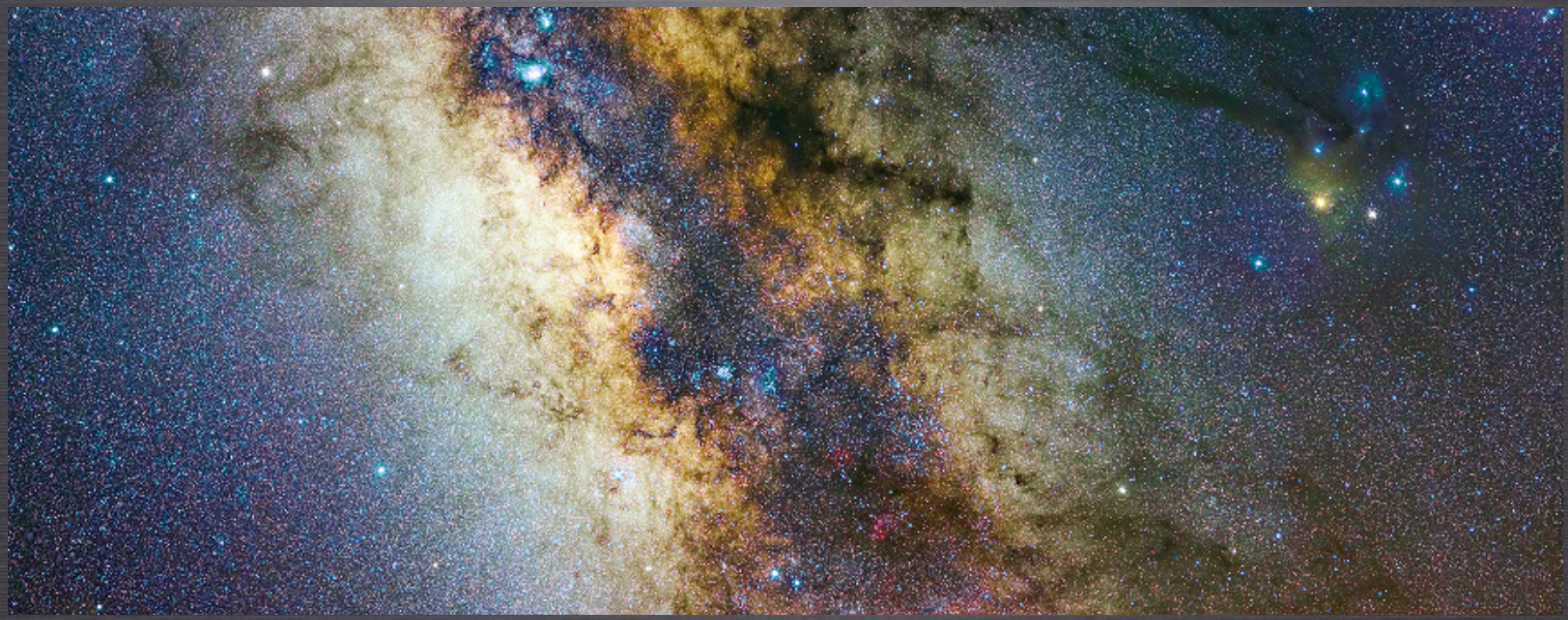
Night Photography



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cs178

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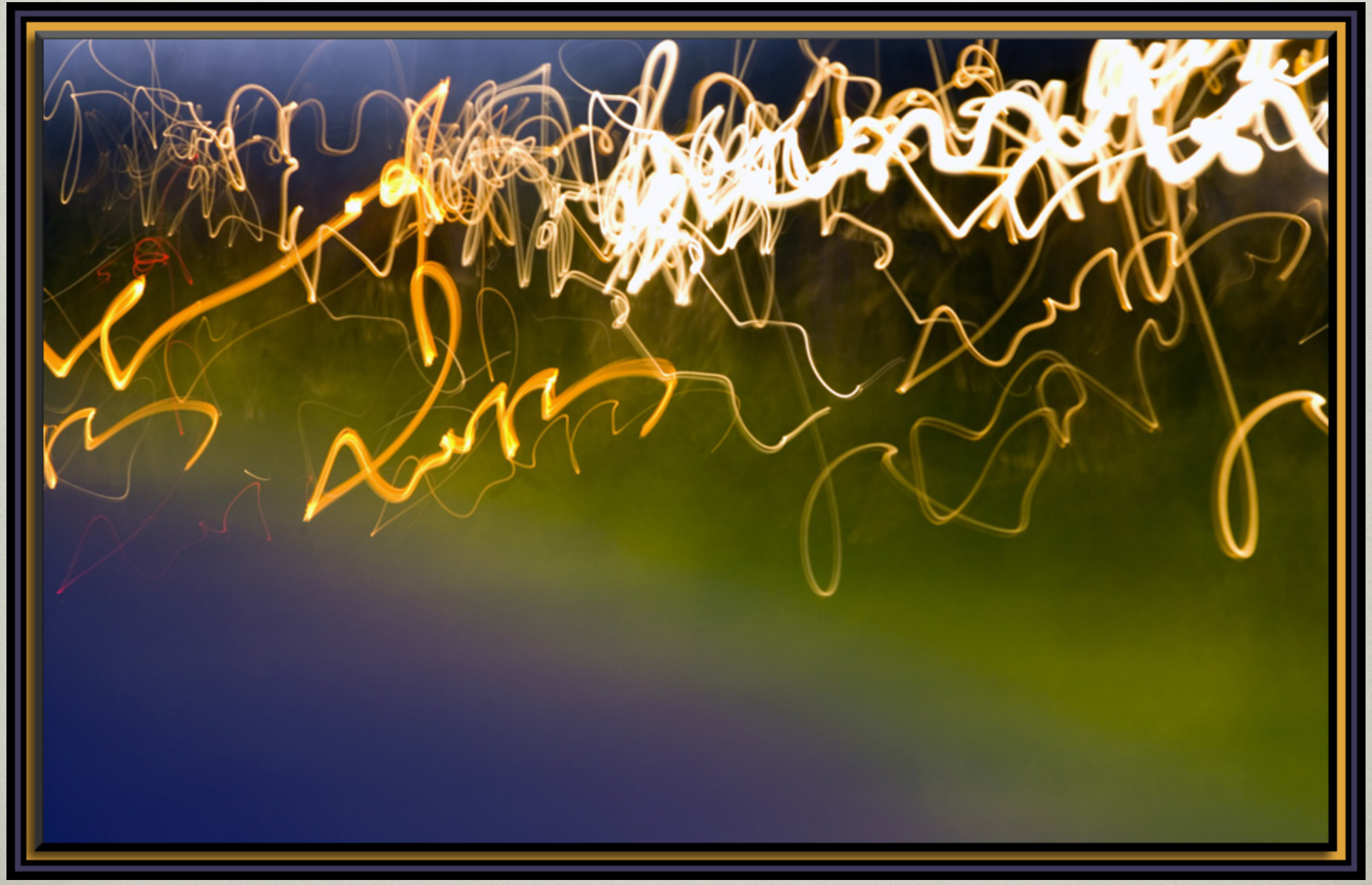
Night Photography

- Why is it hard?
  - Not much light
  - Huge dynamic range
  - Framing is difficult
  - Not obvious how photo will look

Twilight

Twilight

Twilight



Twilight

Cities at Night

Cities at Night

Cities at Night

Cities at Night

Early Morning

Early Morning

Starry Nights

Starry Nights

Starry Nights

Starry Nights

Starry Nights

Starry Nights

Astrophotography

- Capturing images of the sky
- There are amazing things out there!
- Good targets: star clusters, nebulas, galaxies
- Requires tripod and bulb mode

Challenges

- Extremely dark, hard to focus, cold...
- Want to track the earth's rotation
- Small objects require big lens/telescope
- Worry about all kinds of image noise
- Light pollution! Clouds! Atmosphere!

Tracking

- Earth rotates 360 degrees in 24 hours
- Equatorial Mount compensates for this
- Anywhere from $100 to $1,000,000
- Rule of thumb: without tracking, trails are visible at 1000sec / focal length

Different Scales

- Some objects are tiny:

~10,000mm

- Some objects are bigger:

~1,000mm

- Some “objects” are huge:

~25mm

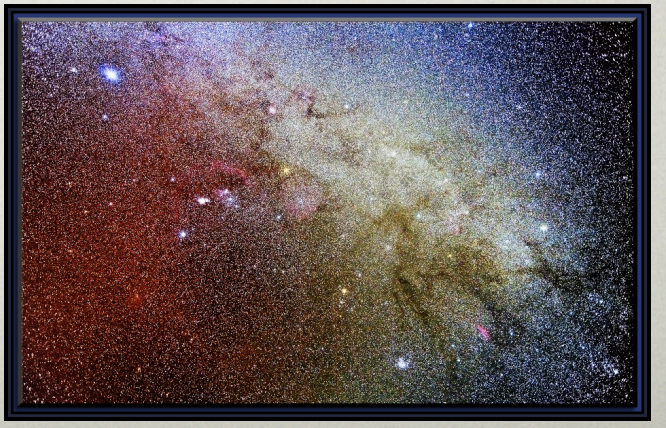


Image Stacking

- Averaging multiple images reduces read and shot noise
- Dark frame subtraction reduces dark current noise (essential!)
- Alignment sometimes necessary
  - Can be done by hand or automatically

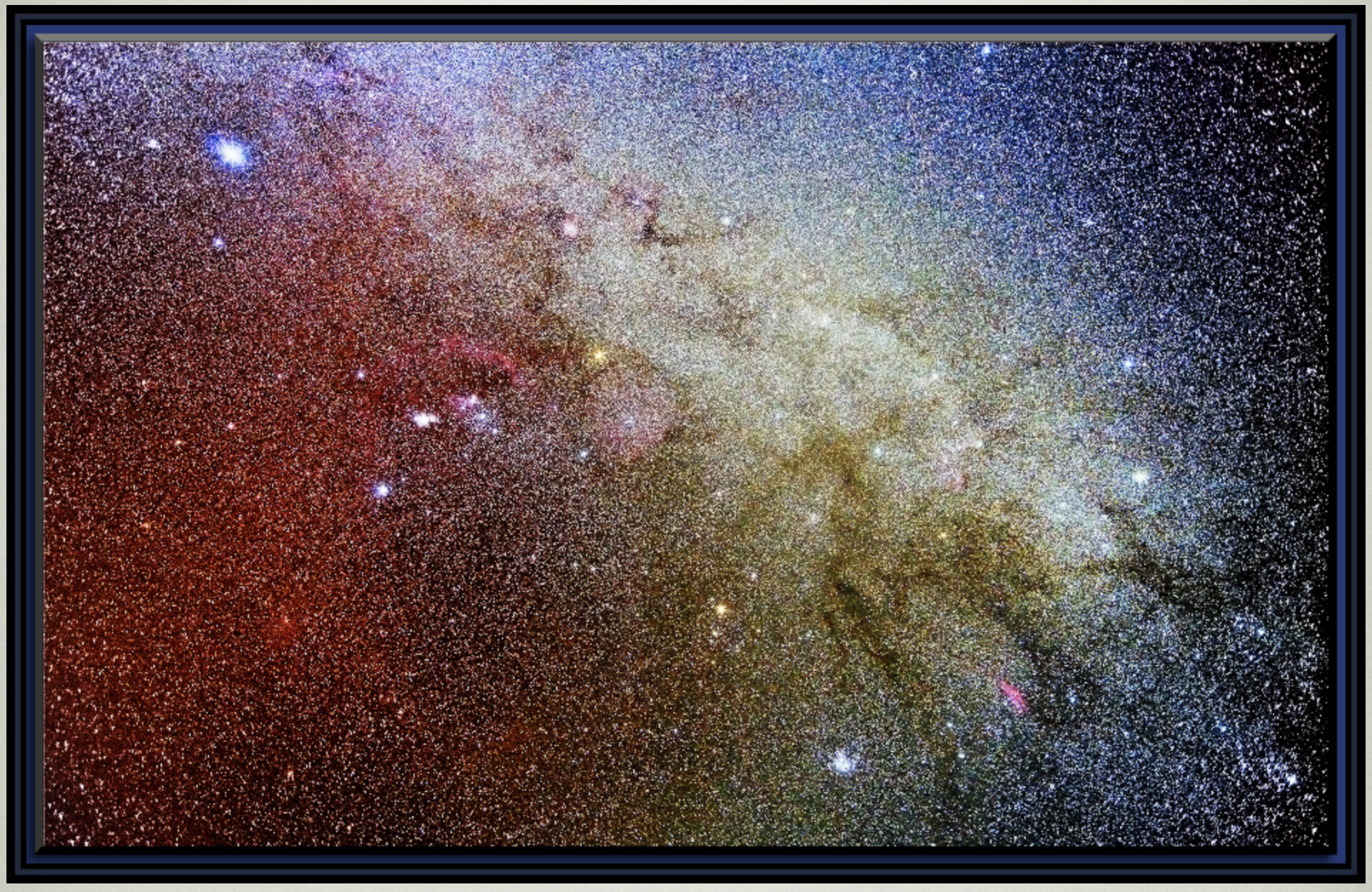
Post Processing

- Need to transform a histogram where almost everything is near-back to a pleasing image
- Can use Levels / Curves in Photoshop
- I wrote a program to do this automatically

My Program

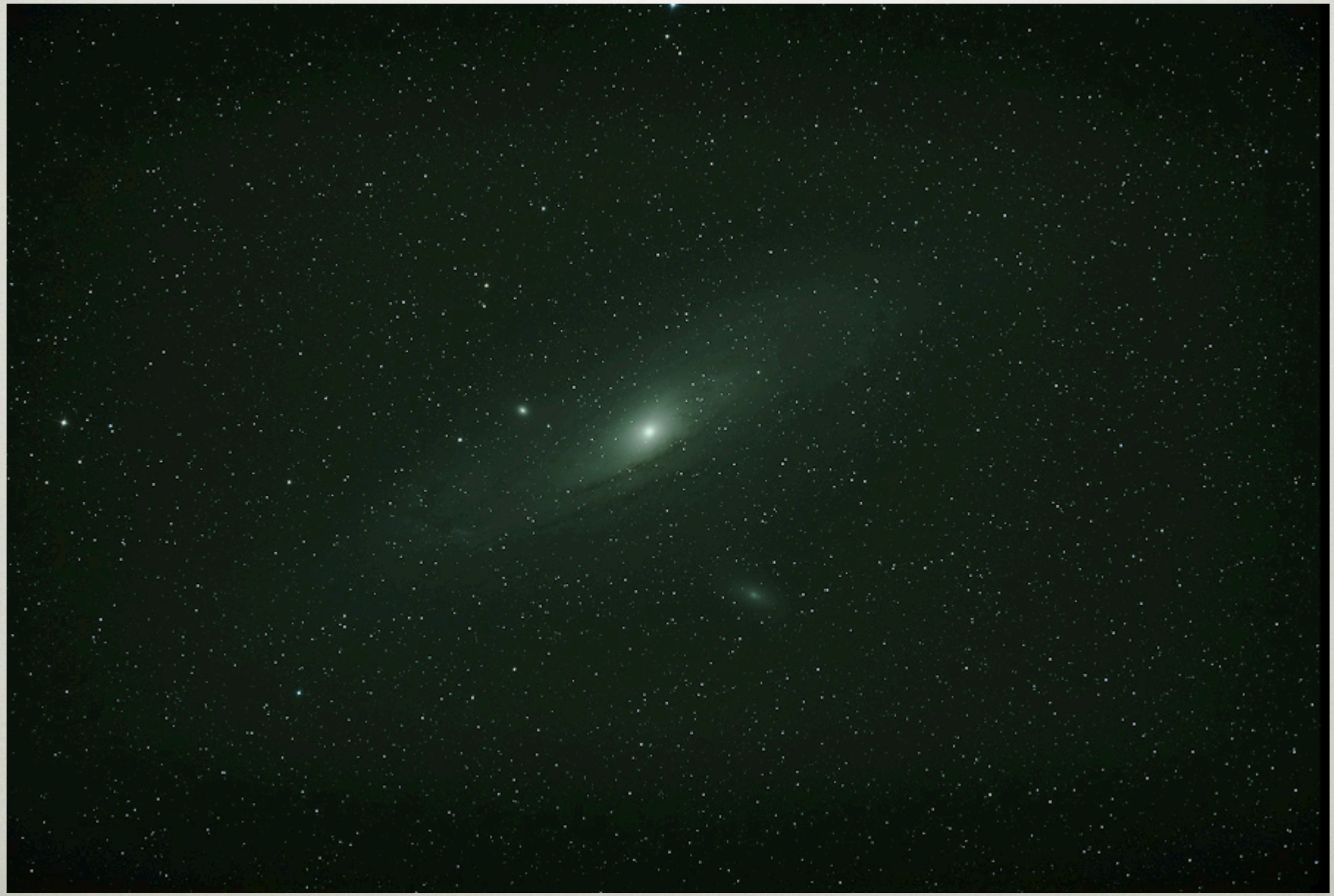
- Bucket sort pixels by brightness
- Separately for each color channel
- Generate output image with desired histogram
- Monotonic transformation

Winter Milky Way from Sea Level, Hawaii
Canon 5DII, 1 image with Zeiss 21/2.8 at f/4, 6 min

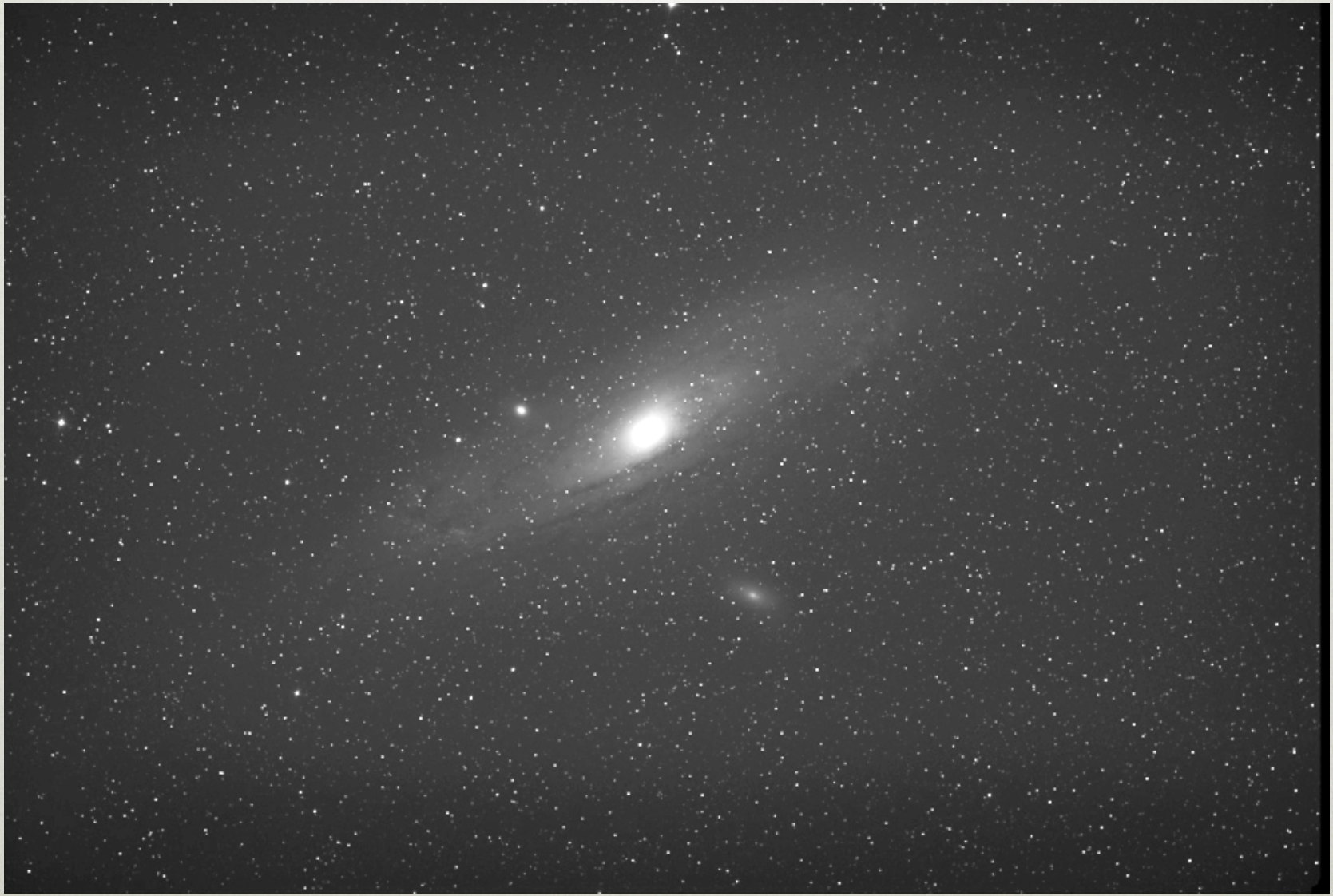


Winter Milky Way from Sea Level, Hawaii
Canon 5DII, 10 images with Zeiss 21/2.8 at f/4, 6 min each

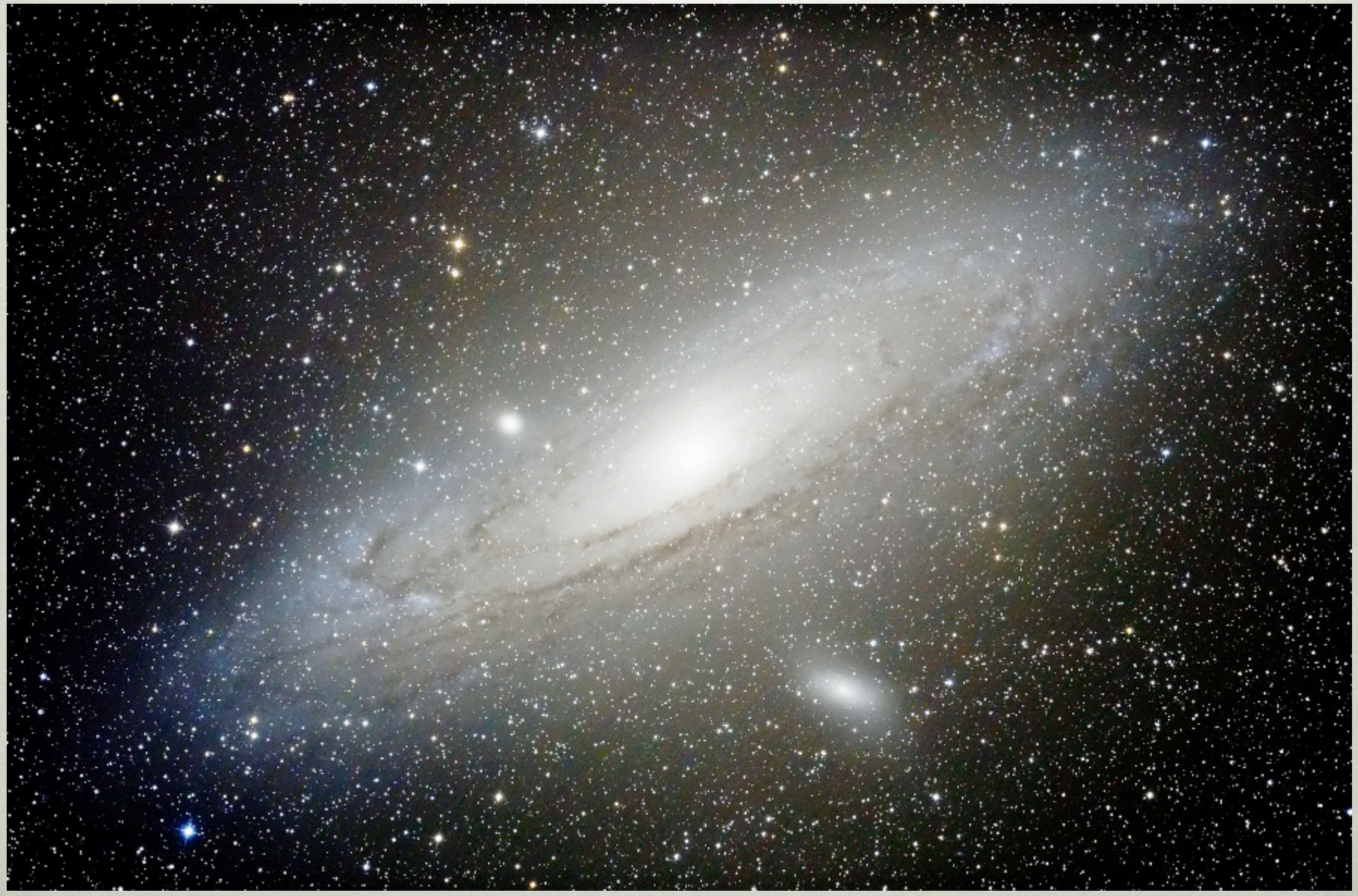
Andromeda: Single Image



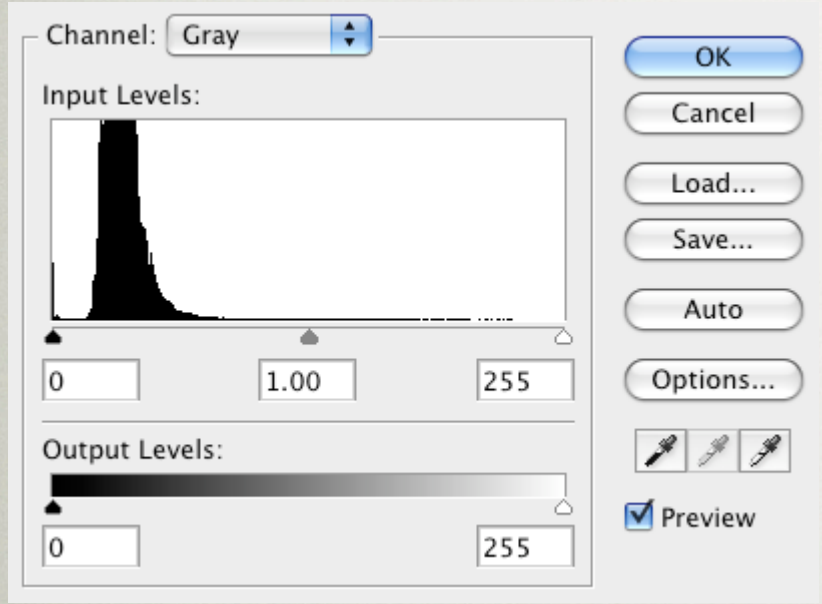
Andromeda: Auto Levels



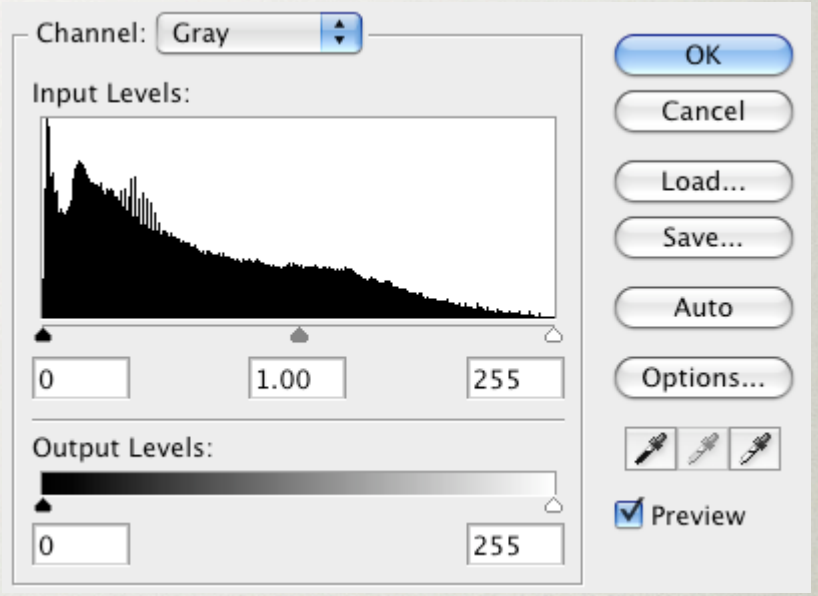
Andromeda: Stack, Process



Histogram Comparison



Original

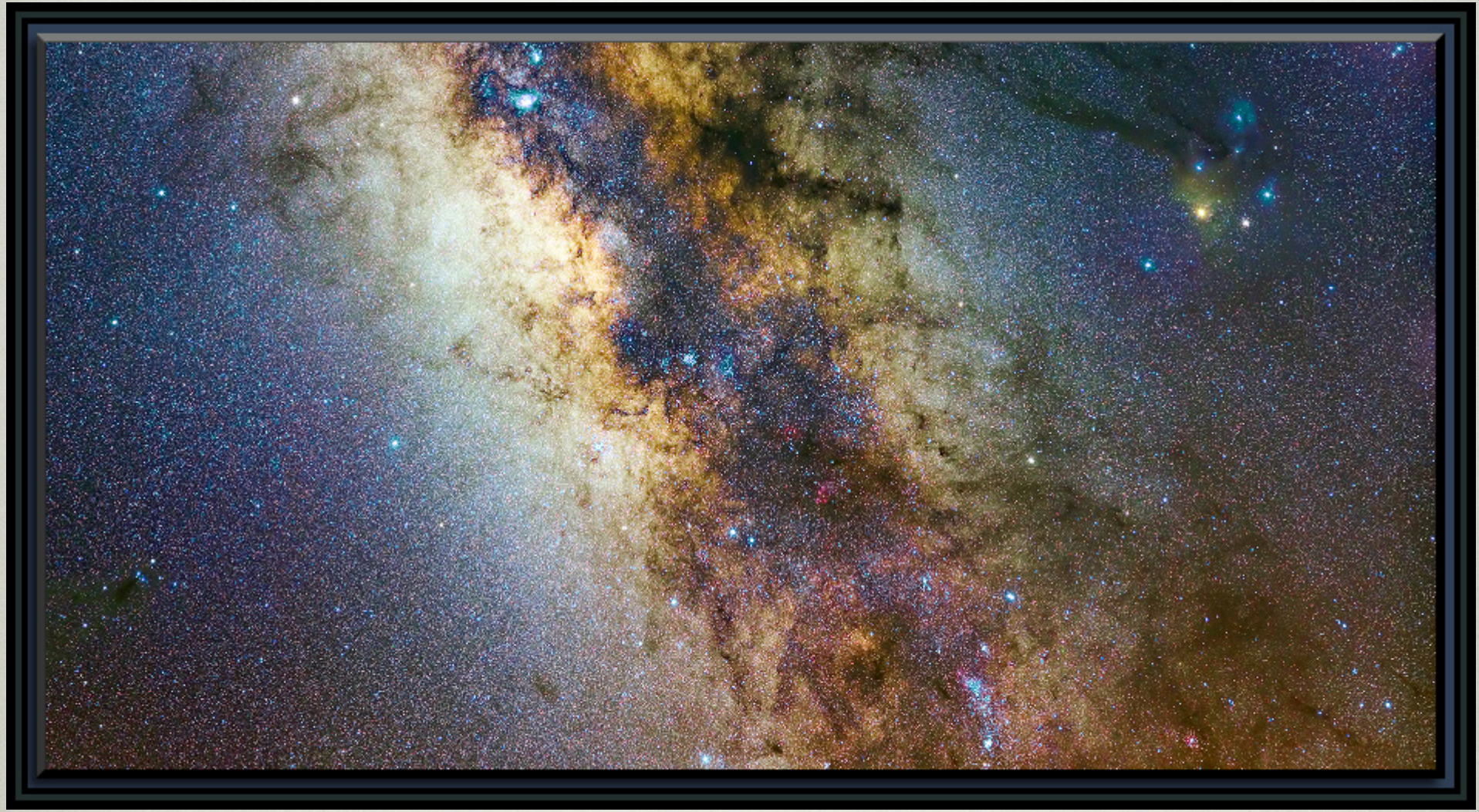


Final

Horsehead Nebula

Panoramas!

- You can stack, but probably don't need to
- Alignment can be hard



Milky Way from Mauna Kea Summit, 14,000 feet

Canon 1Ds, 4 images with 85/1.2L at f/2.5, 5 min each