Generating Astronomical Multiband Images using the Hue-Saturation-Value Colour Space

Presented by

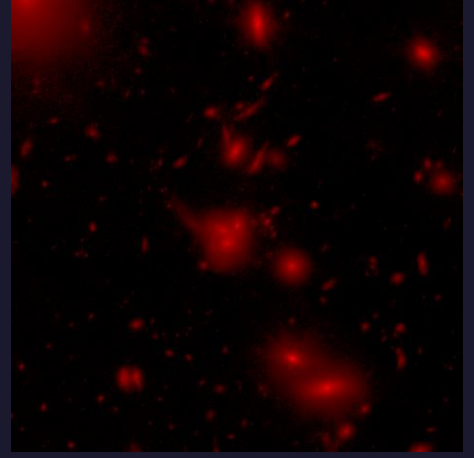
Hansen Jiang

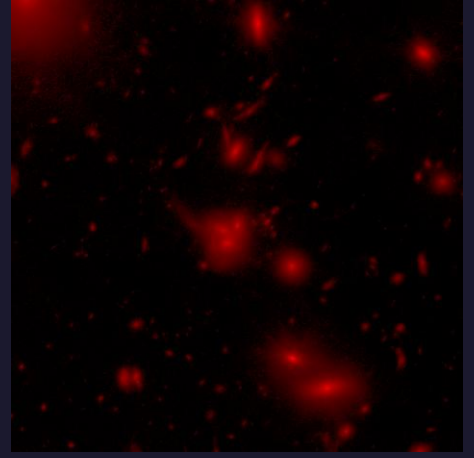
Contributors

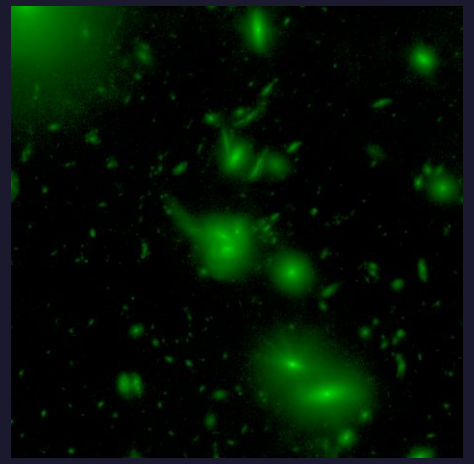
Mubdi Rahman
Jennifer Scora
Tai Withers

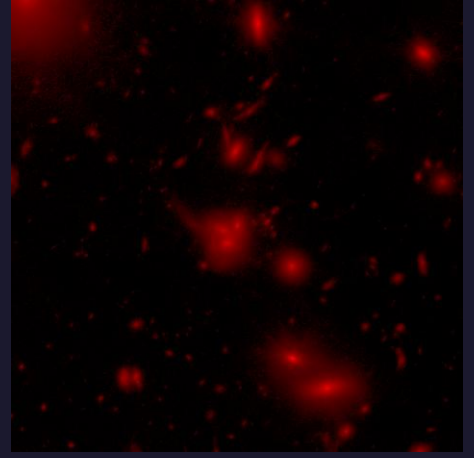
How astronomers make images

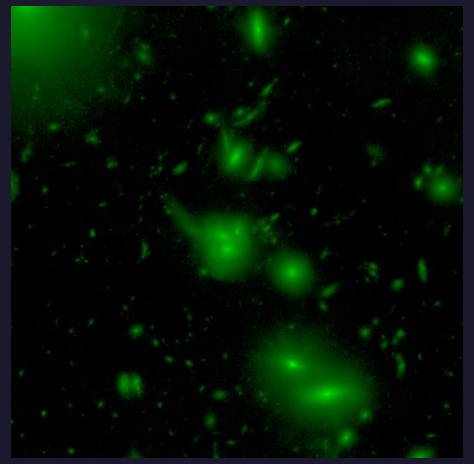
(and why it's wrong)

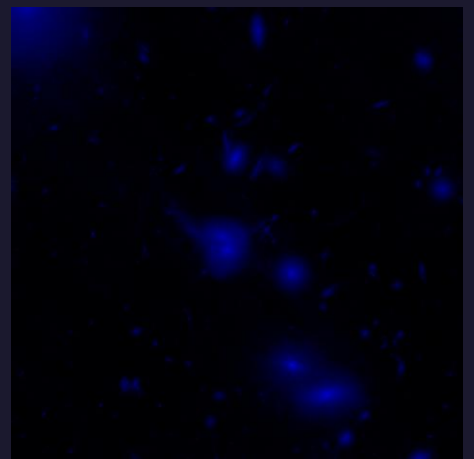


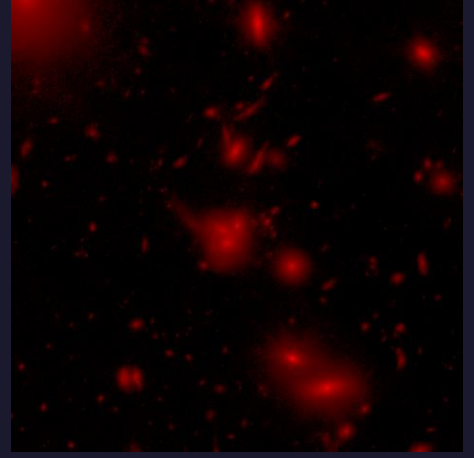


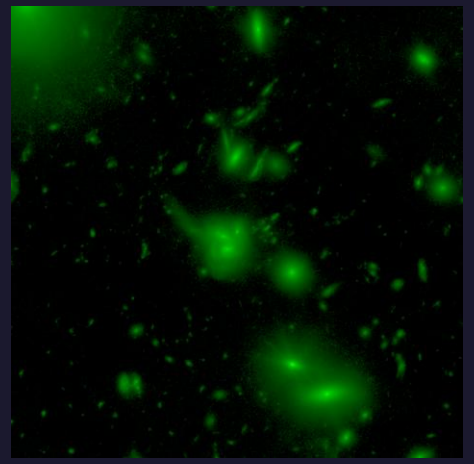


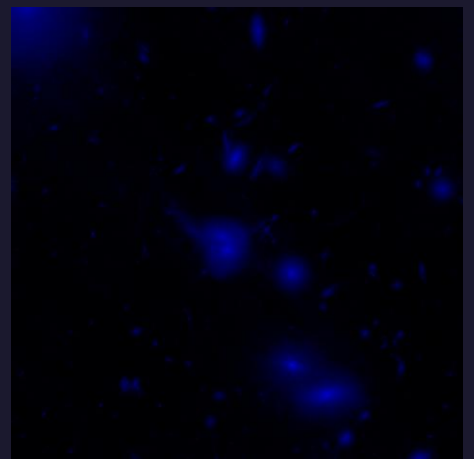


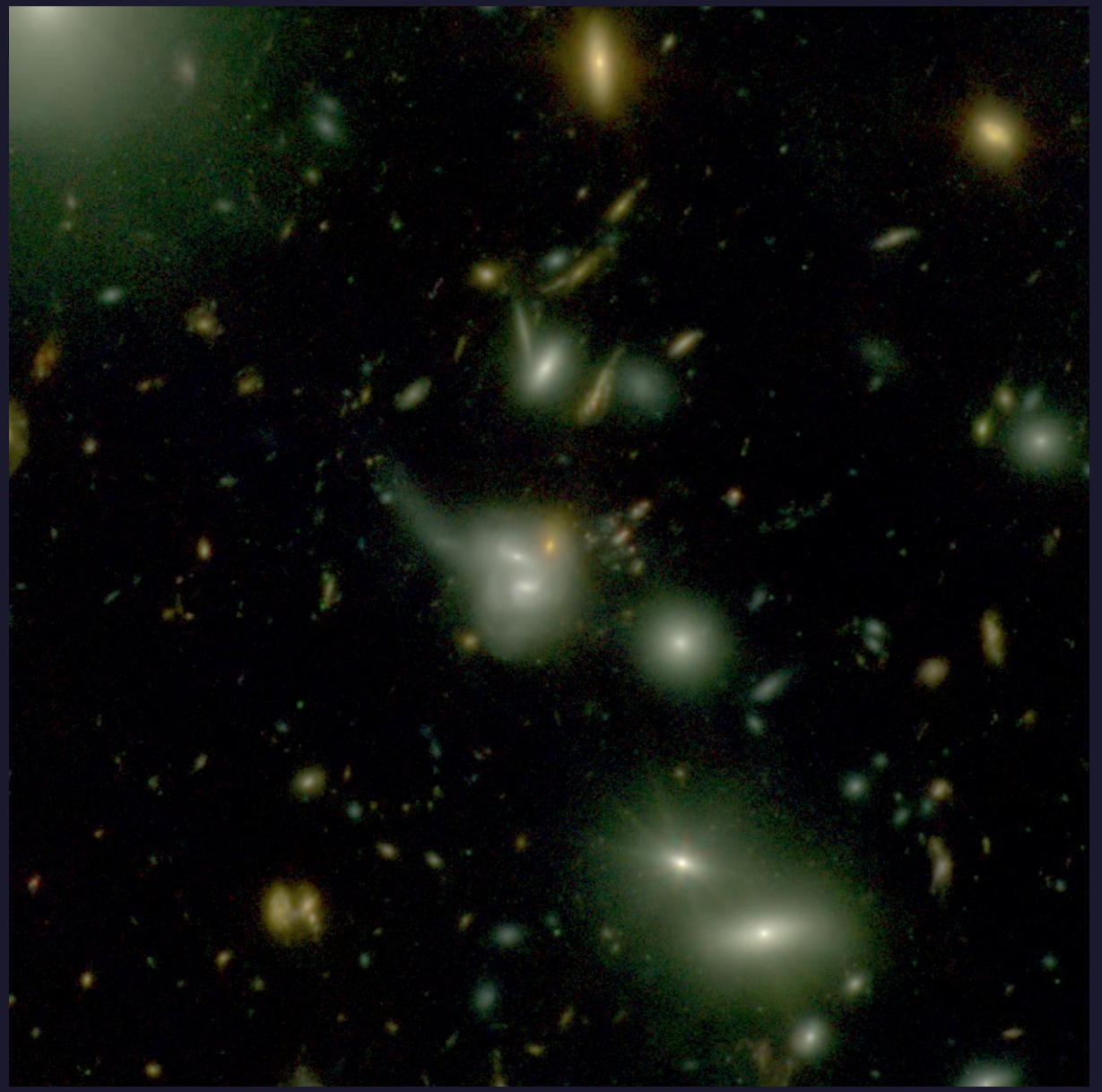




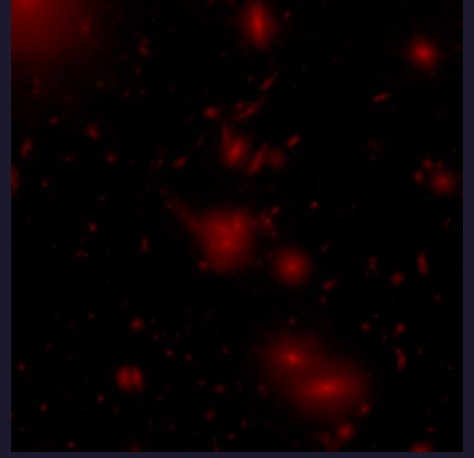








0.75 ×



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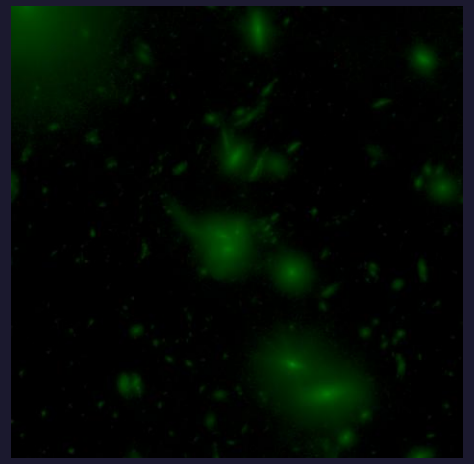

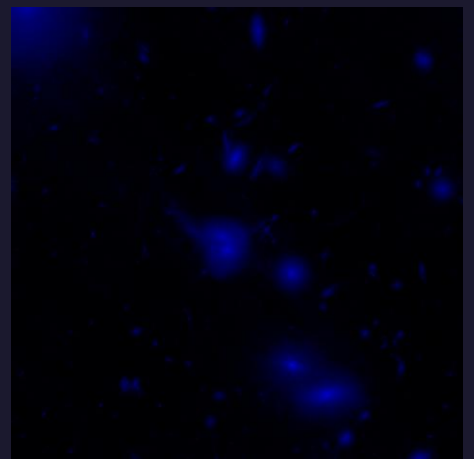

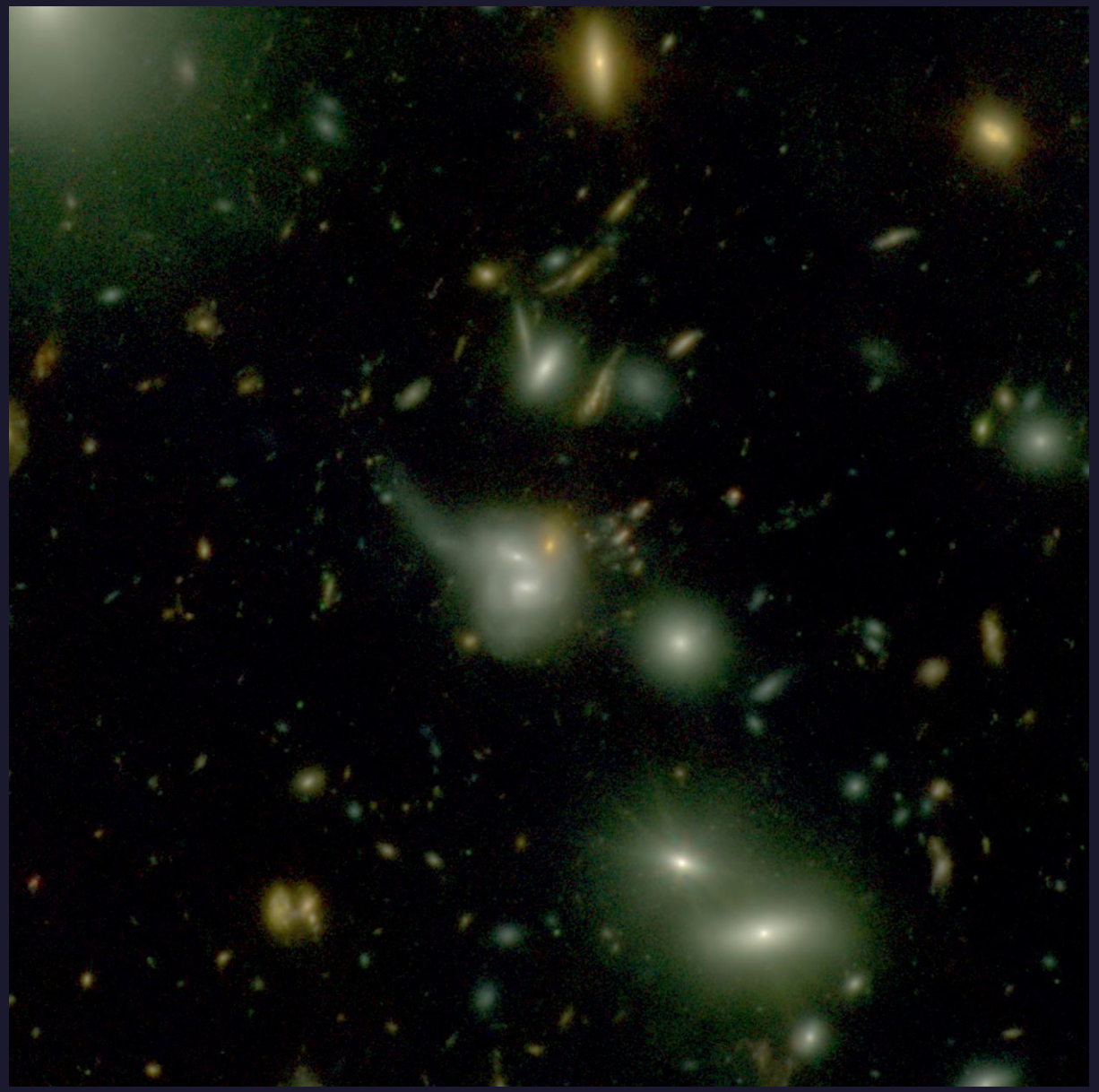

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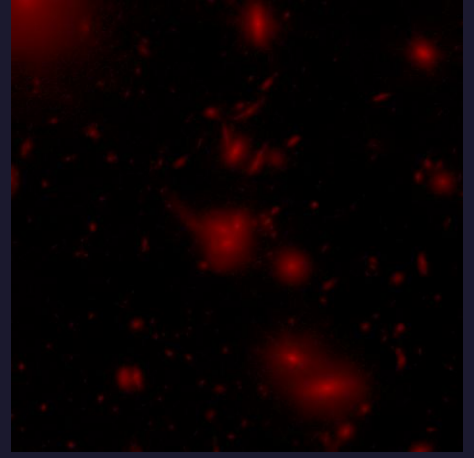

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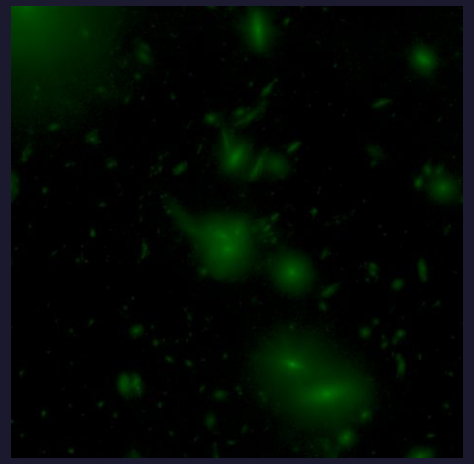
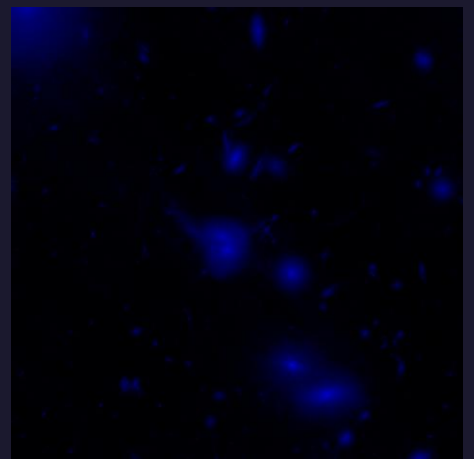
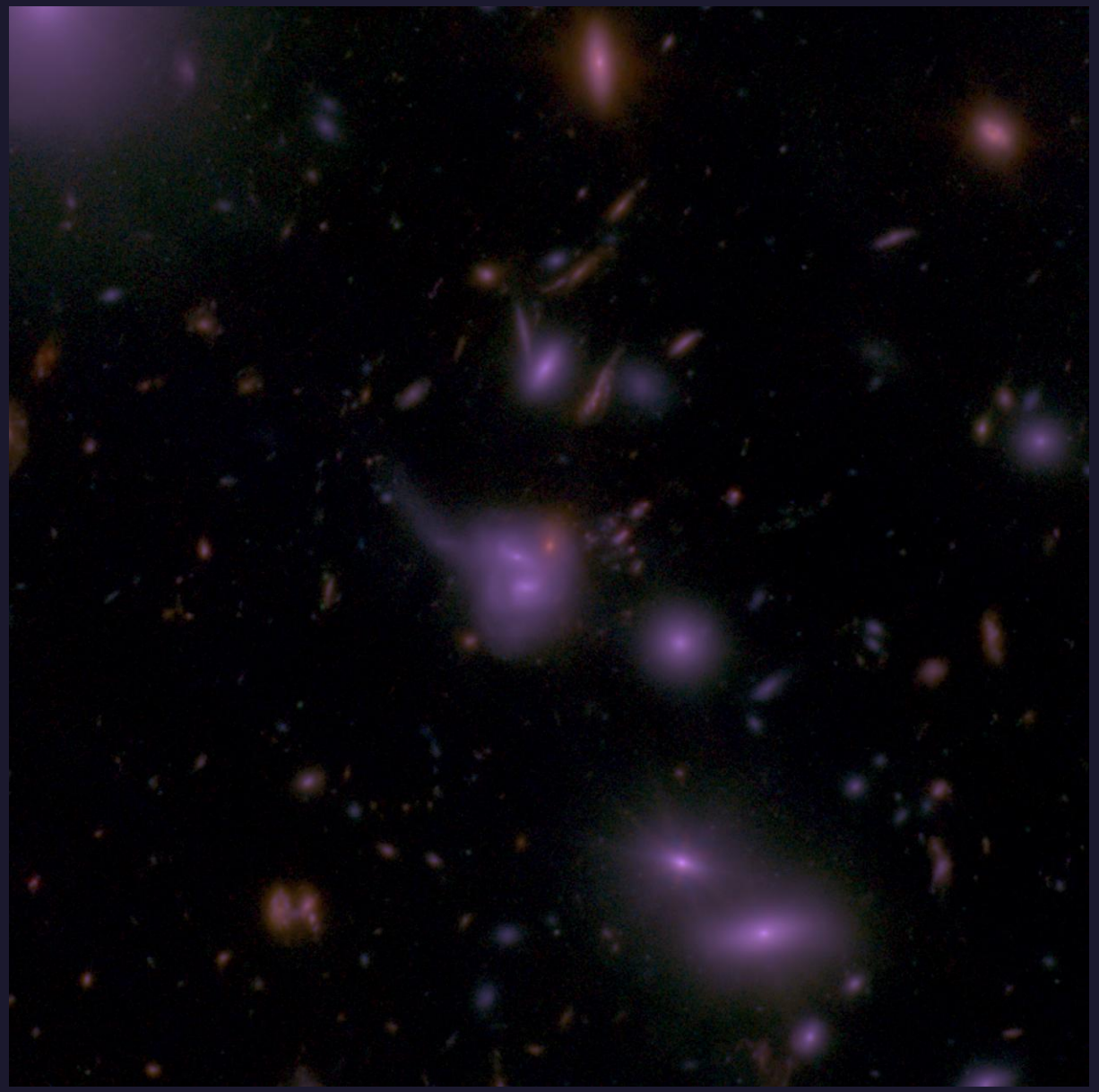
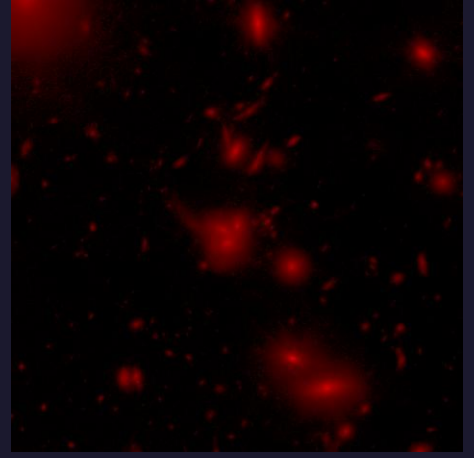


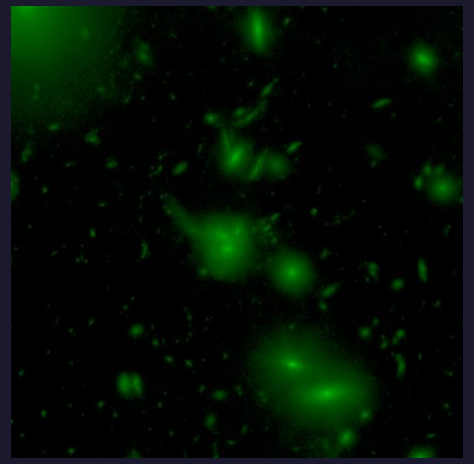


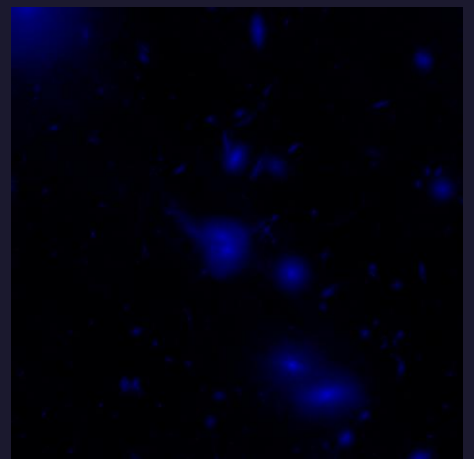


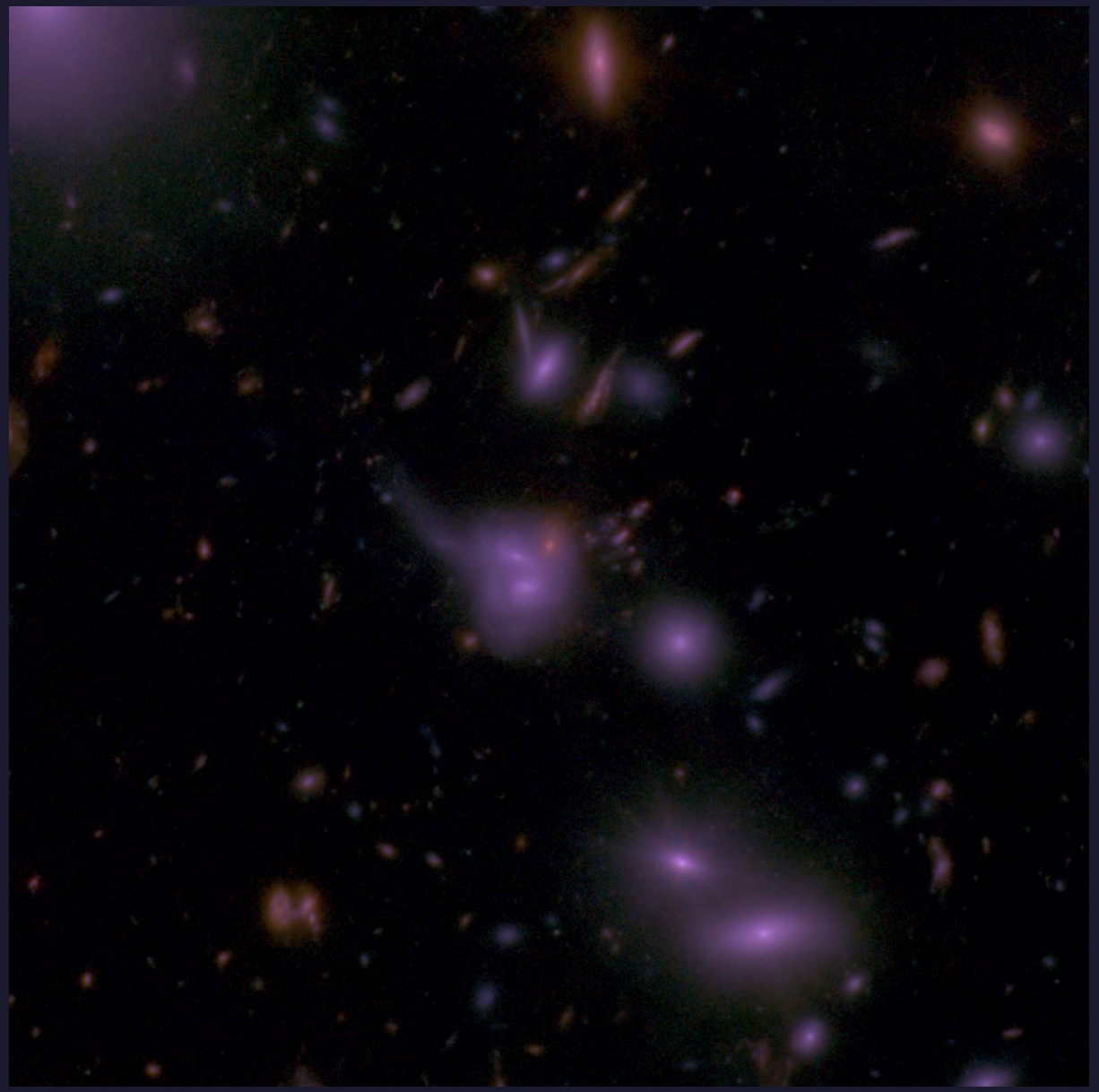
0.9 ×



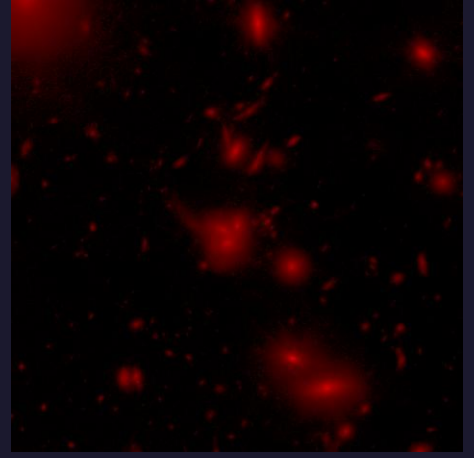
0.8 ×







0.9 ×



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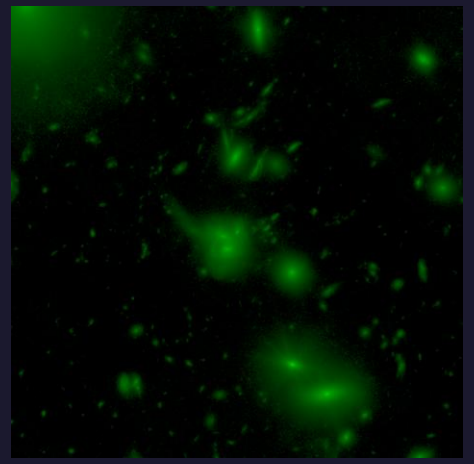
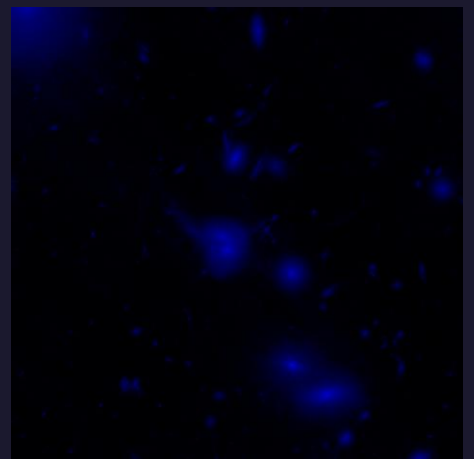
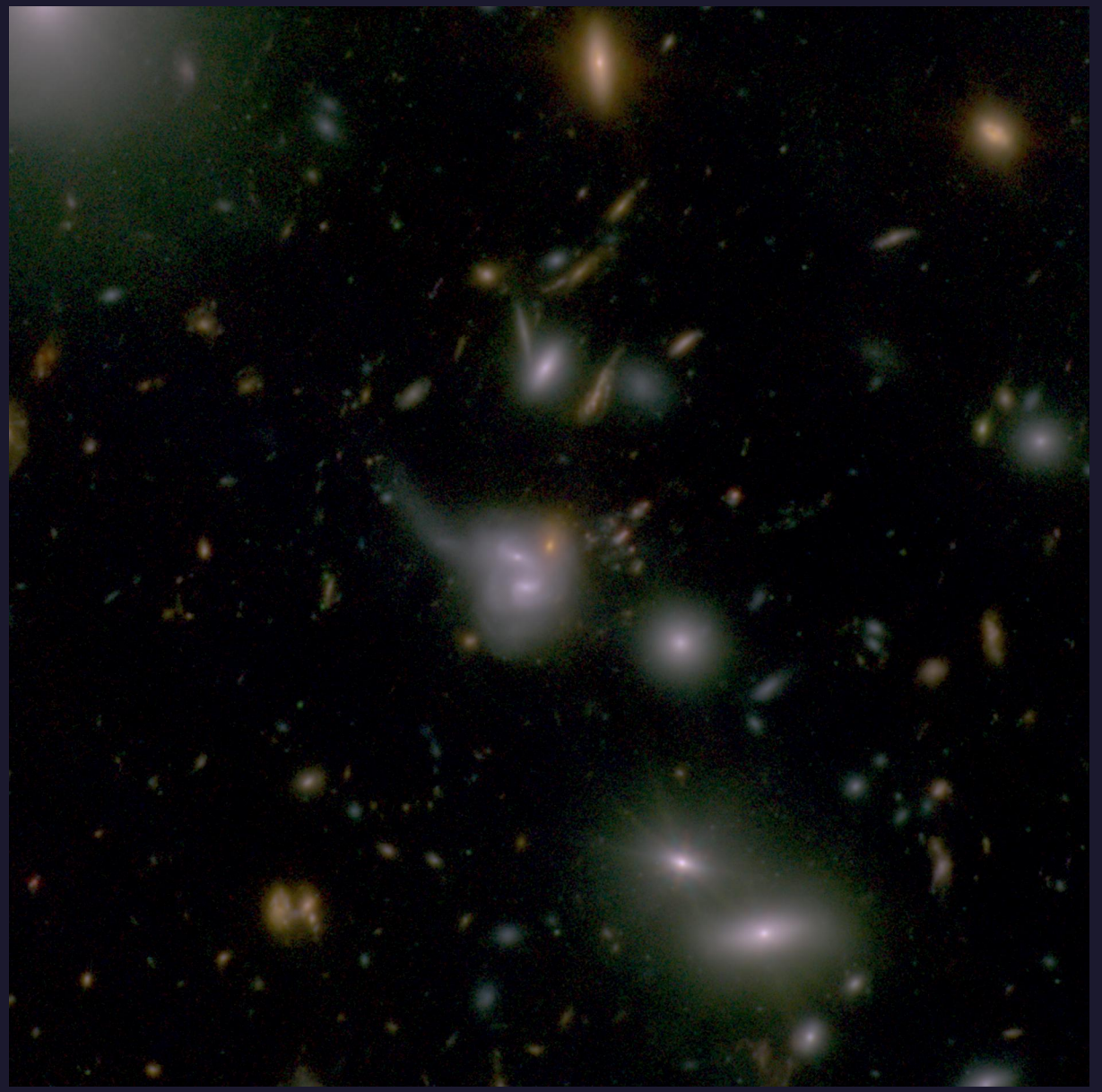


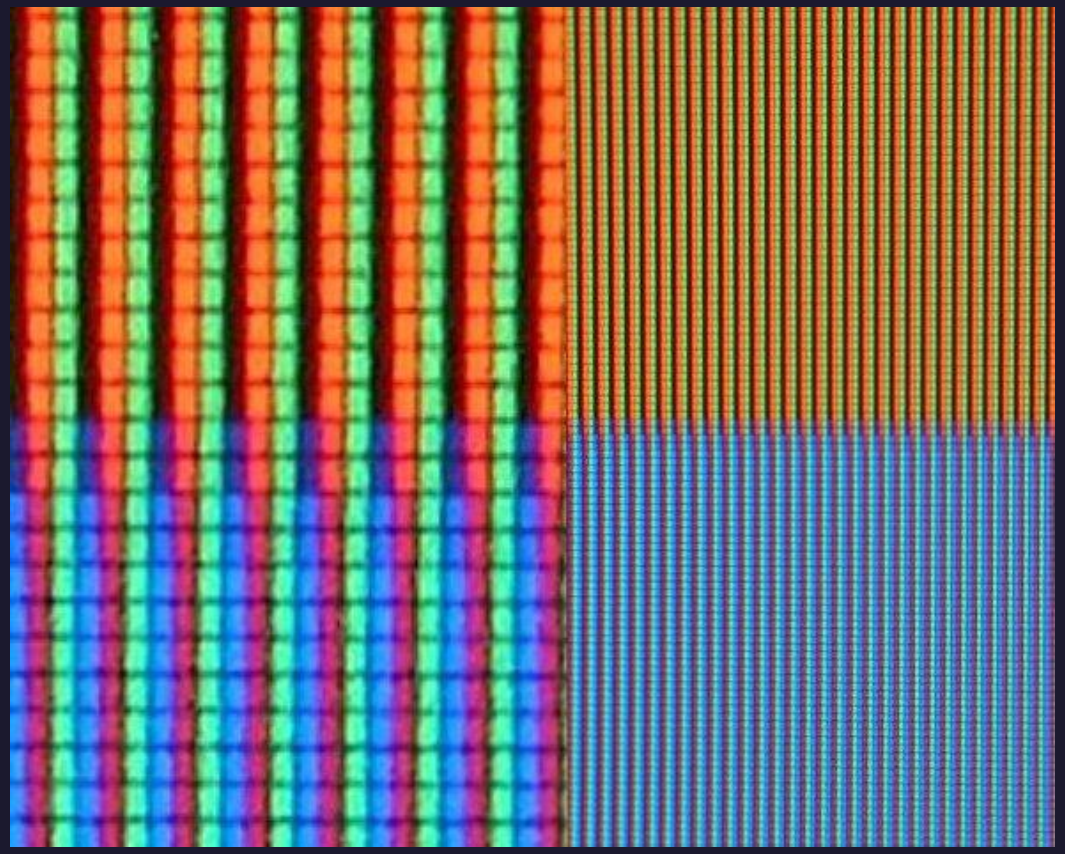




The RGB color model

The RGB color model

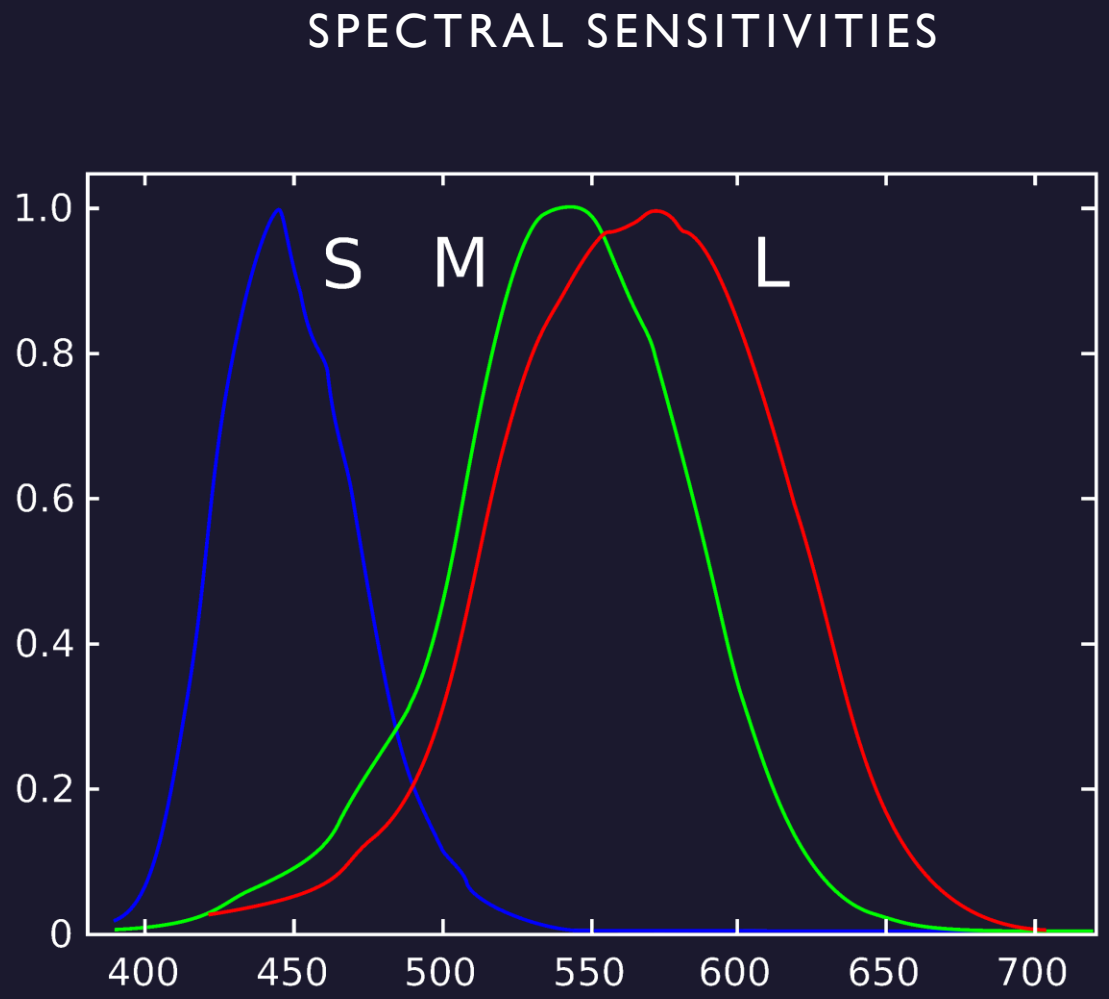
The RGB color model



How human vision works

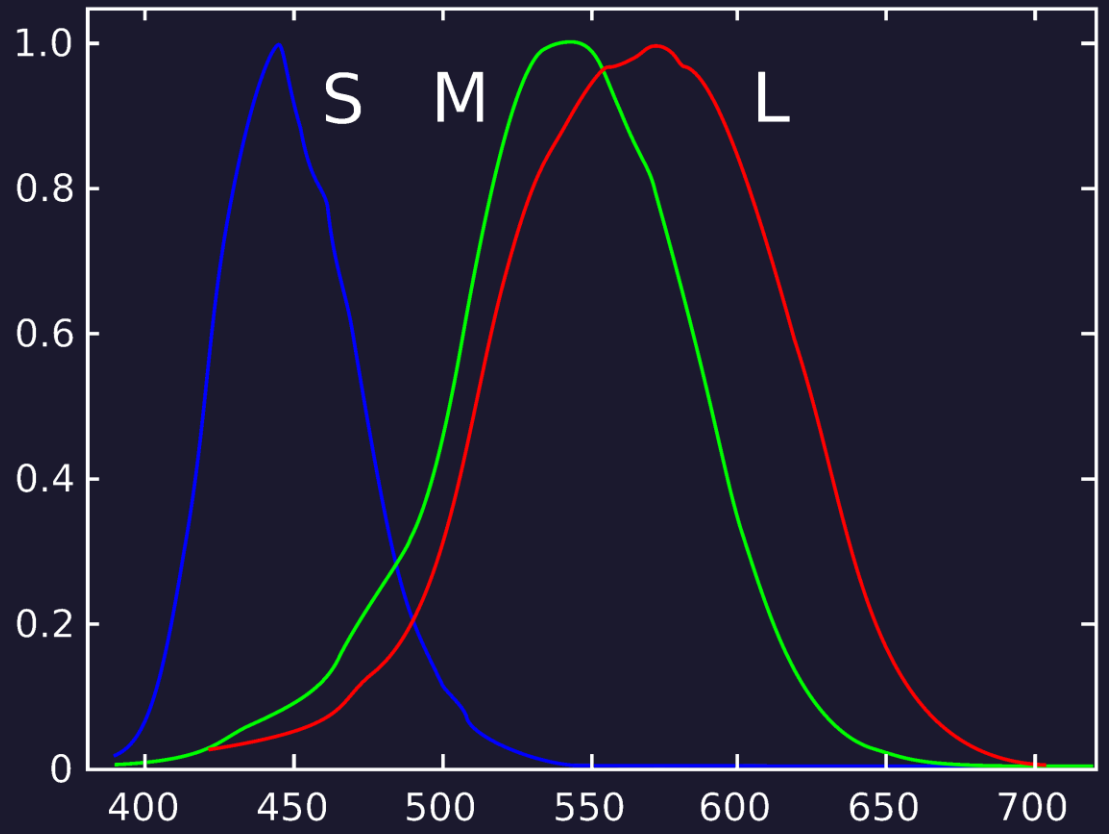
Humans have three types of cone cells

Humans have three types of cone cells

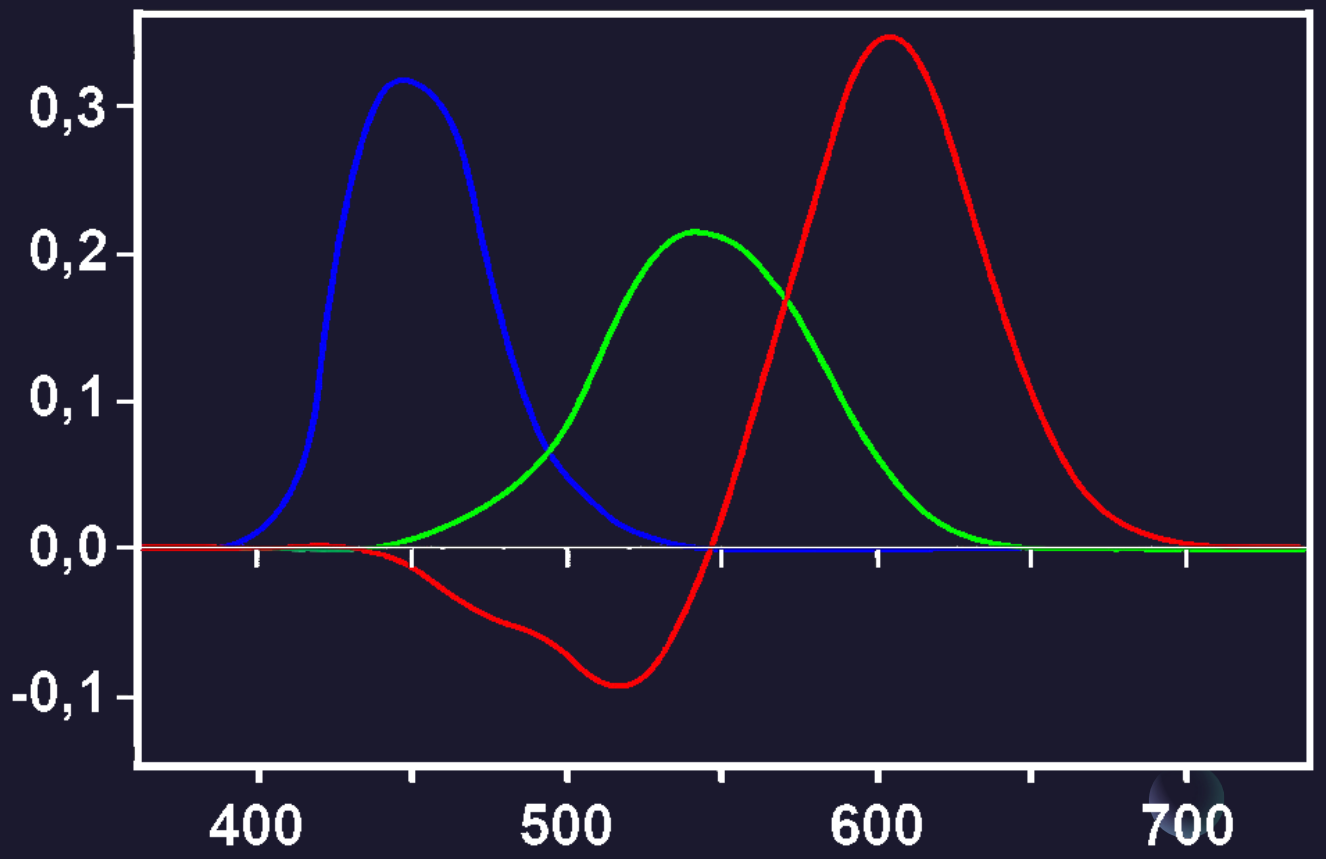


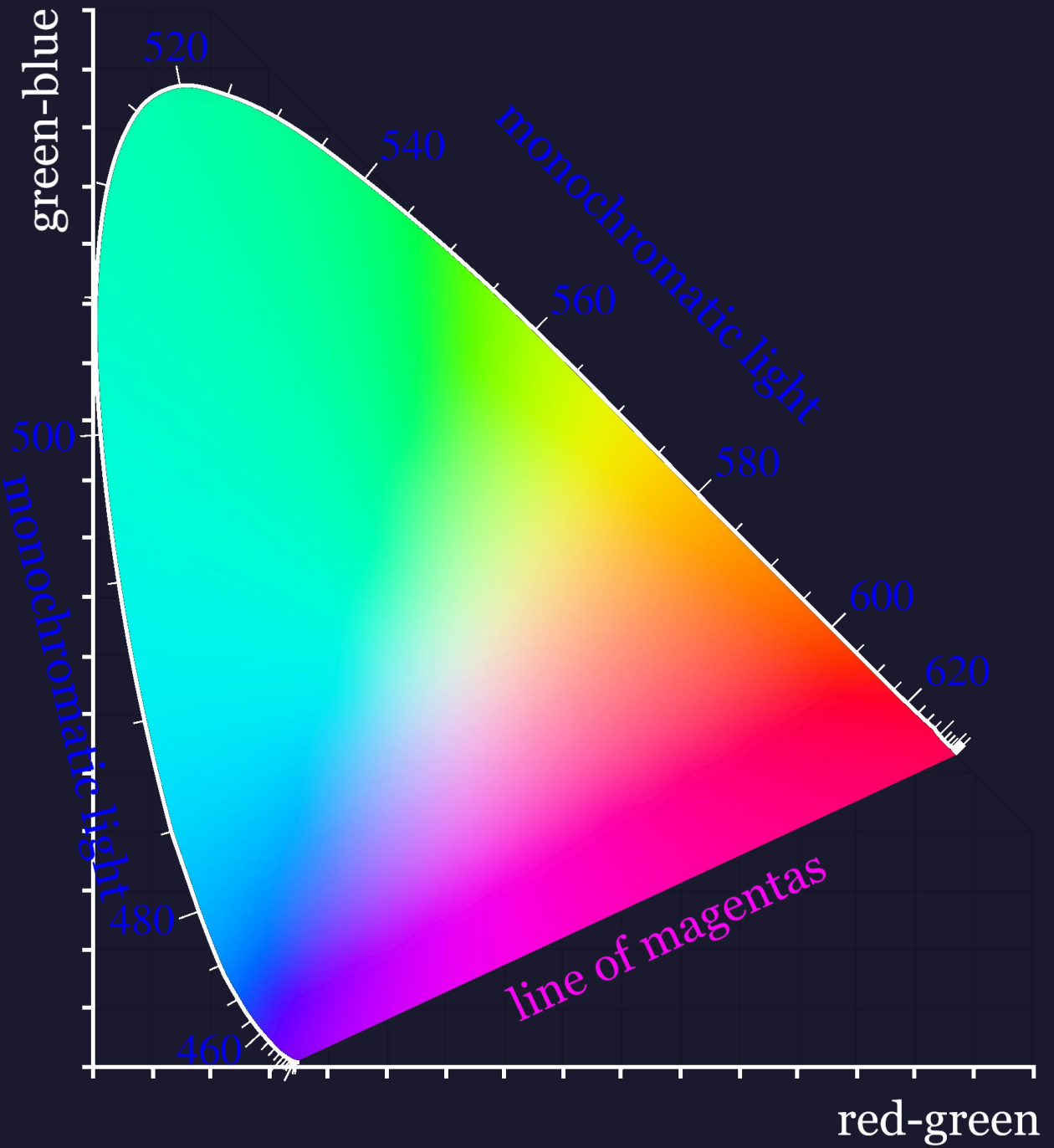
Humans have three types of cone cells

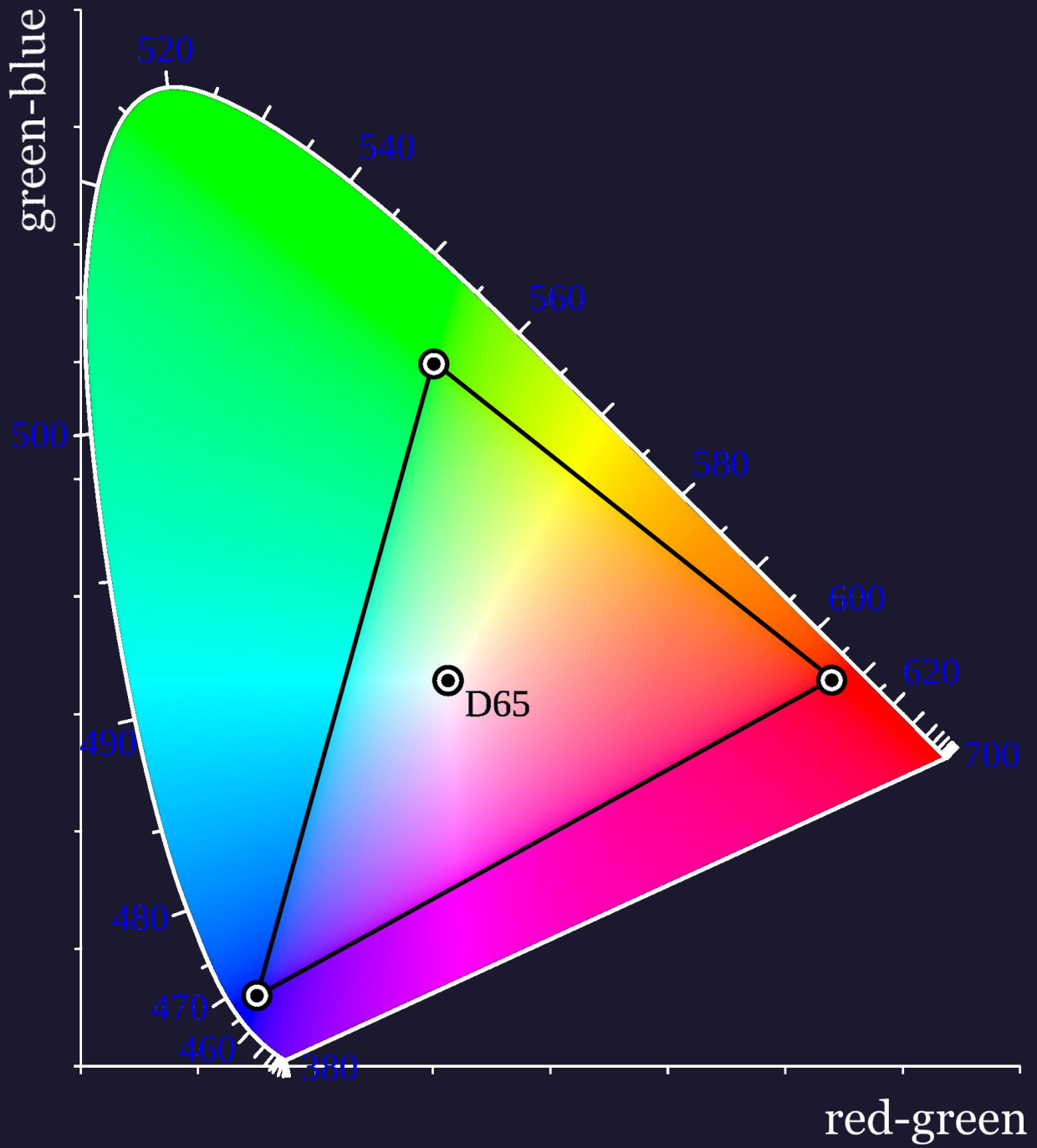
SPECTRAL SENSITIVITIES



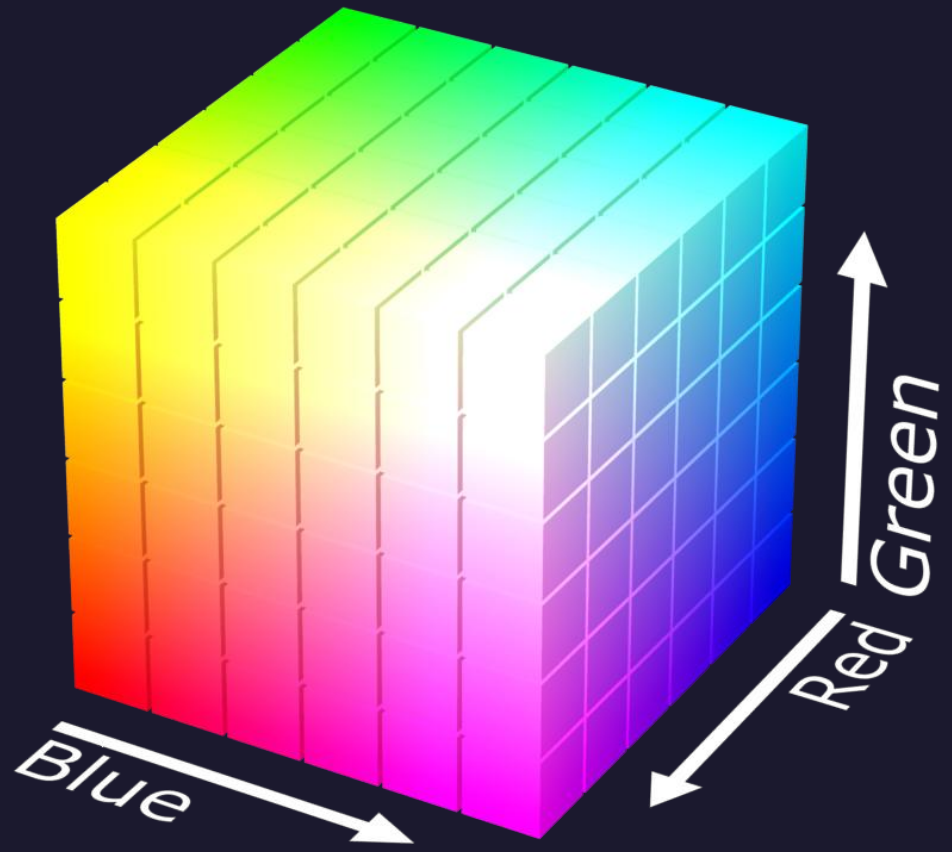
COLOUR-MATCHING FUNCTIONS



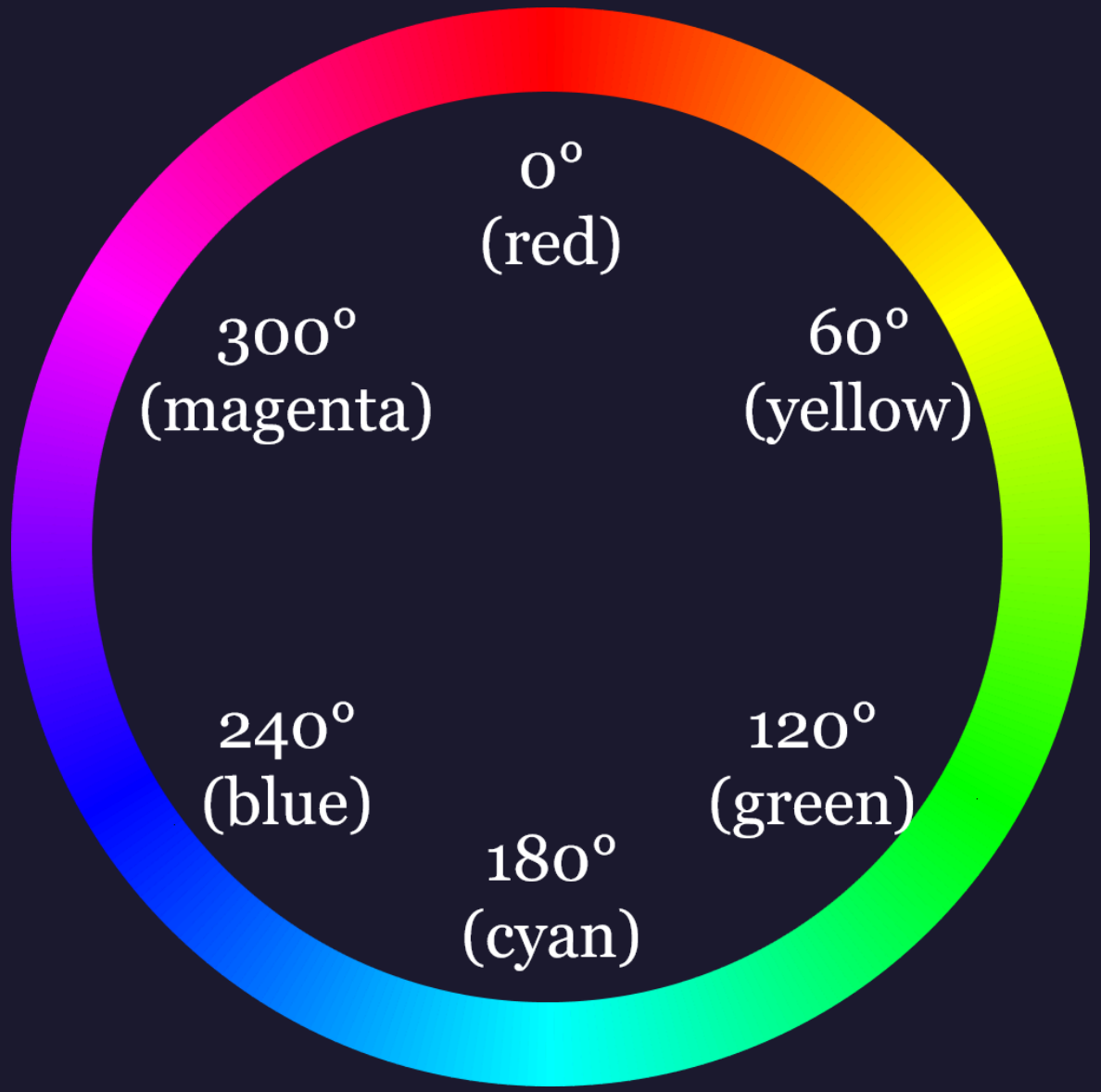

green-blue
520
540
monochromatic light
560
580
600
620
500
monochromatic light
480
460
line of magentas
red-green


green-blue
520
540
560
580
600
620
700
500
490
480
470
460
380
D65
red-green

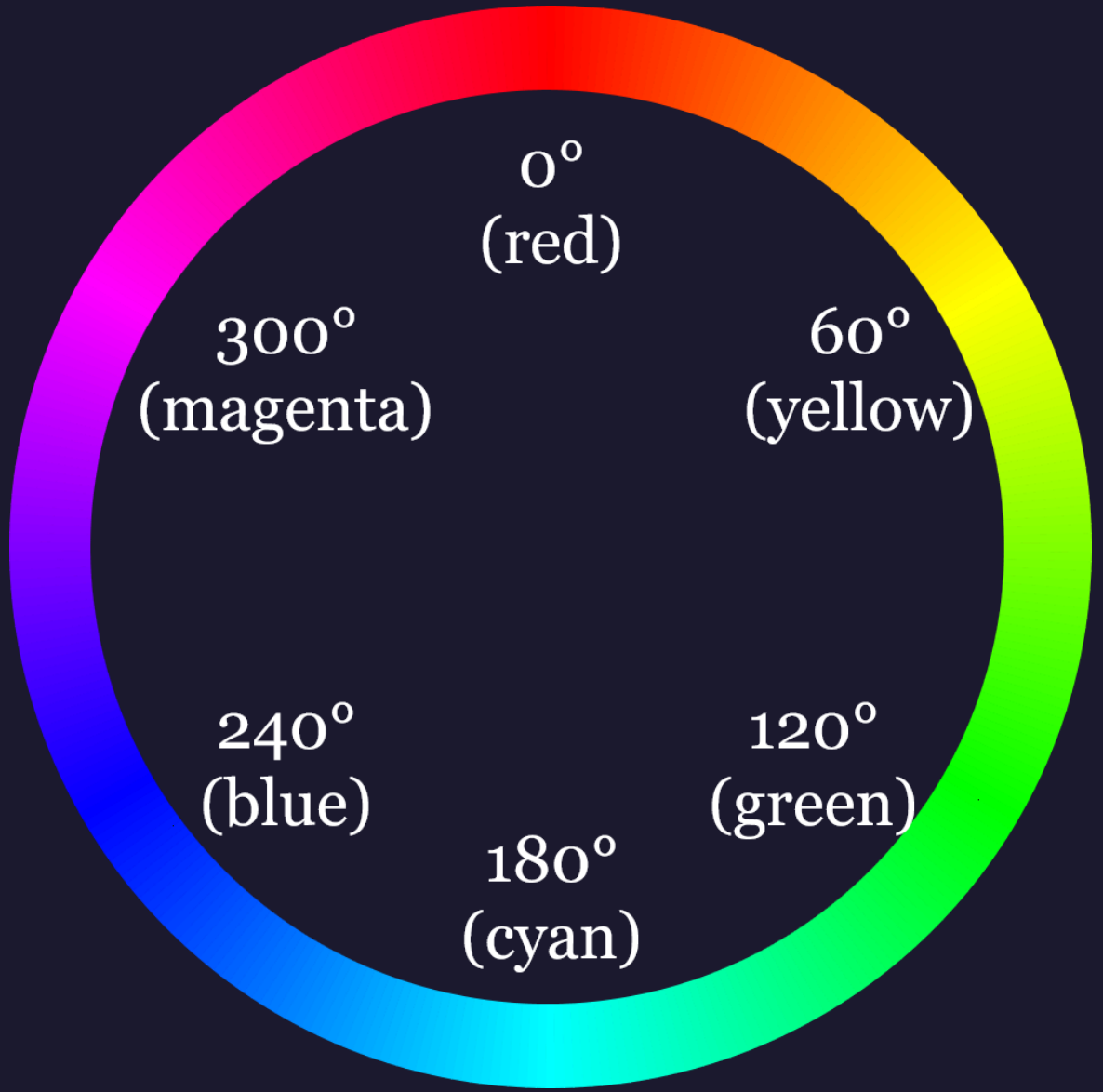
RGB is wrong

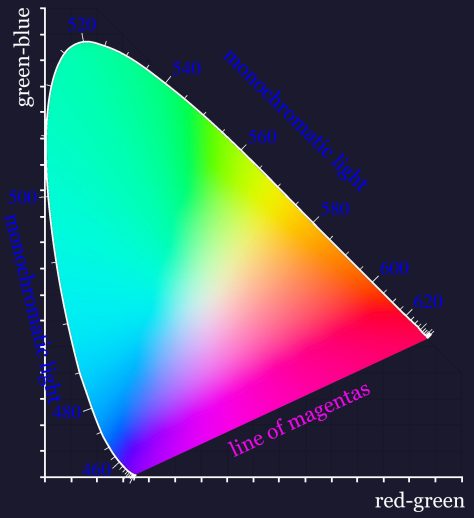


Hue

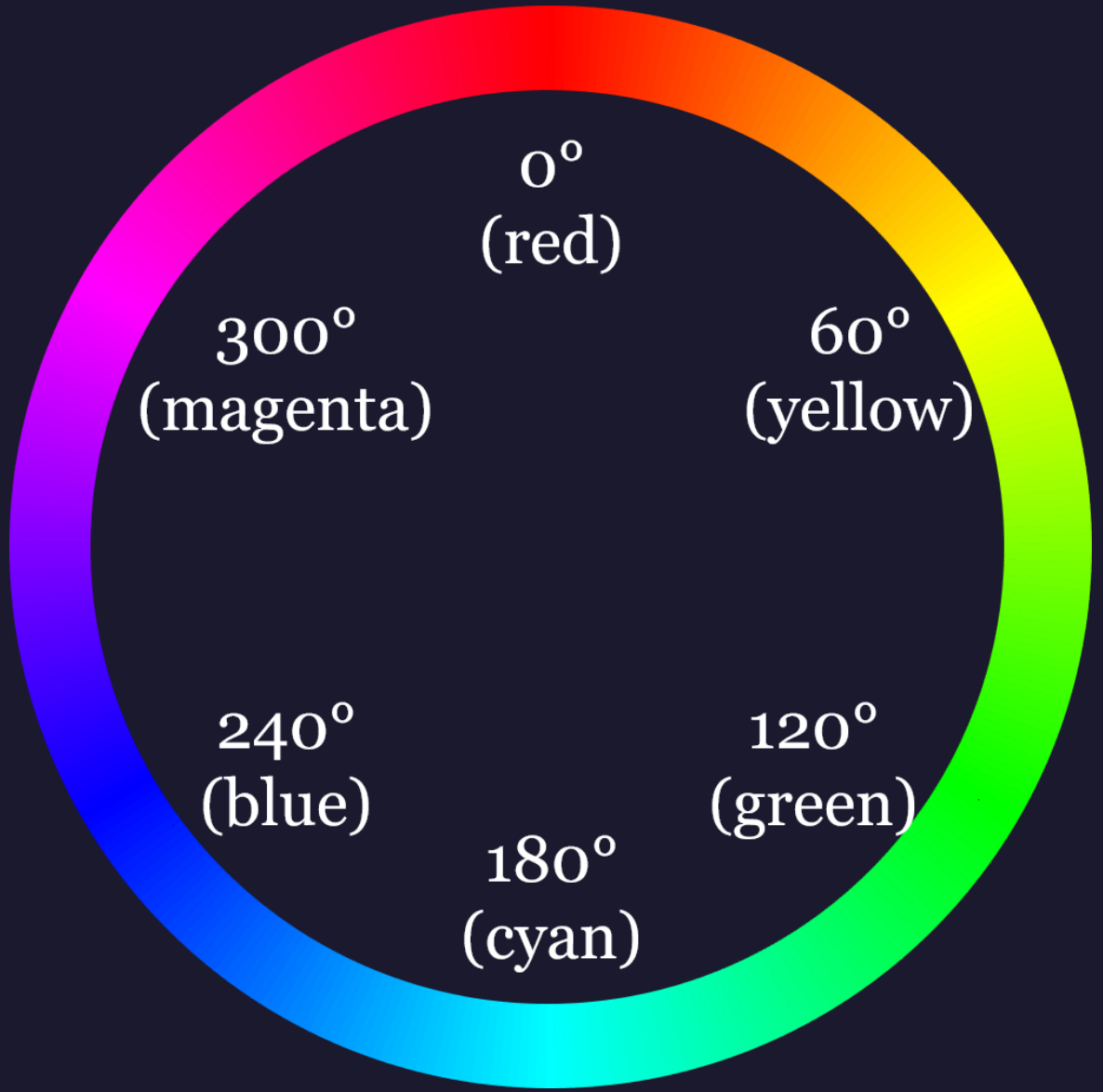


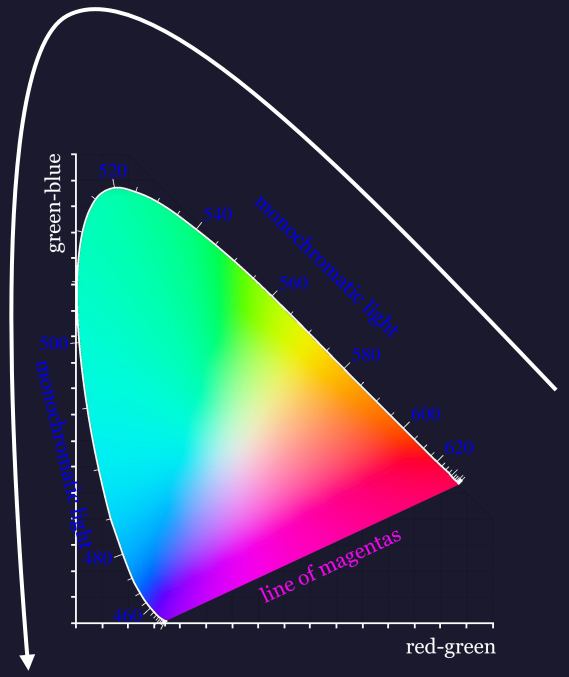
Hue


0°
(red)
60°
(yellow)
120°
(green)
180°
(cyan)
240°
(blue)
300°
(magenta)

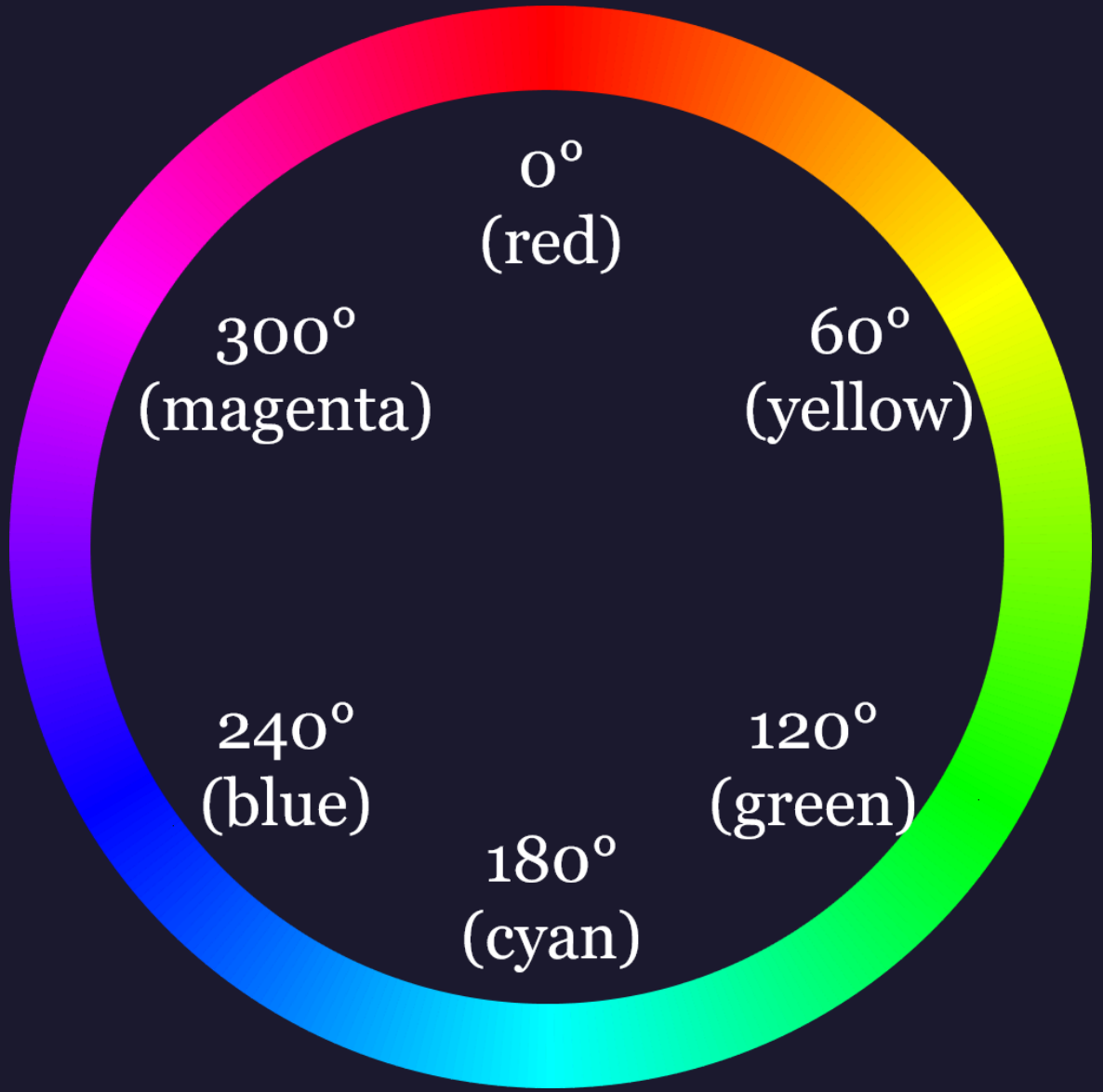

green-blue
red-green
520
540
560
580
600
620
500
480
460
monochromatic light
line of magentas

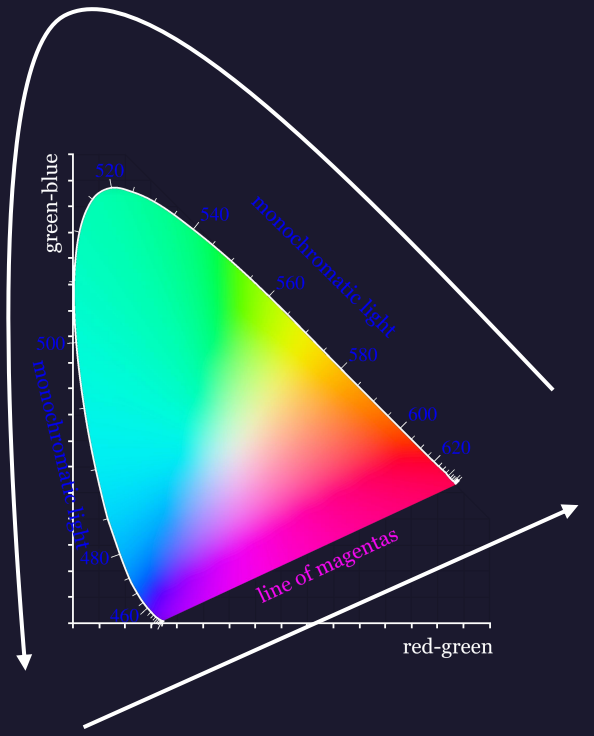
Hue


0°
(red)
60°
(yellow)
120°
(green)
180°
(cyan)
240°
(blue)
300°
(magenta)


green-blue
520
540
560
580
600
620
500
480
460
monochromatic light
monochromatic violet
line of magentas
red-green

Hue

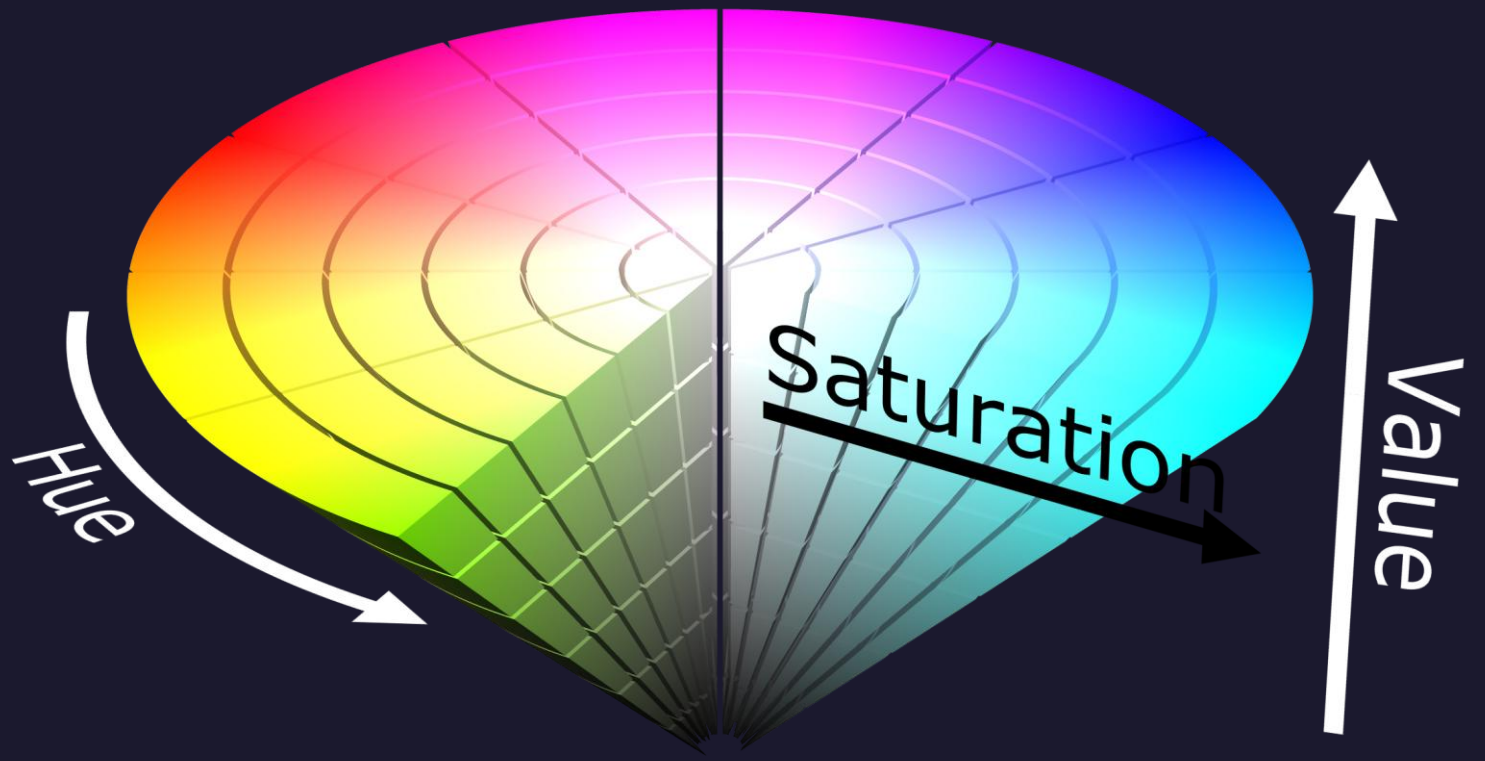

0°
(red)
60°
(yellow)
120°
(green)
180°
(cyan)
240°
(blue)
300°
(magenta)


green-blue
520
540
560
580
600
620
500
480
460
monochromatic light
monochromatic violet
line of magentas
red-green

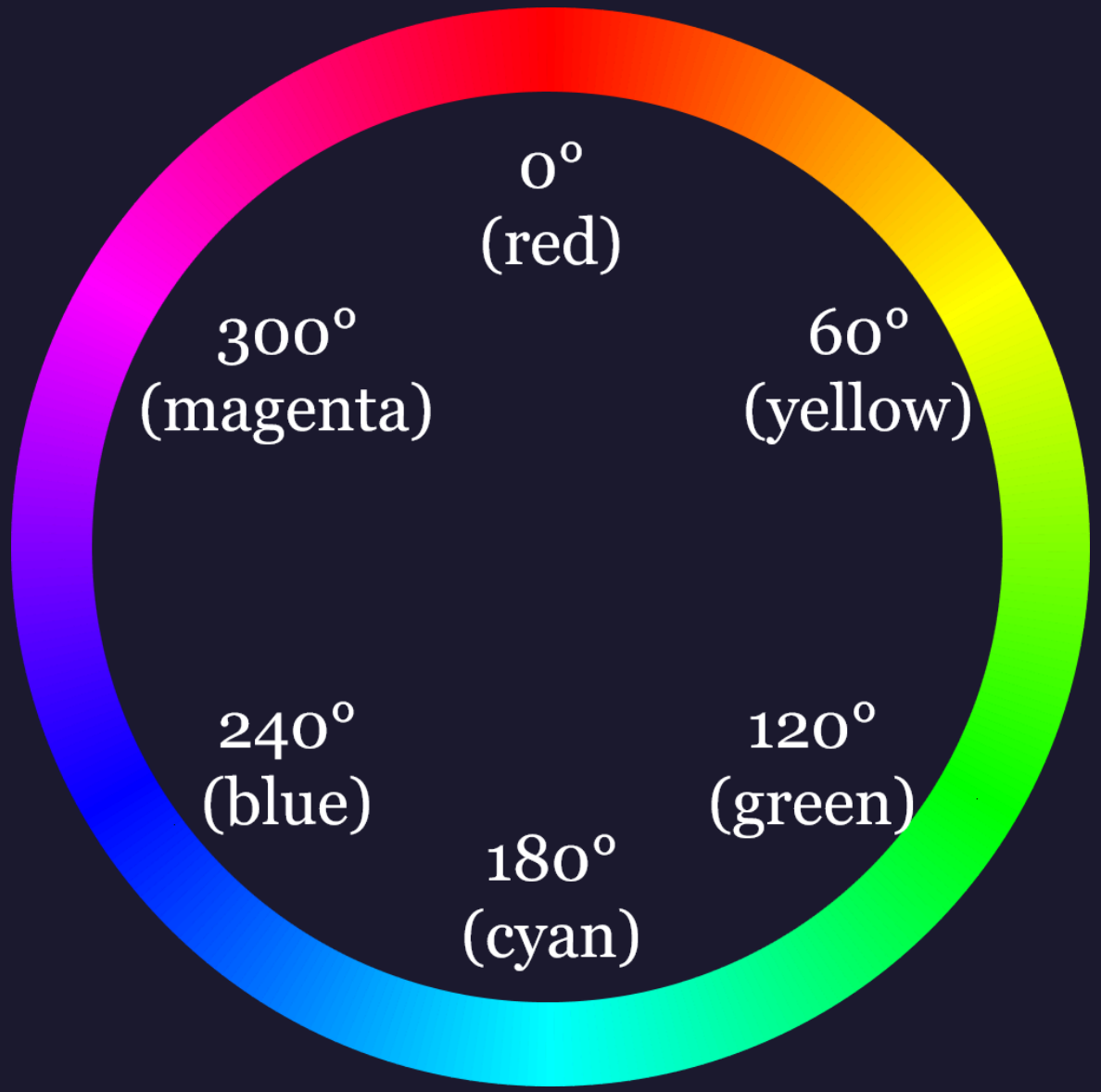
Saturation

Value

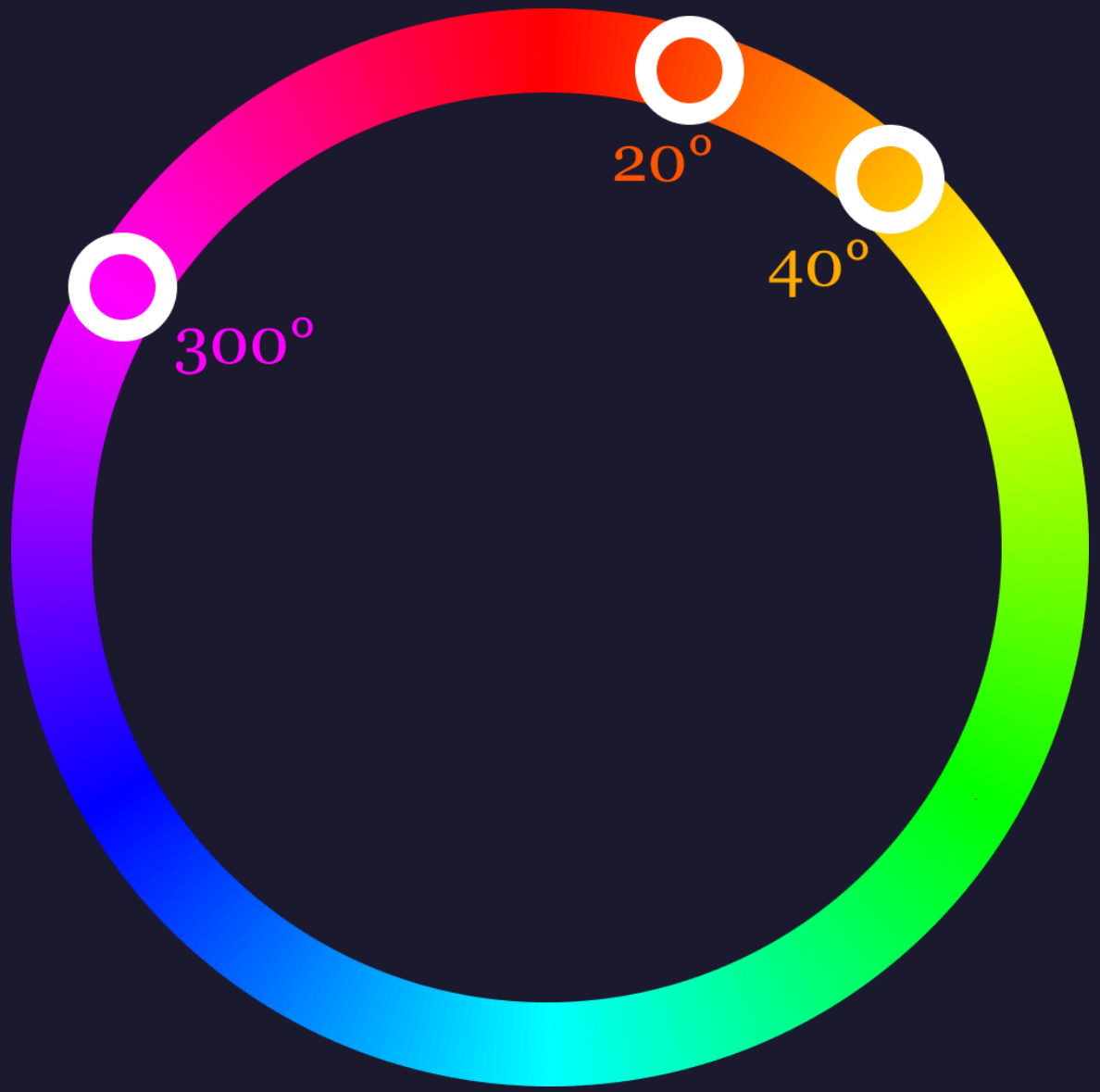
The HSV color model



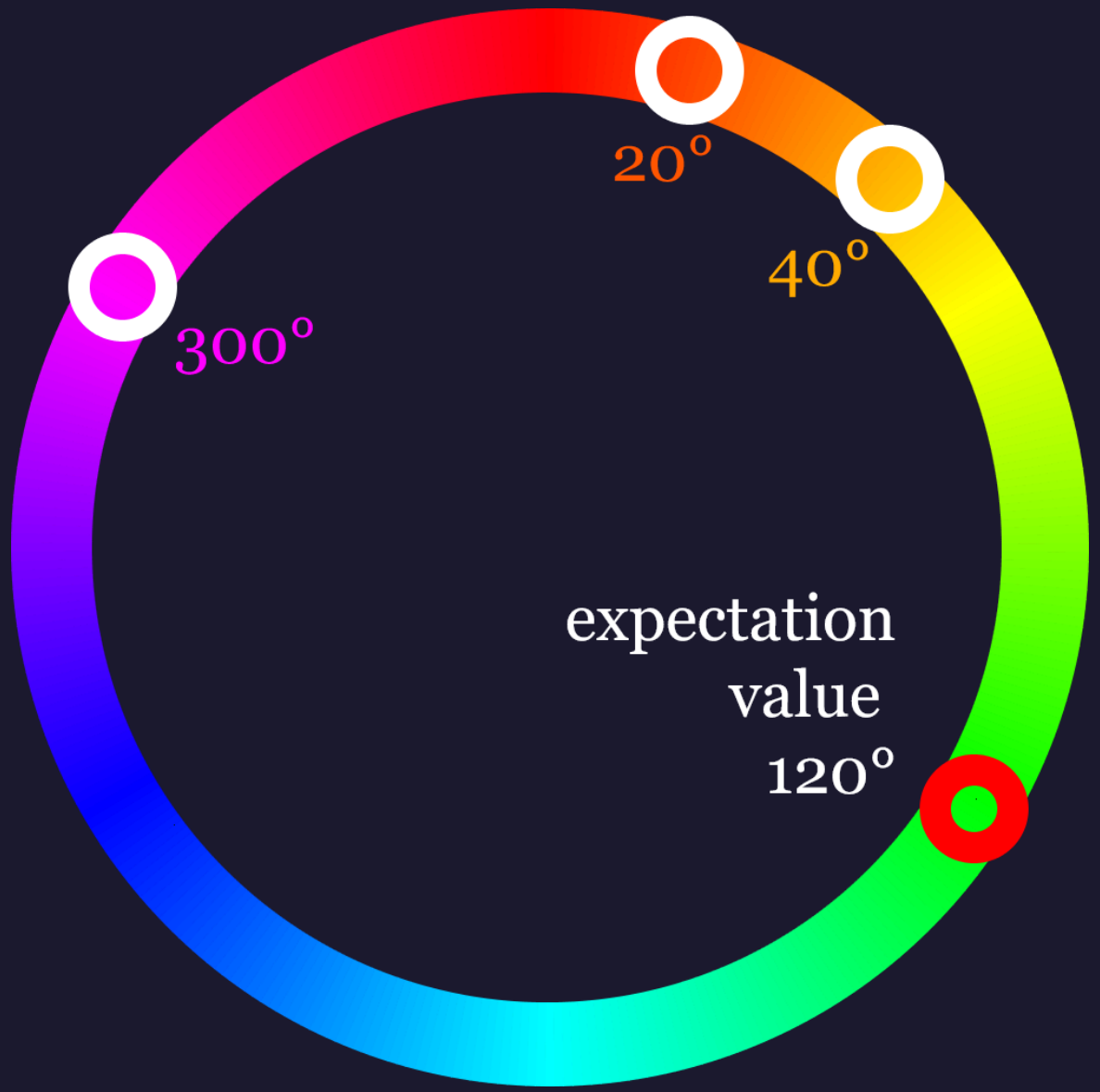
Hue



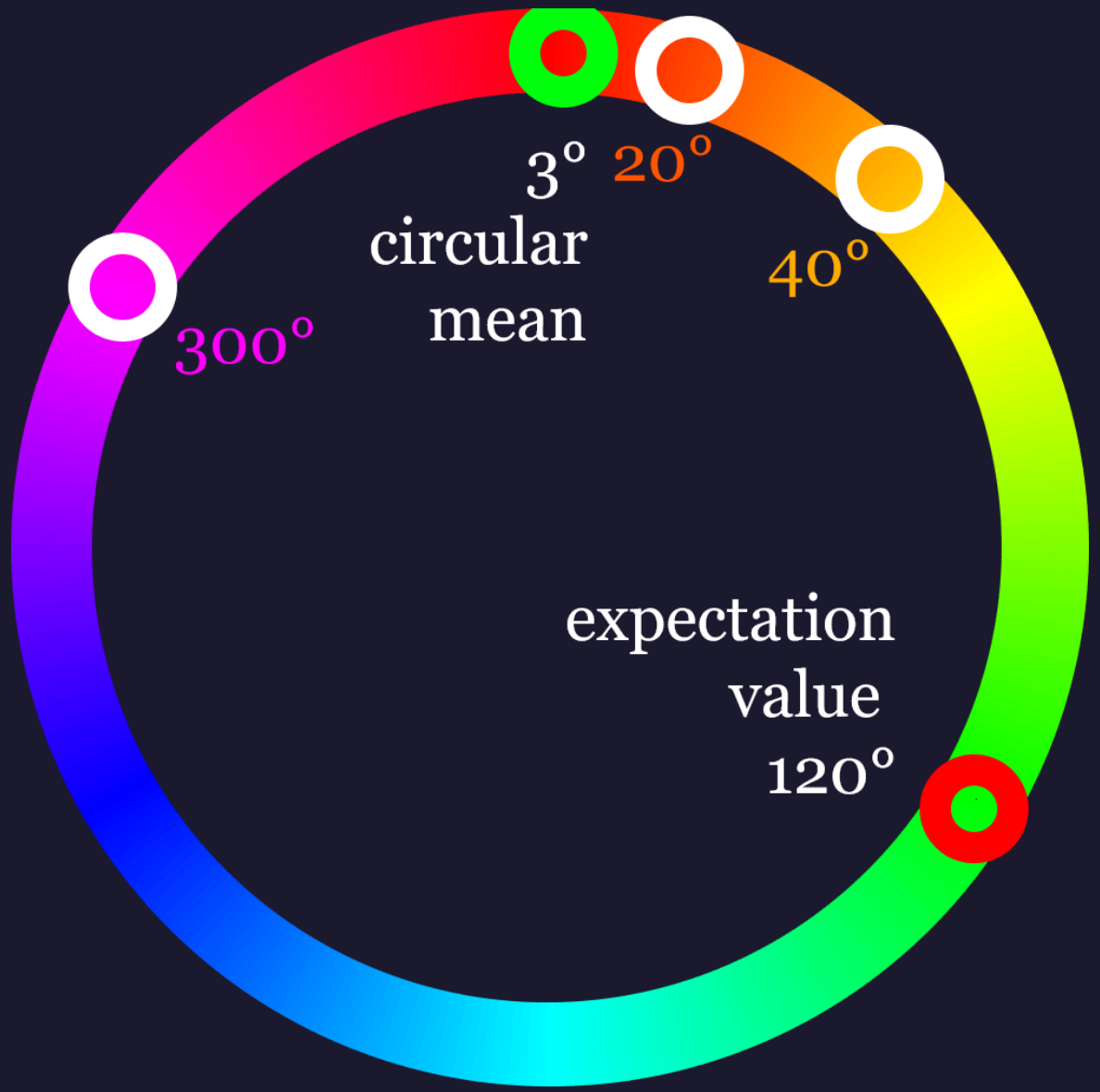
Hue



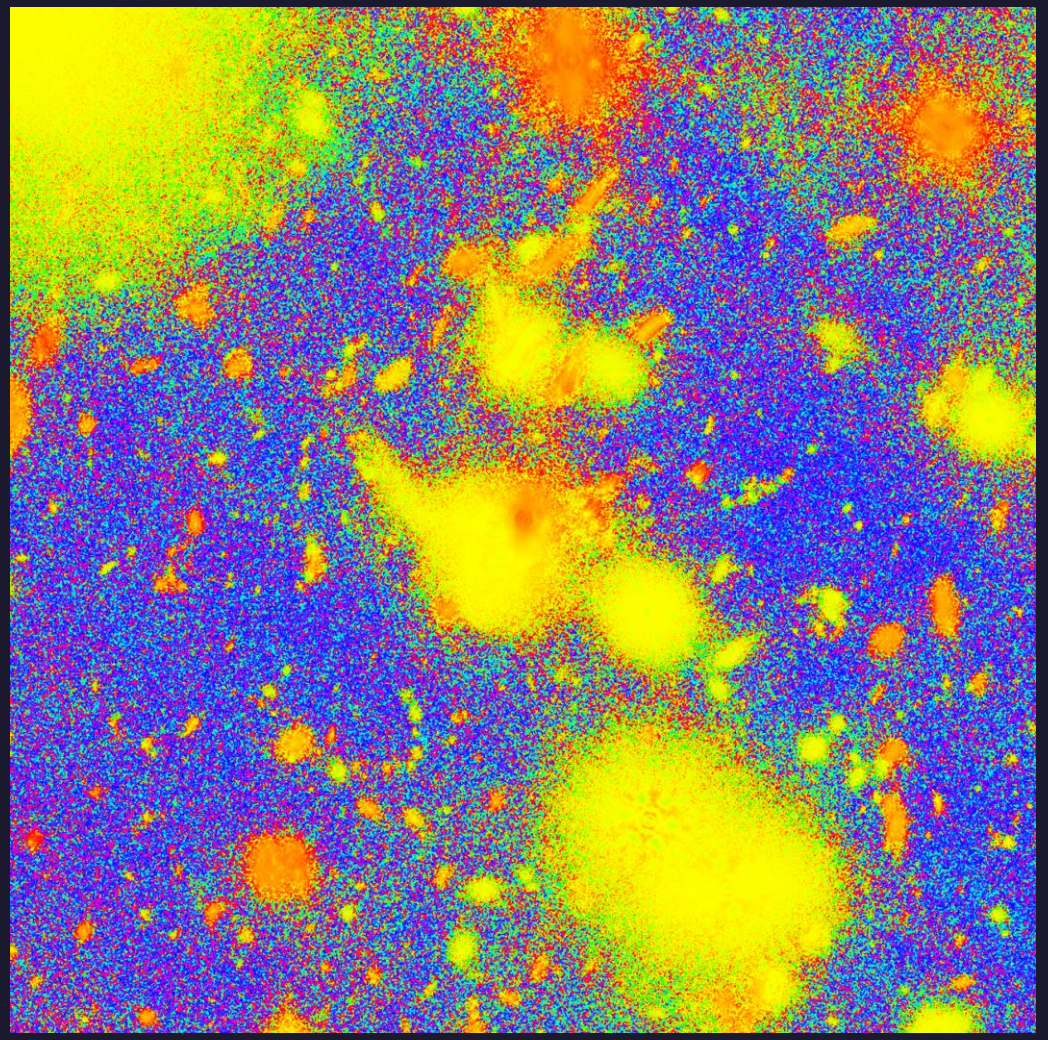
Hue



Hue

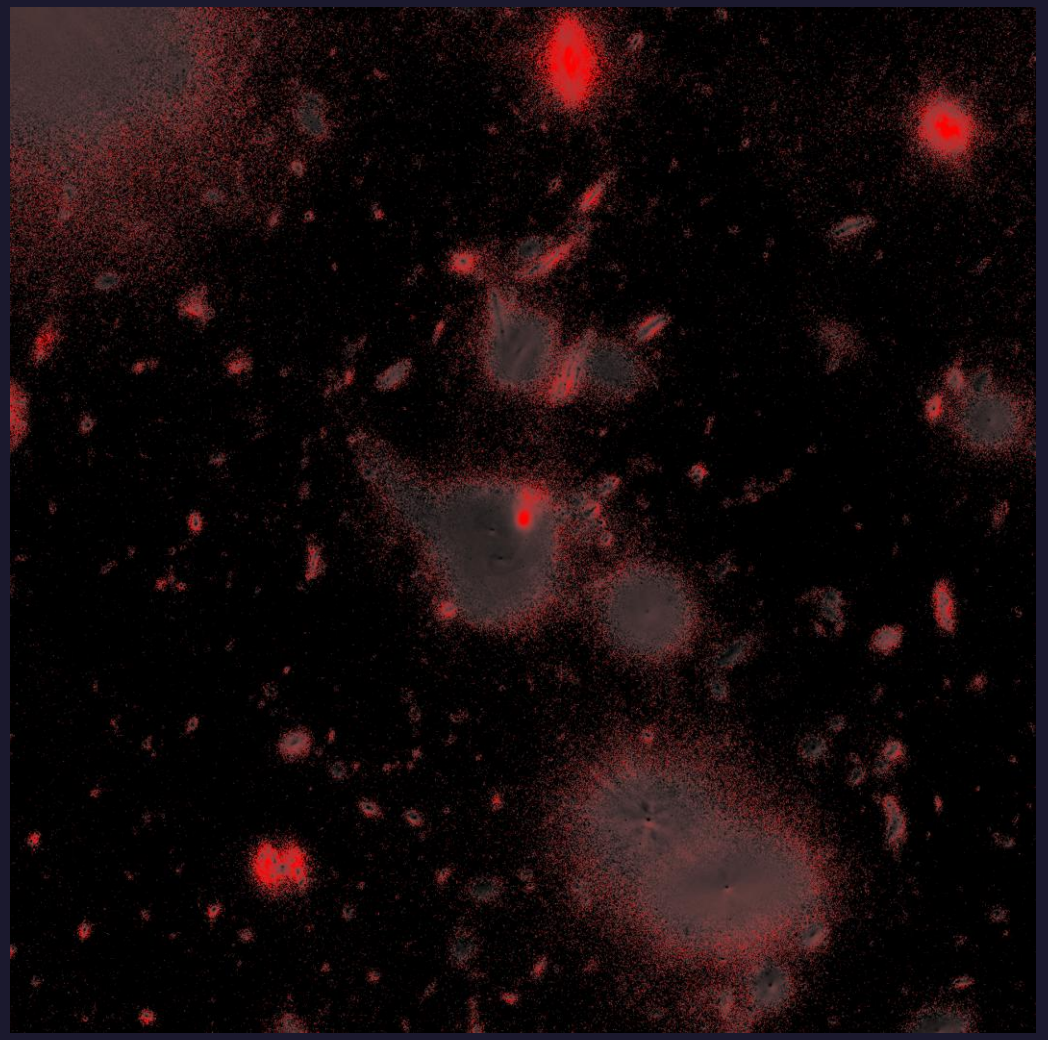


Hue



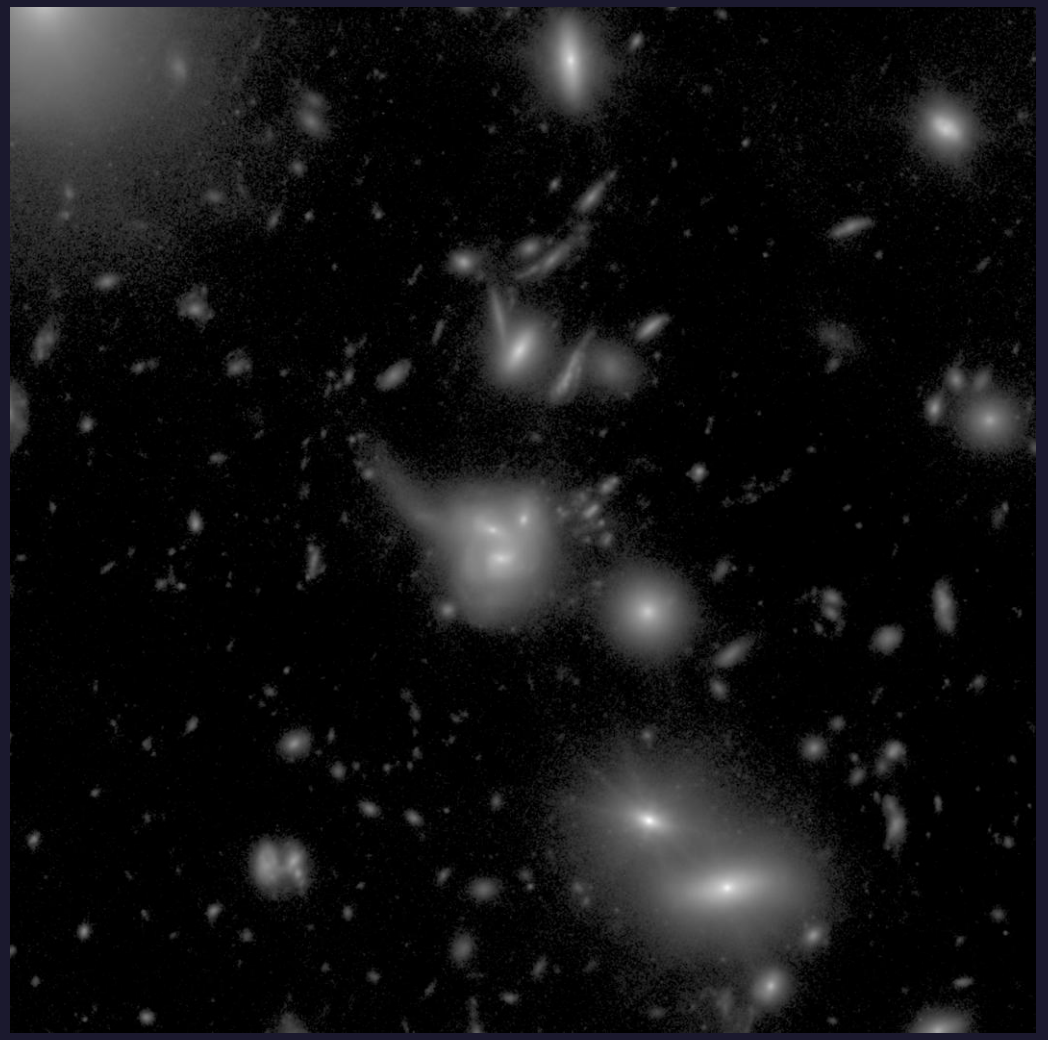
Saturation

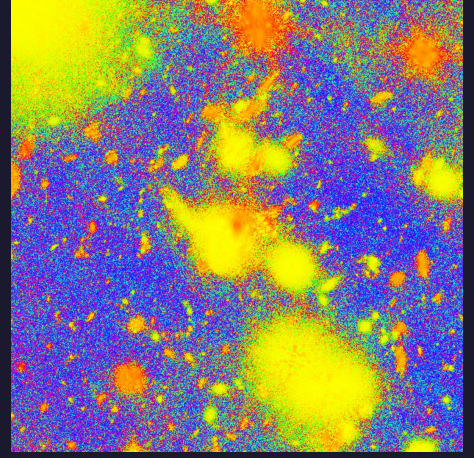
Saturation

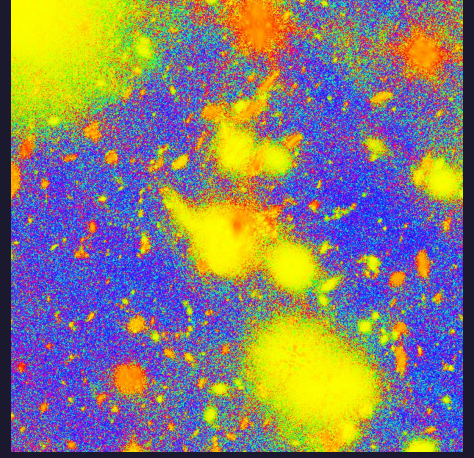


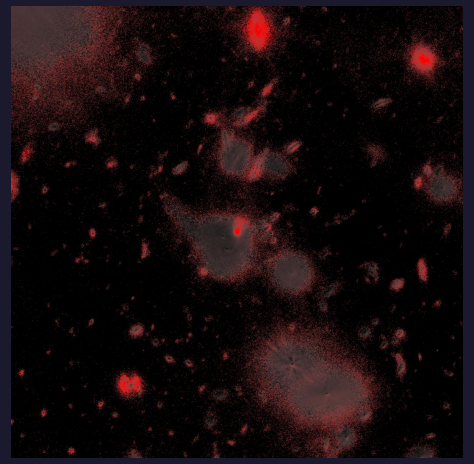
Value

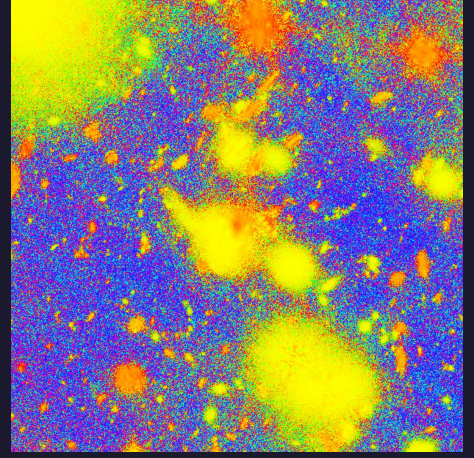
Value

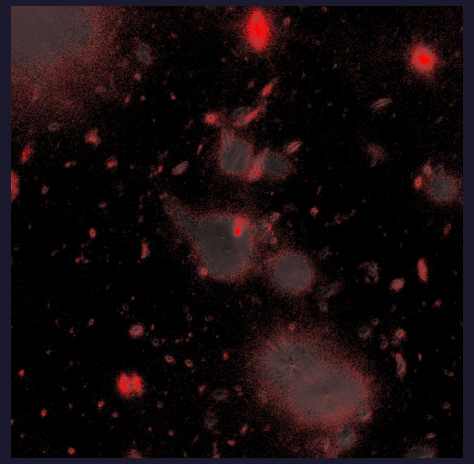


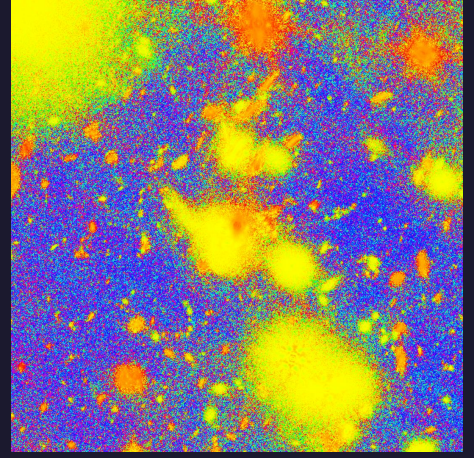


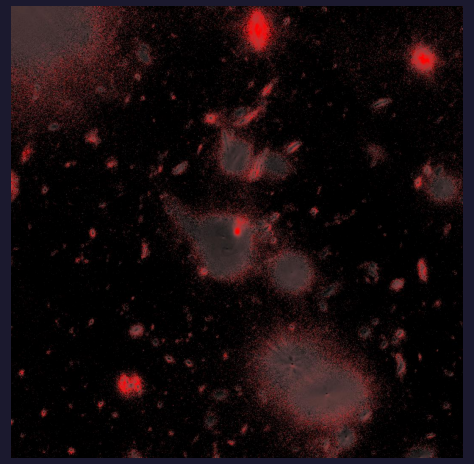


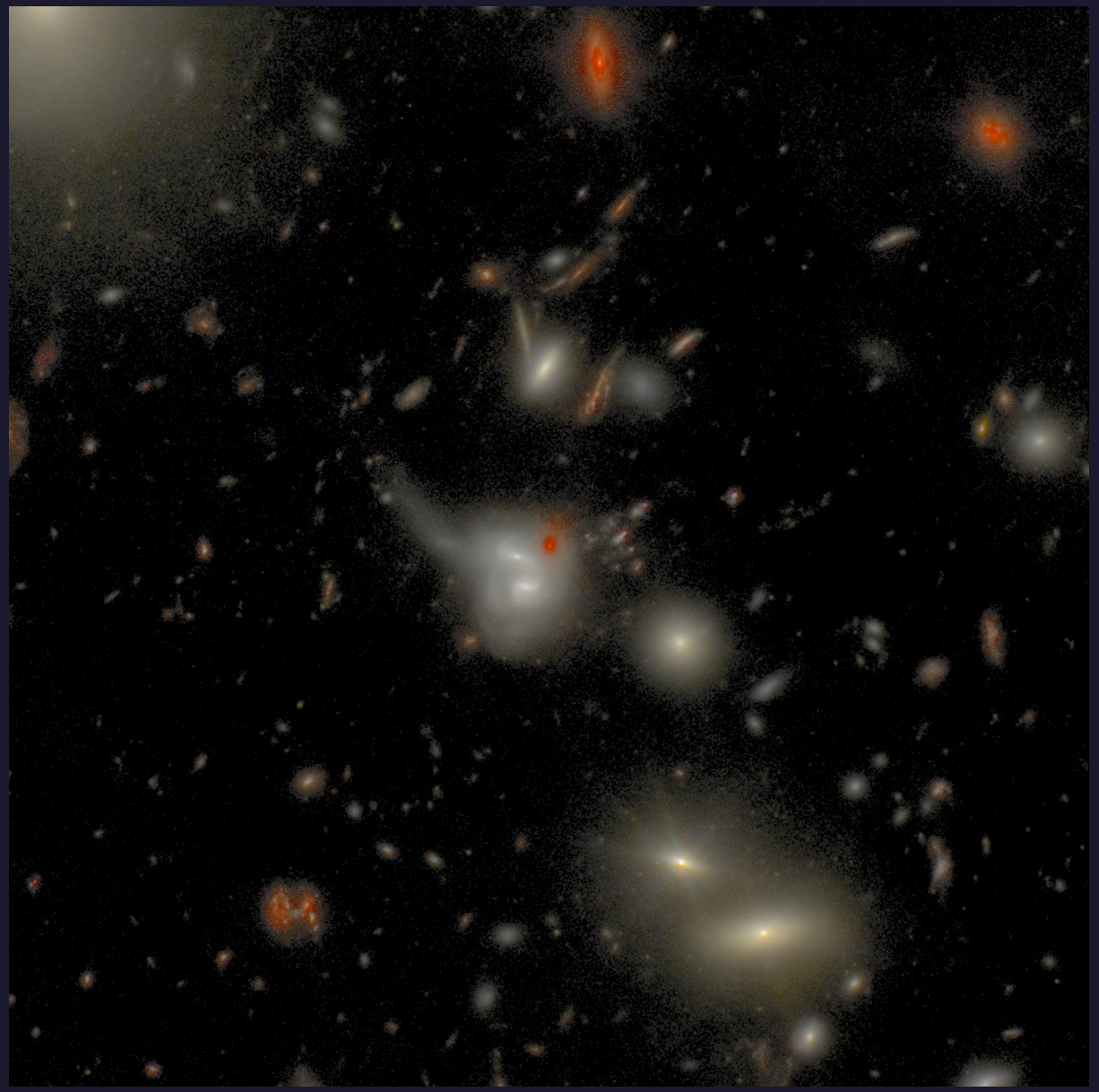




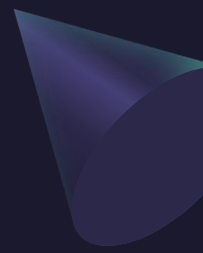


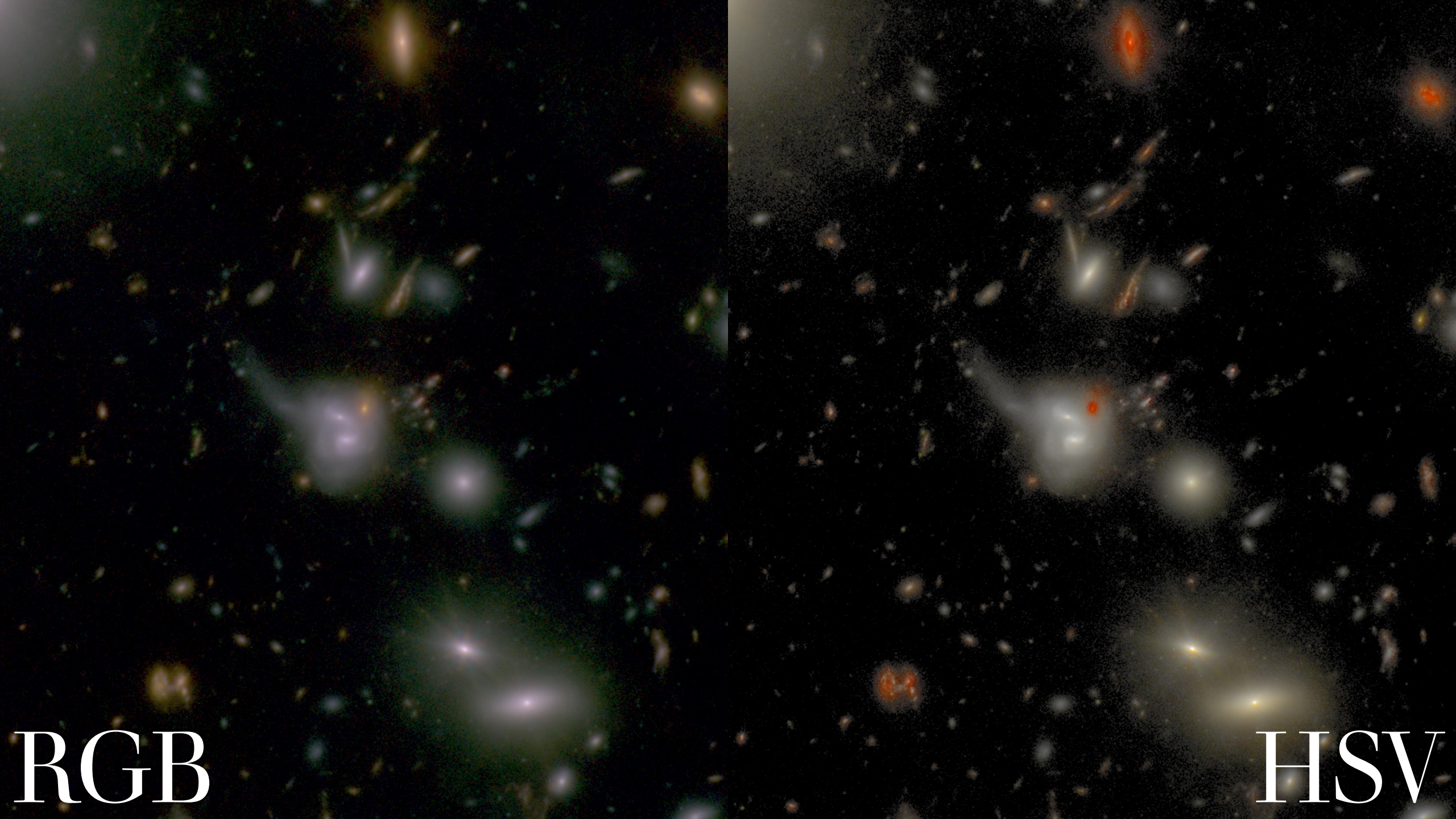


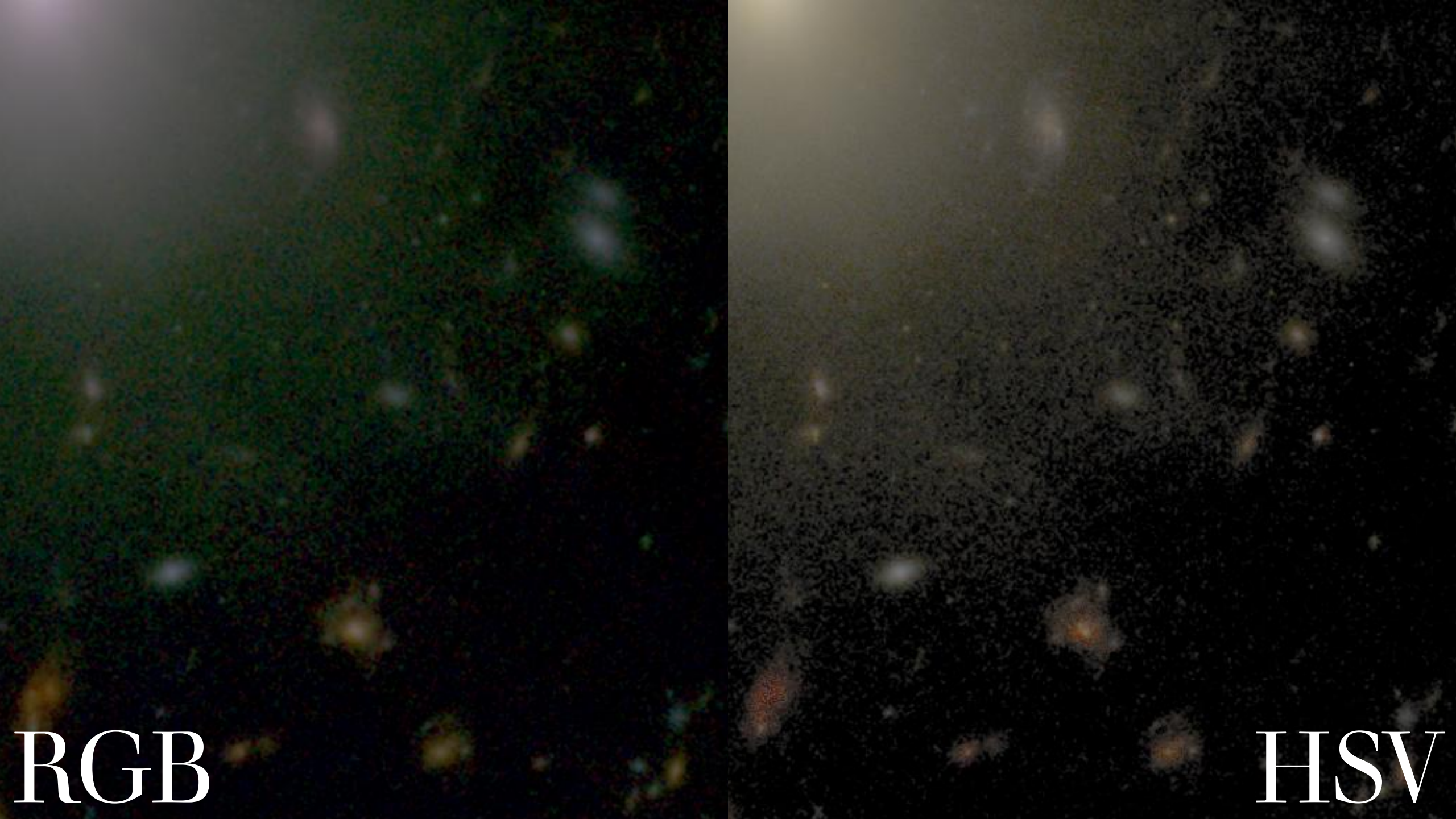




Examples

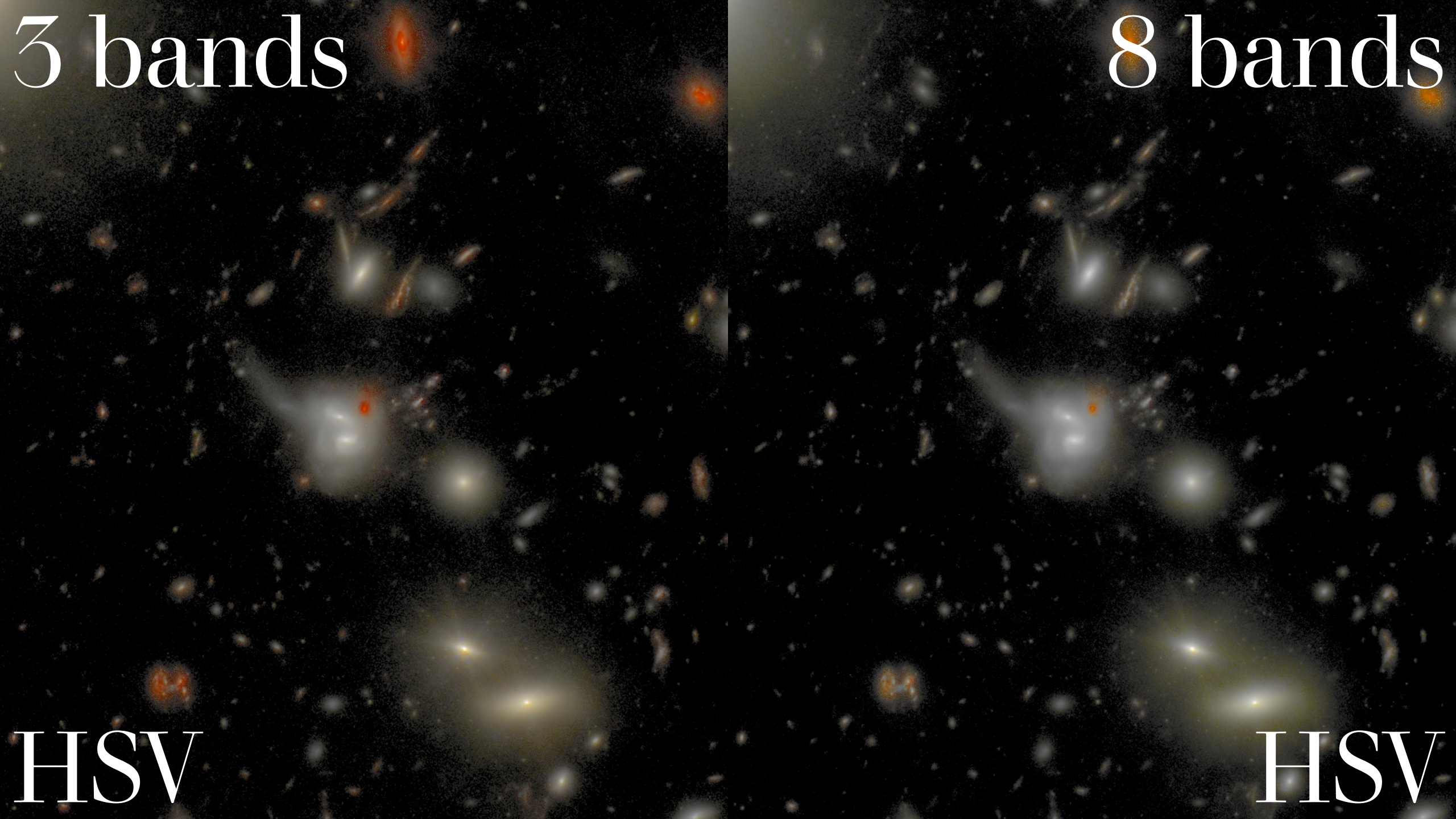


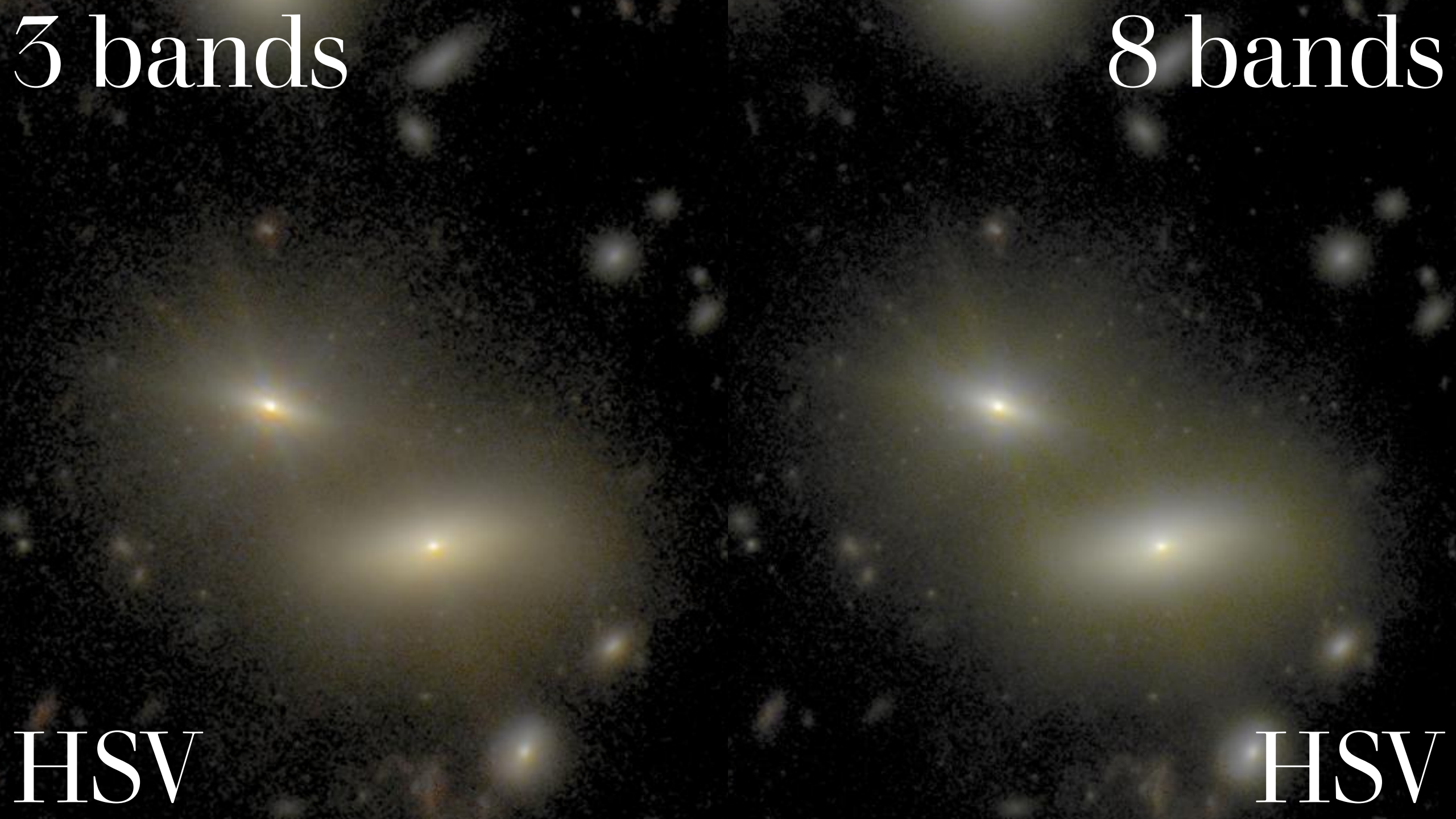

RGB
HSV

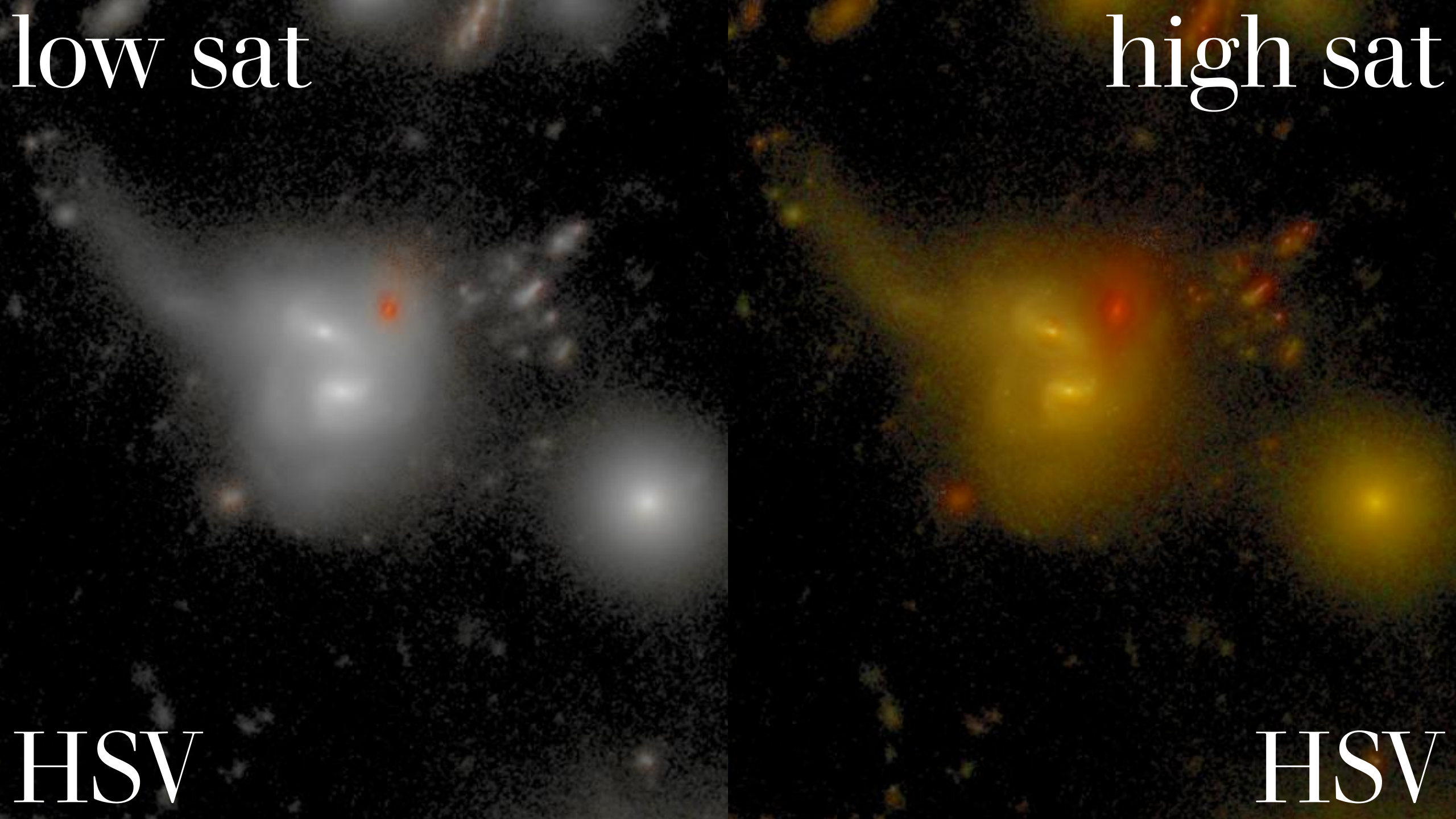

RGB
HSV

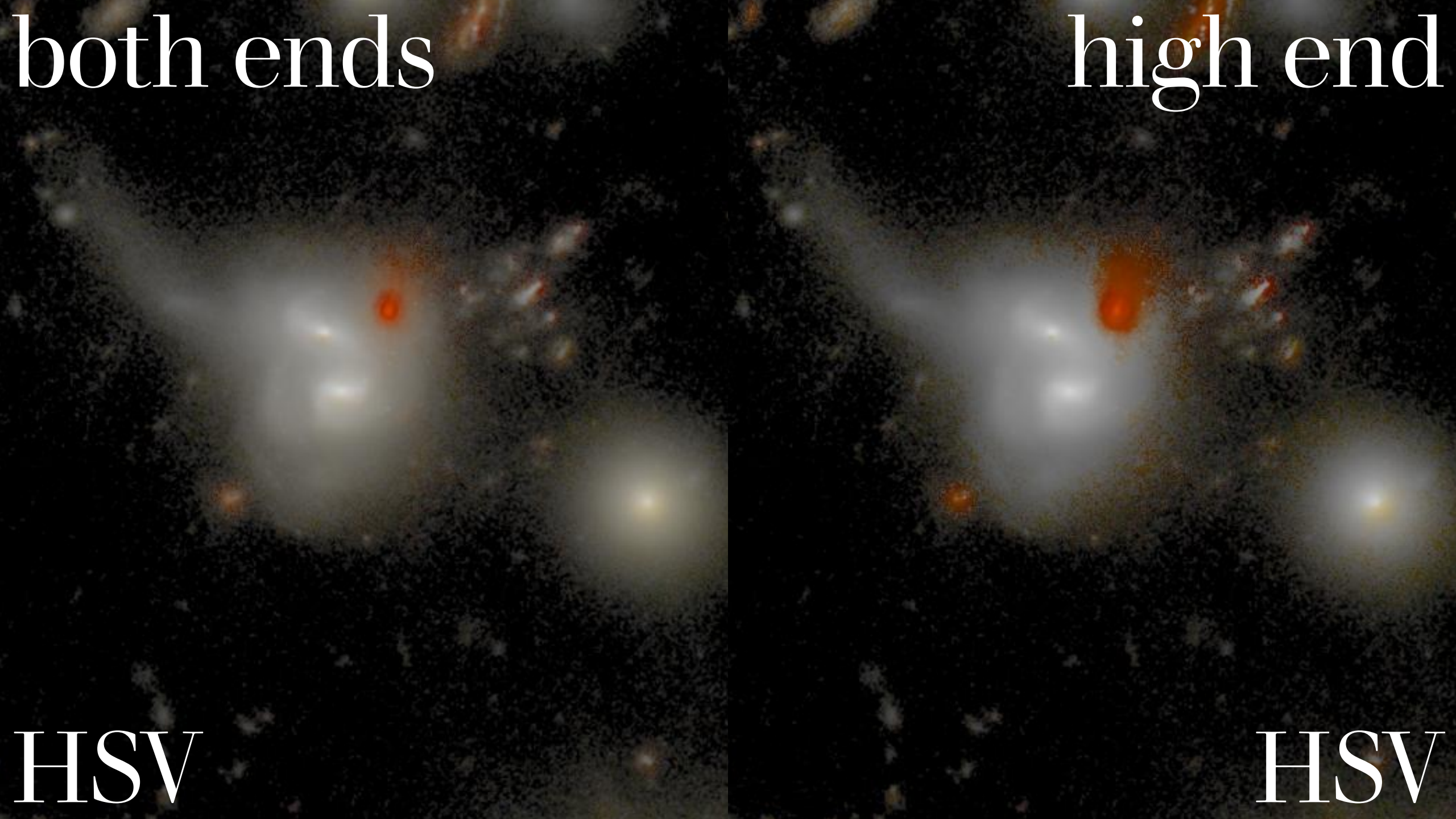

RGB
HSV


RGB
HSV


3 bands
8 bands
HSV
HSV


3 bands
8 bands
HSV
HSV

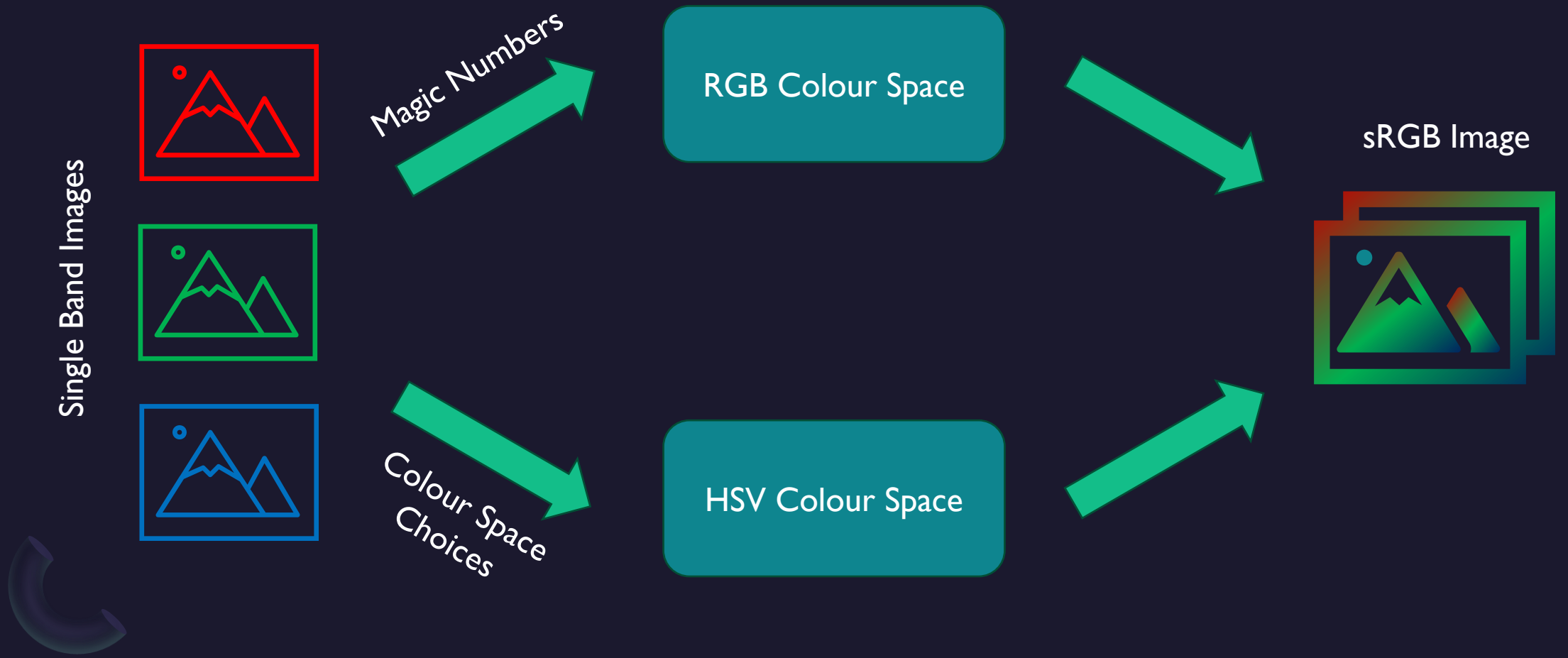

low sat
high sat
HSV
HSV


both ends
high end
HSV
HSV

Make explicit choices

- What should look neutral?
- What should difference between bands look like?
- What should noise look like?

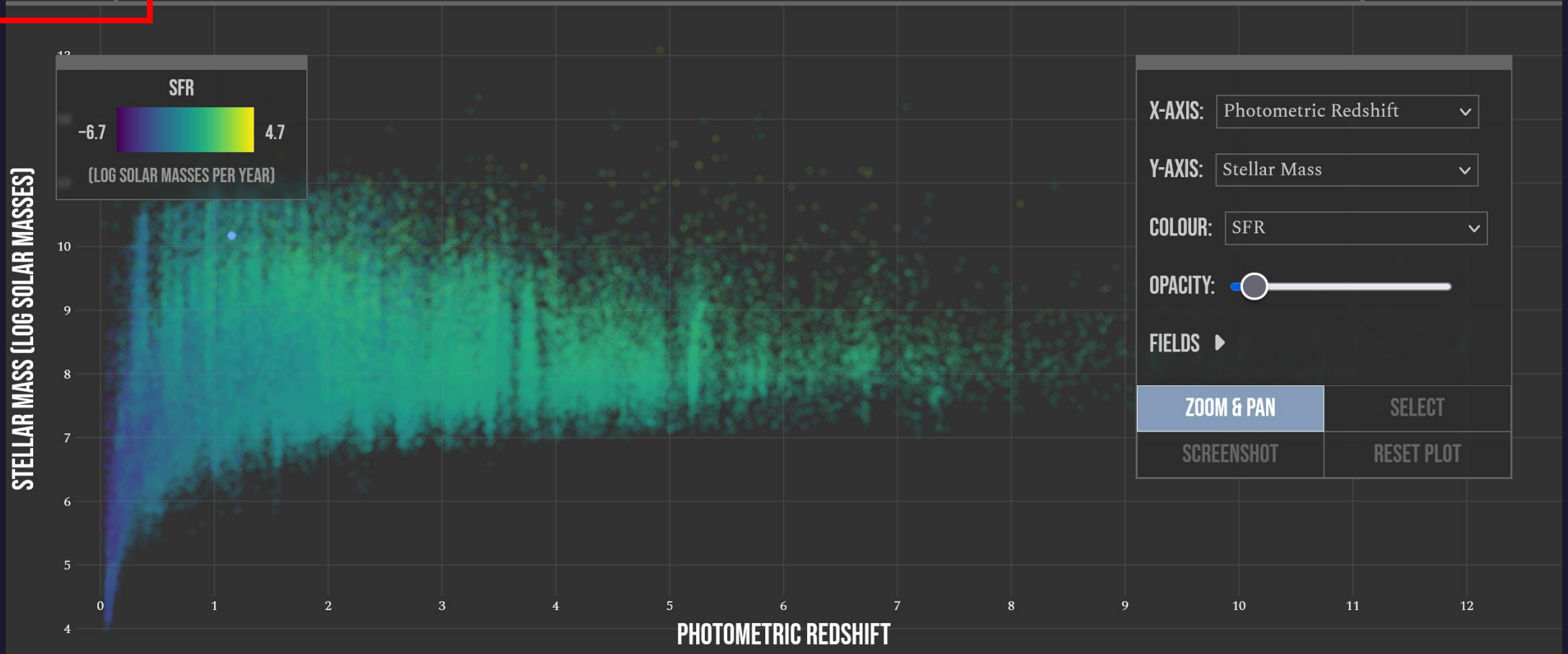
Still sRGB in the end

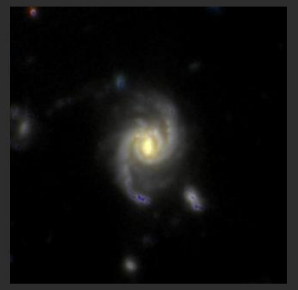


J-HIVE

JWST'S HOMOGENEOUS INFORMATION-RICH VISUALIZATION OF EXTRAGALACTIC DATASETS

VERSION 1.0.0

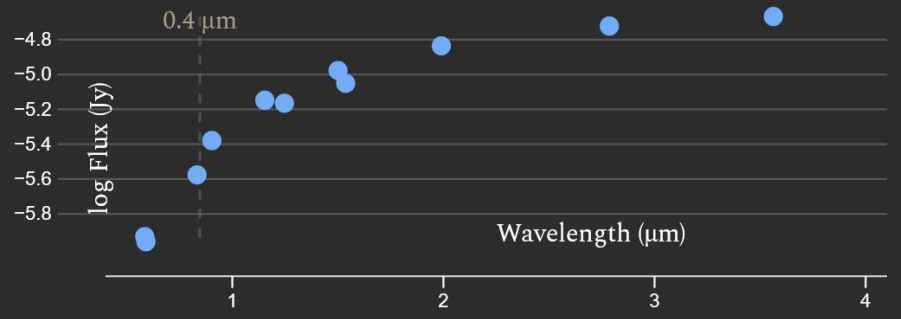


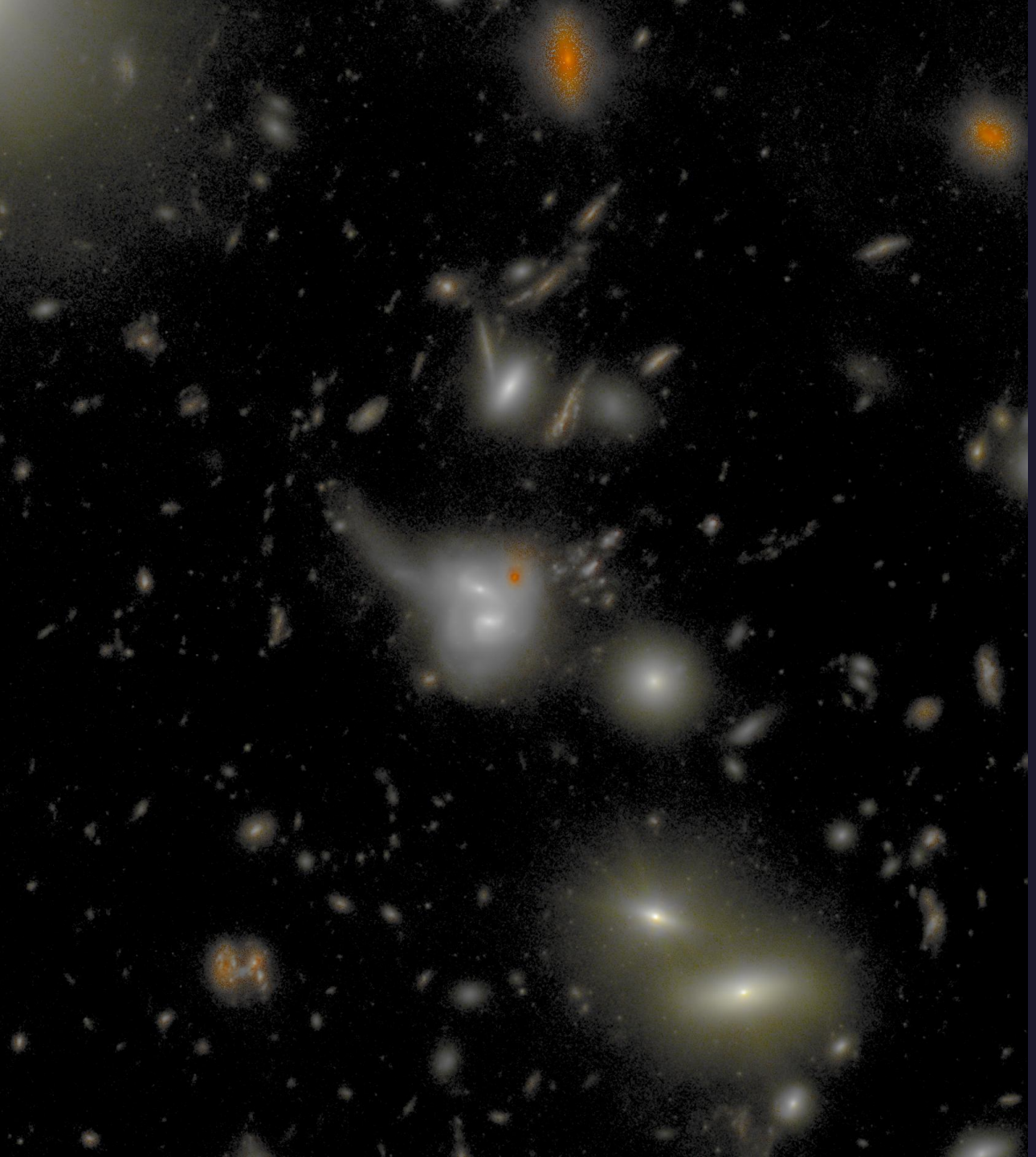


NGDEEP 23648

REDSHIFT: 1.12 SFR (LOG $M_\odot$/YR): 0.6
STELLAR MASS (LOG $M_\odot$): 10.2
RADIUS ("): 1.6 (150) 1.6 (444)
MAGS: 21.3 (150) 20.7 (444)

OPEN SUMMARY
OPEN FITS MAP
COPY ALL DATA





Conclusions

- Don’t stack your images in RGB
- RGB: for computers, displays
- HSV: for humans, visualizations
- Libraries in the works

Feel free to reach out:
hansen@sidratresearch.com

SIDRAT RESEARCH