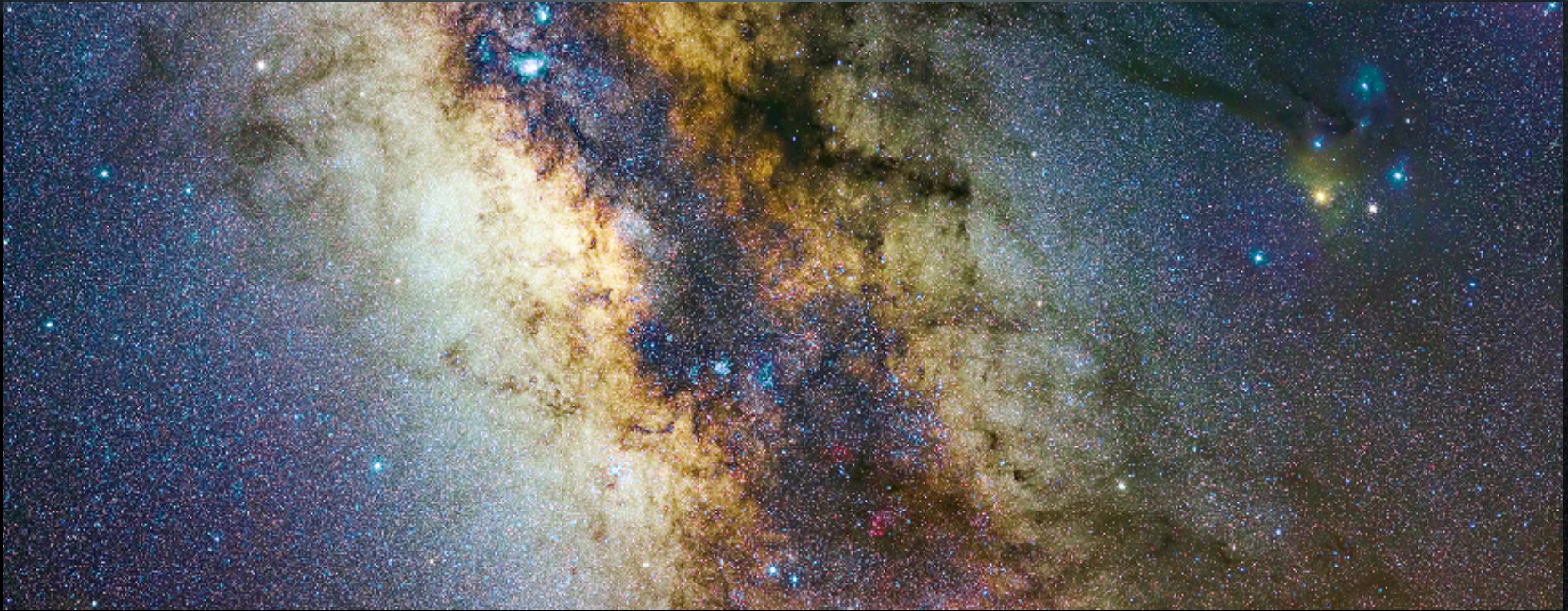


Night Photography



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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

Tips

- If you do not have a tripod, find a ledge
- Use 2-sec self timer to minimize shake
- Check your histogram very carefully
- Image will look brighter on LCD
- Turn off IS when not handholding

Twilight



Canon 1DsII, 180mm f/4, 4s, ISO 100

Twilight



Canon 10D, 200mm f/6, 2s, ISO 200

Twilight



Canon 1DsII, 12mm f/5.6, 1/8s, ISO 800

Twilight



Canon 1DsII, 100mm f/8, 15s, ISO 100

Twilight



Canon 10D, 63mm f/7, 1s, ISO 100

Twilight

Canon 5DII,
12mm f/5.6,
1/4s, ISO
1600



Cities at Night



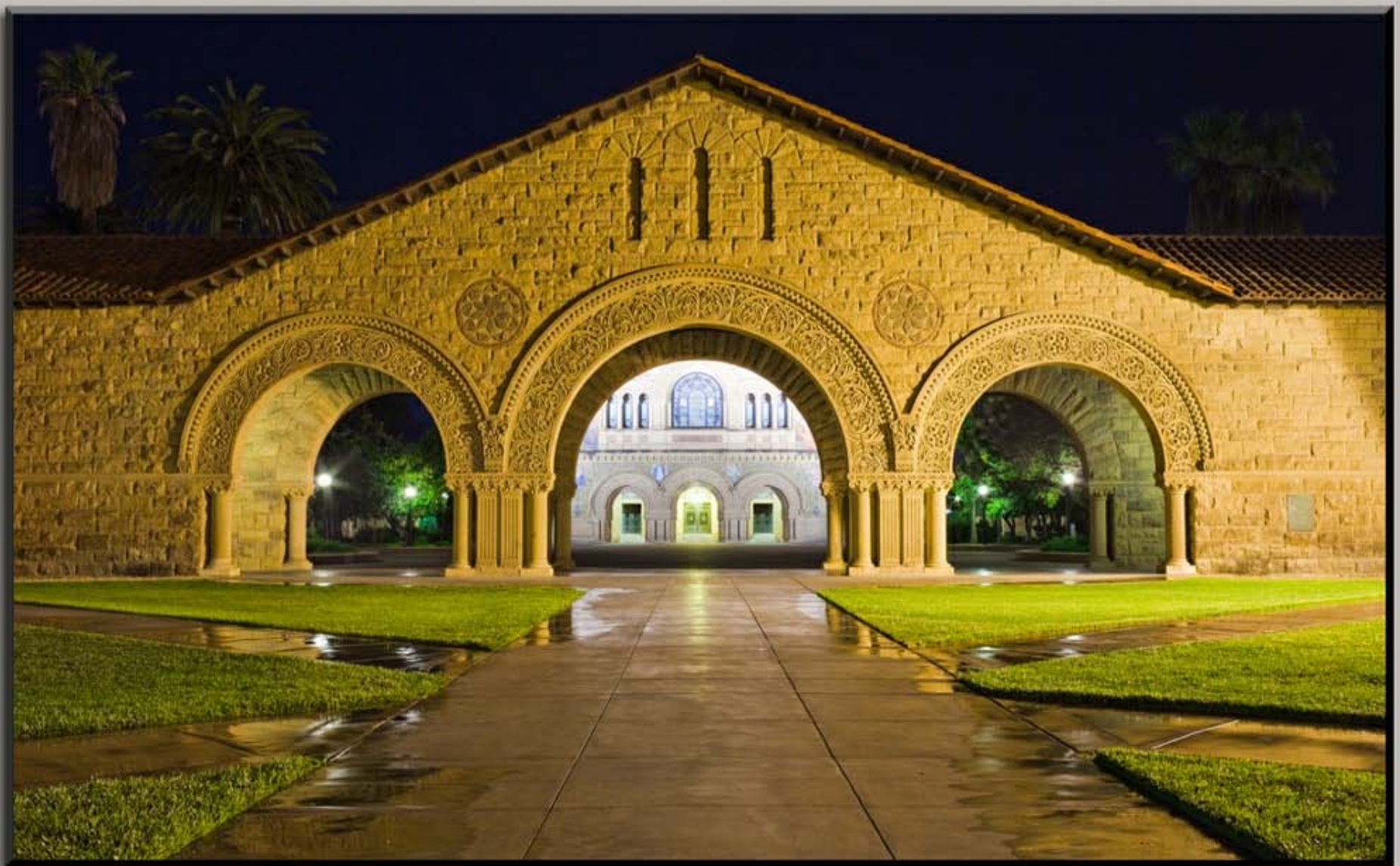
Canon 1DsII, 24mm f/6, 3s, ISO 1600

Cities at Night



Canon 5DII, 24mm f/6.3, 2s, ISO 200

Cities at Night



Canon 5DII, 35mm f/8, 30s, ISO 100

Cities at Night



Canon 5DII, 300mm f/2.8, 1/2s, ISO 400

Cities at Night



Canon 5DII, 300mm f/2.8, 2s, ISO 200, 10 image pano

Cities at Night



Canon 5DII, 135mm, f/4.5, ISO 200, 4 x 13 image pano

Cities at Night



Canon 5DII, 135mm, f/4.5, ISO 200 (crop)

Cities at Night



Canon 5DII, 135mm, f/4.5, ISO 200 (crop)

Cities at Night



Canon 5DII, 12mm f/8, 1s+4s+30s, ISO 100

Early Morning



Canon 10D, 70mm f/6.5, 7 min, ISO 400

??????



Canon 5DII, 200mm, f/6.7, 1/500s, ISO 200

Starry Nights



Canon 1DsII, 15mm f/4, 2 min, ISO 800

Starry Nights



Canon 10D, 28mm f/6, 8 min, ISO 100

Starry Nights



Canon 10D, 28mm f/4, 3 min, ISO 100, 4 images

Starry Nights



Canon 5DII, 50mm f/3, 6 min, ISO 400

Starry Nights



Canon 5DII, 50mm f/2.6, 13s, ISO 1600 + ACR boost

Starry Nights



Canon 5DII, 24mm f/5.6, 12 min, ISO 100

Starry Nights



Canon 5DII, 100mm f/2.8, 3s, ISO 400

Starry Nights



Canon 5DII, 100mm f/4, 30s, ISO 400

Starry Nights



Canon 5DII, 100mm f/2.8, 30s, ISO 400, 2x focus stack

Starry Nights



Canon 5DII, 100mm f/2.8, 30s, ISO 800

Starry Nights

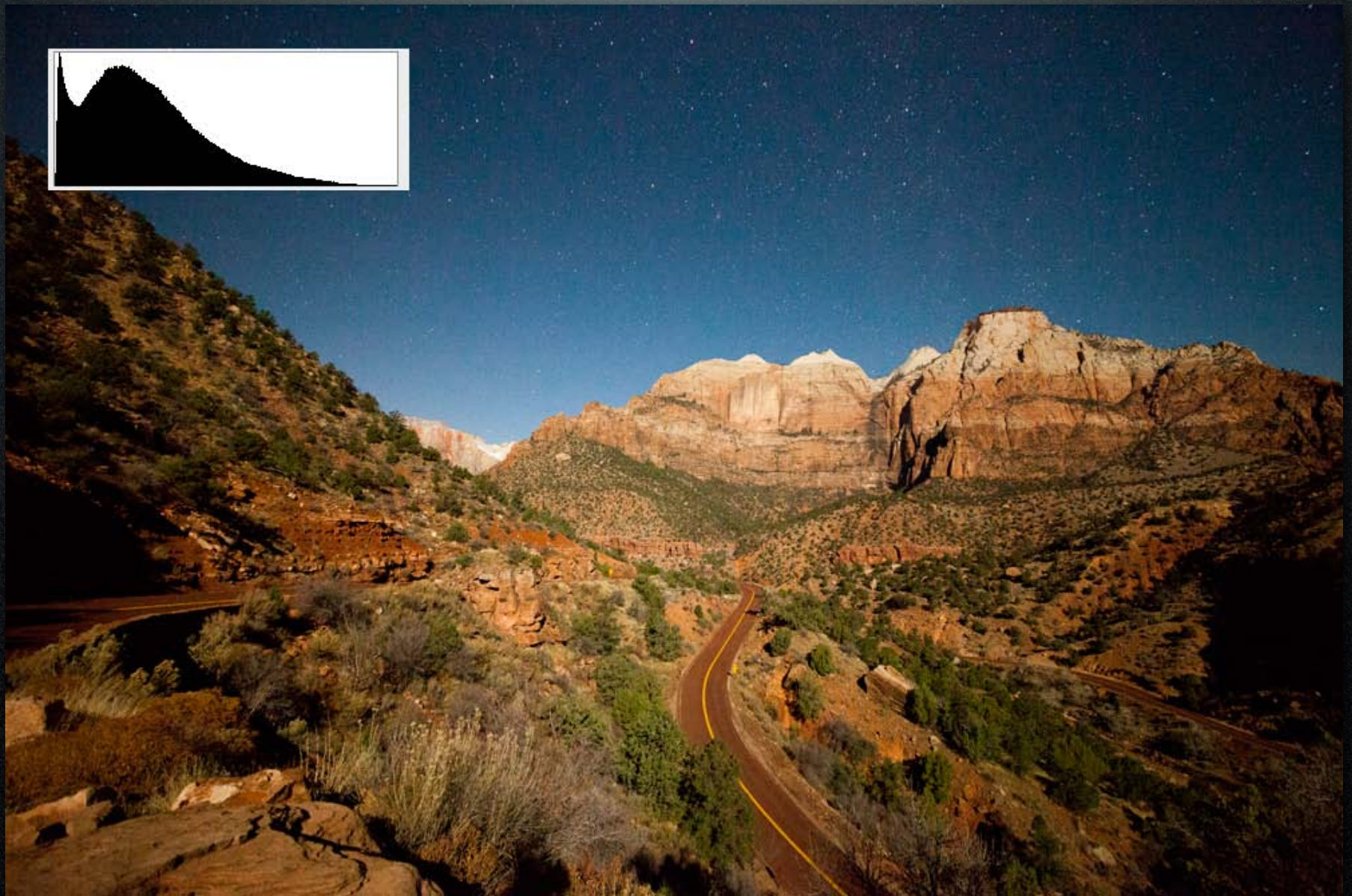


Canon 5DII, 50mm f/5.6, 30s, ISO 400

Super long exposures

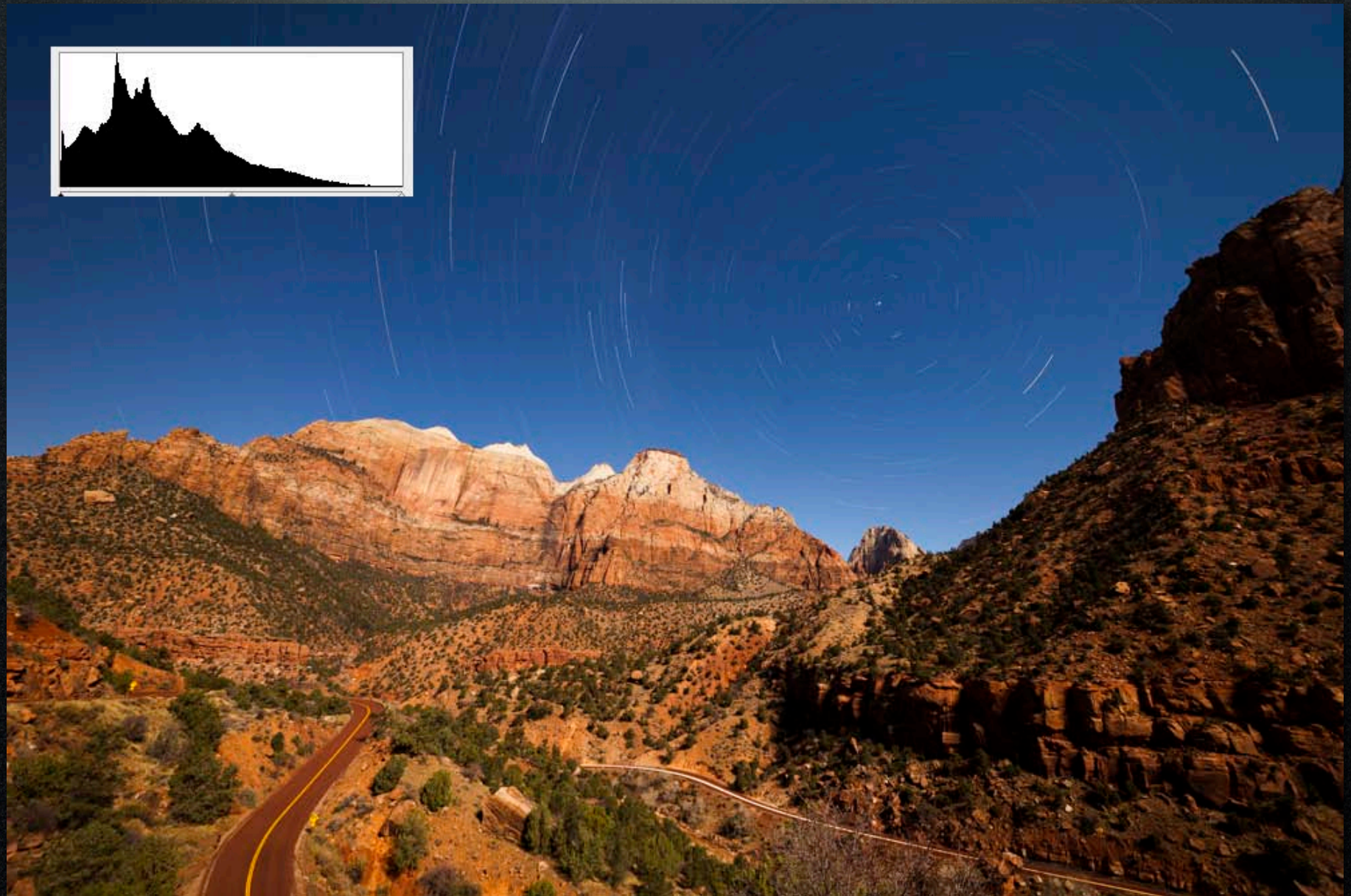
- No time to wait an hour to see if your framing and exposure are correct?
- Take a test exposure at high ISO, wide open!
- Use your CS178 skills to compute equivalent exposure for low ISO, desired aperture

Starry Nights



Canon 5DII, 12mm f/4.5, 30 seconds, ISO 6400

Starry Nights



Canon 5DII, 12mm f/6.7, 60 minutes, ISO 100

Starry Nights



Canon 5DII, 12mm f/6.7, 60 minutes, ISO 100

Starry Nights



Canon 5DII, 14mm f/4, 9 minutes, ISO 400

Starry Nights



Canon 5DIII, 17mm f/4.5, 67 minutes, ISO 400

Starry Nights



Canon 5DII, 12mm f/6.3, 80 minutes, ISO 100

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 rotation of the earth
- 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 $1000\text{sec} / \text{focal length}$

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, Zeiss 21/2.8 at f/4, 6 min each

Andromeda: Single Image



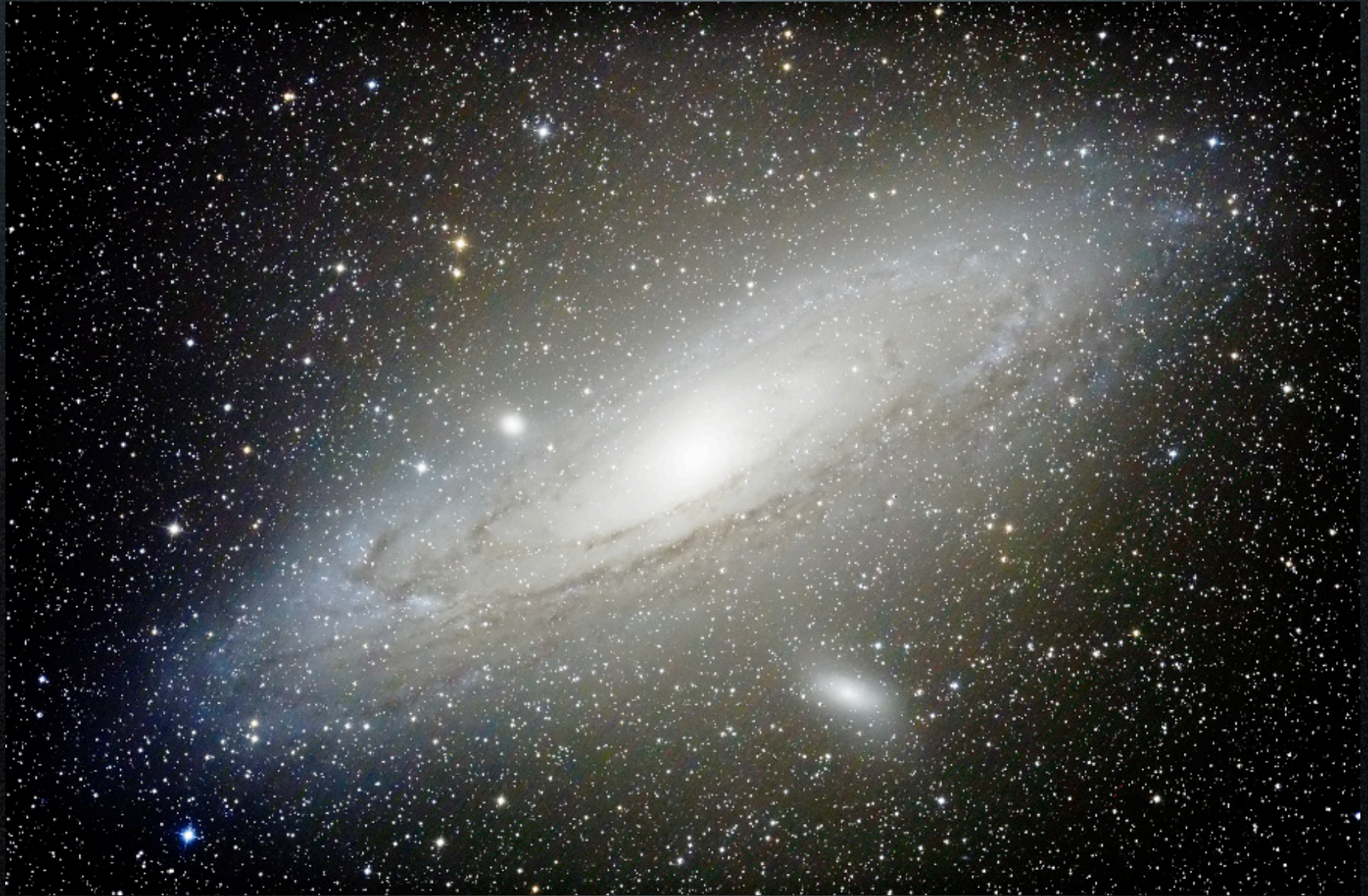
Canon XTi, 500mm f/2.8, 1 image at 3 minutes

Andromeda: Auto Levels



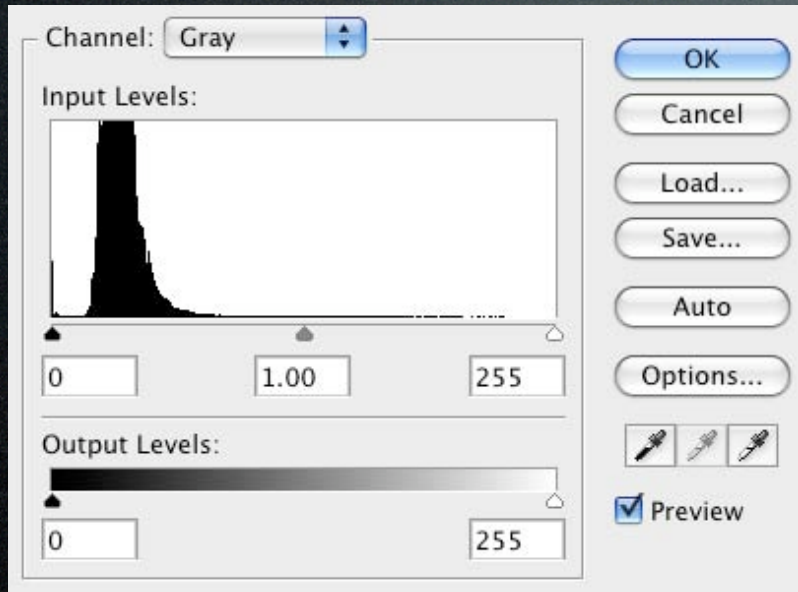
Canon XTi, 500mm f/2.8, 1 image at 3 minutes

Andromeda: Stack, Process

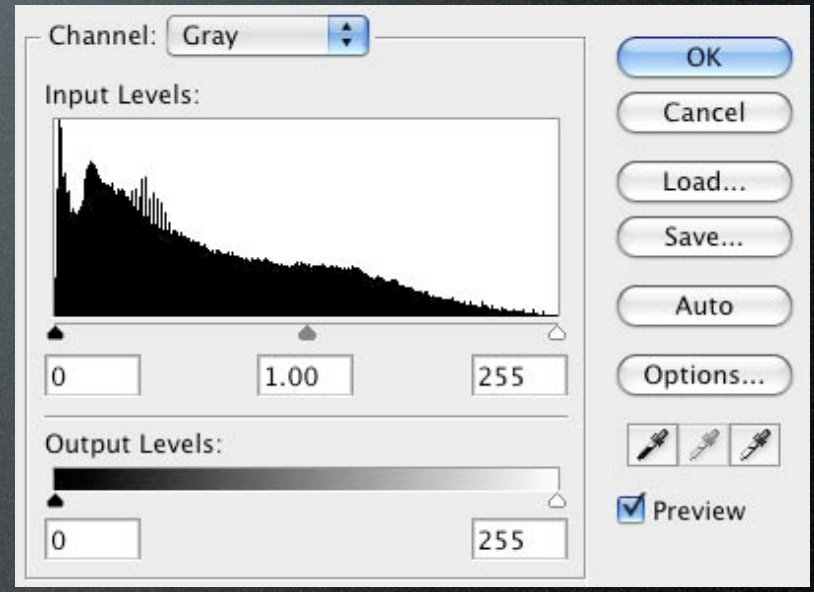
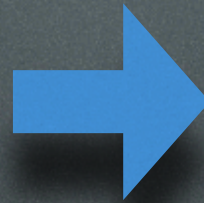


Canon XTi, 500mm f/2.8, 60 images at 3 minutes each

Histogram Comparison



Original

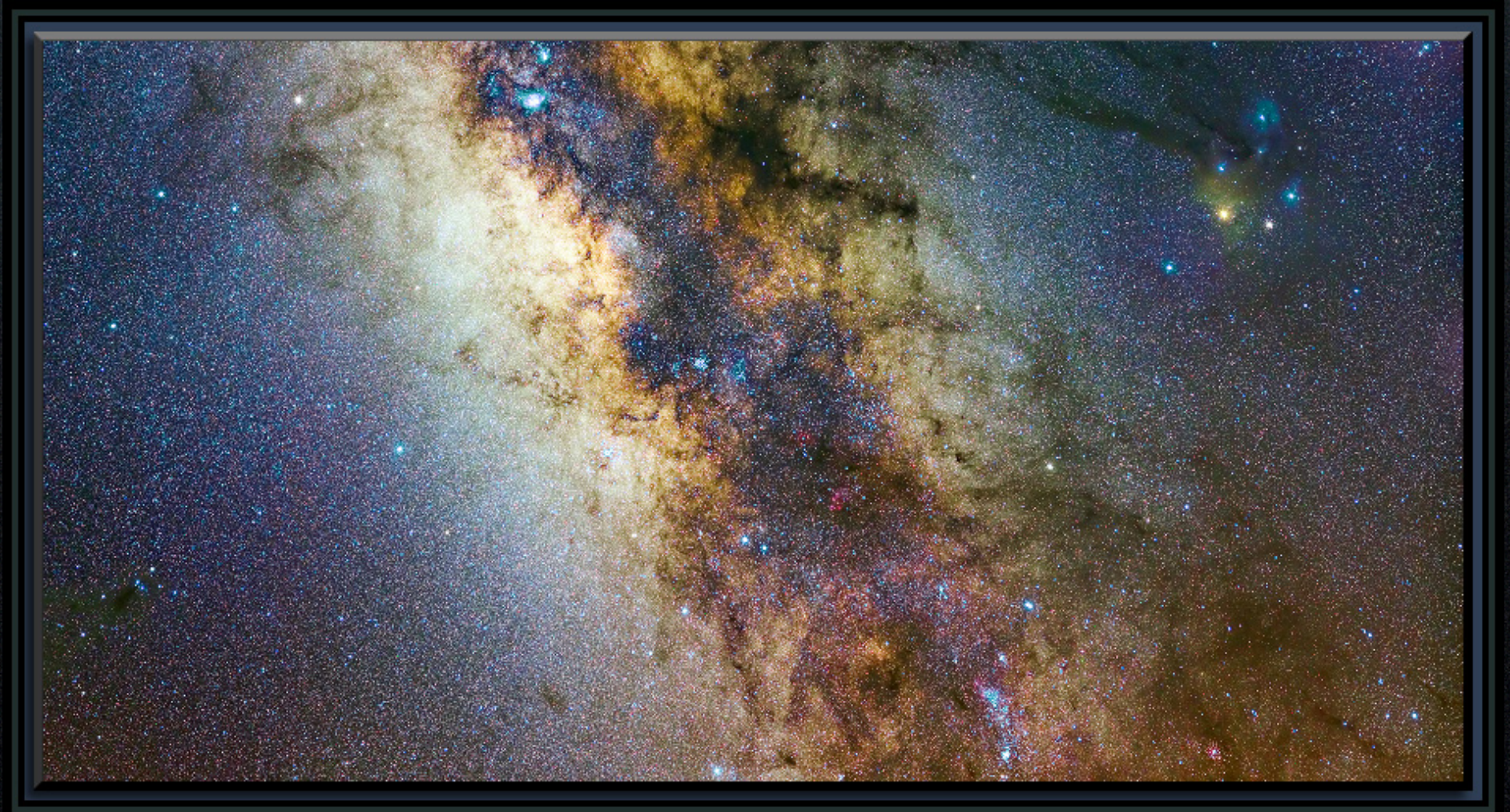


Final

Horsehead Nebula

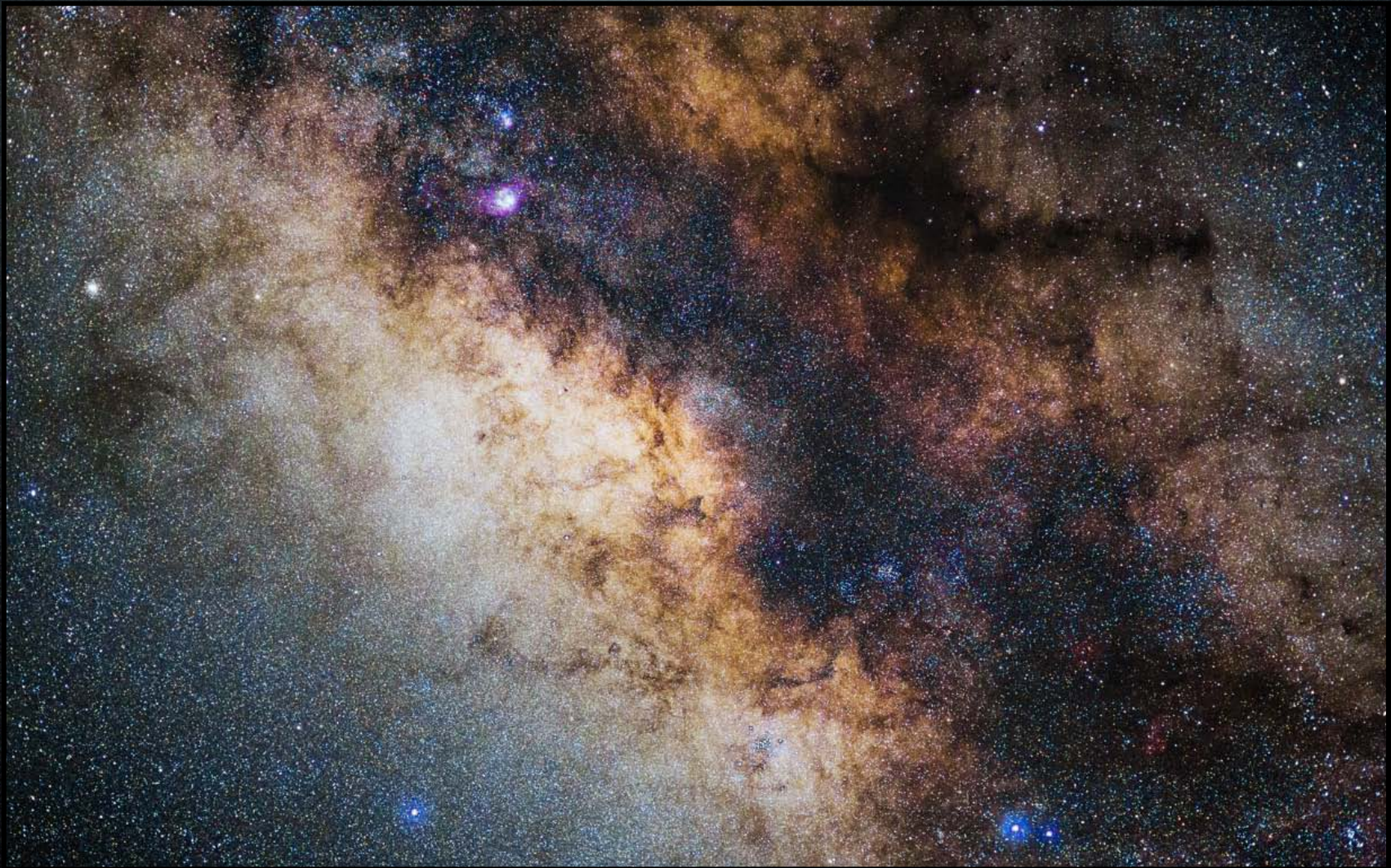


Milky Way from Mauna Kea Summit, 14,000 feet



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

Milky Way from Mauna Kea Summit, 14,000 feet



Canon 5DIII, 1 image, 85/1.8, ISO 6400, 9 sec (!)

Tracking + no tracking merge



Canon 5DIII, 14mm f/4.5, 3 min + 3 min, ISO 800