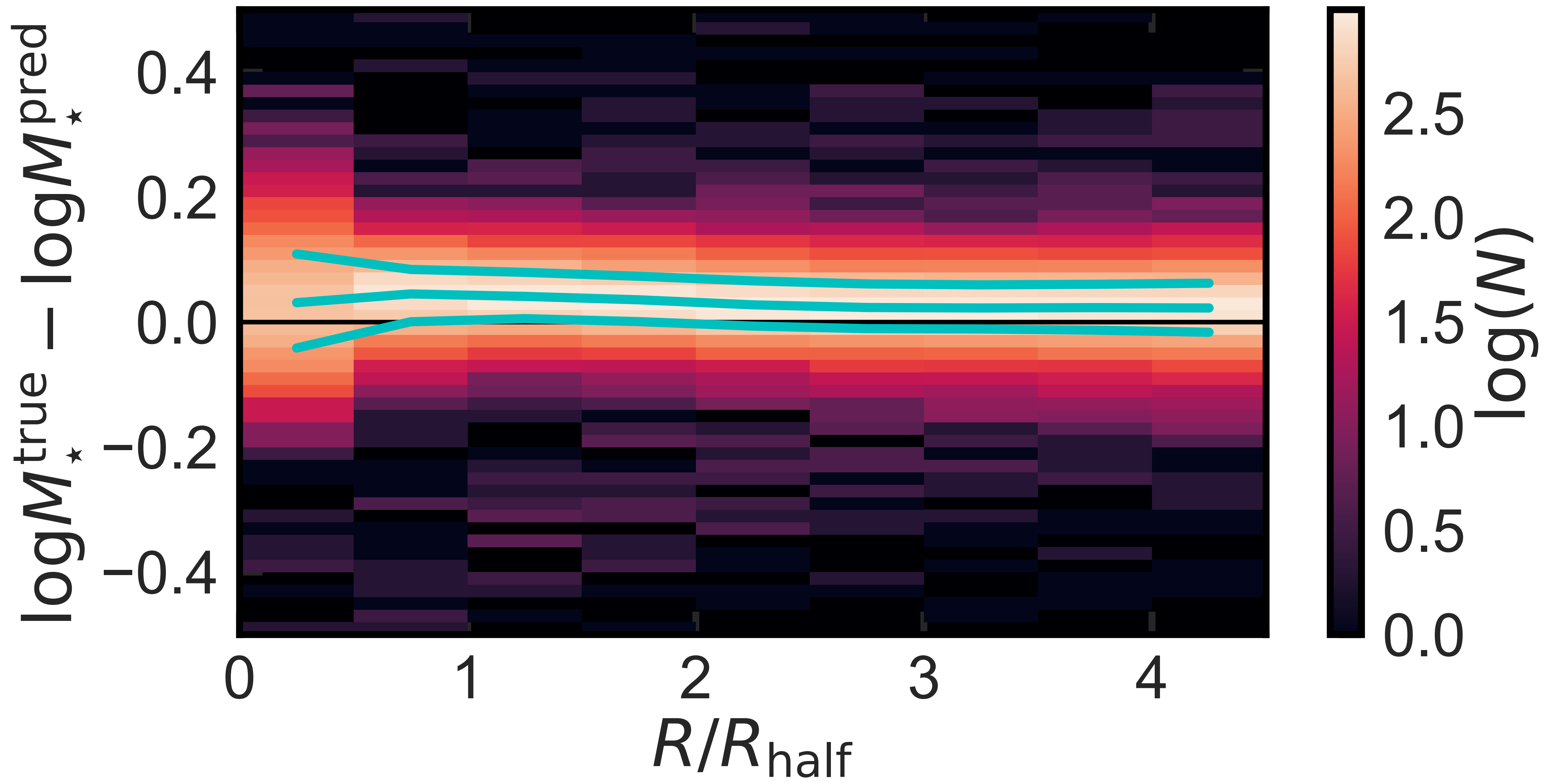
STELLAR PROPERTIES



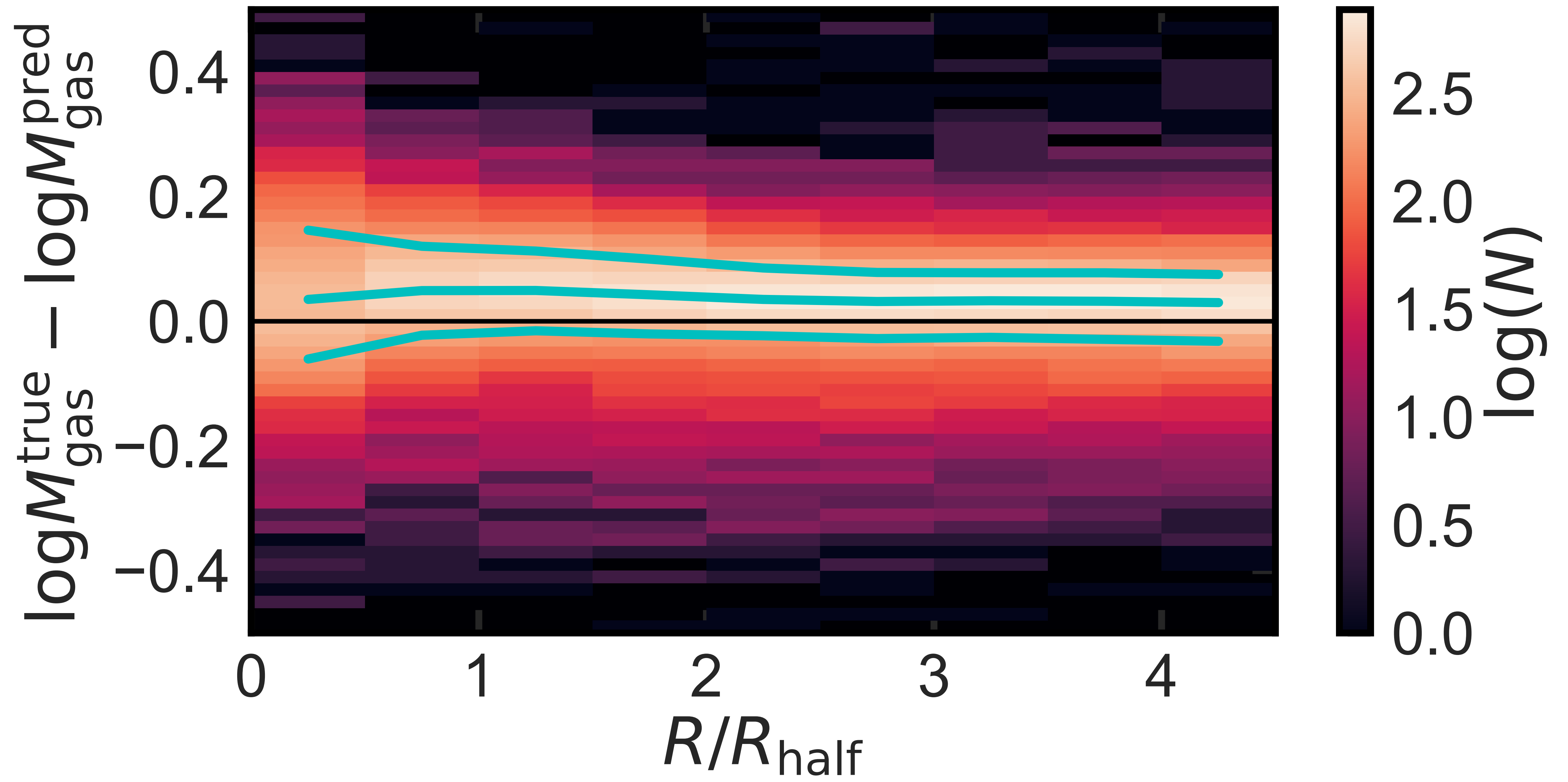
GASEOUS PROPERTIES



RADIAL SYSTEMATICS?



RADIAL SYSTEMATICS?



CONCLUSION

SDSS (MOCK) *U,G,R,I,Z* IMAGES CONTAIN ENOUGH INFORMATION TO *PREDICT* PHYSICAL PROPERTIES OF GALAXIES ON A *PIXEL-BY-PIXEL* BASIS

NEXT STEPS: REAL LIFE APPLICATION

USE PICASSO ON REAL SDSS IMAGES WITH SDSS MANGA, SAMI, OR CALIFA AS TRAININGS SAMPLE