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

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

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

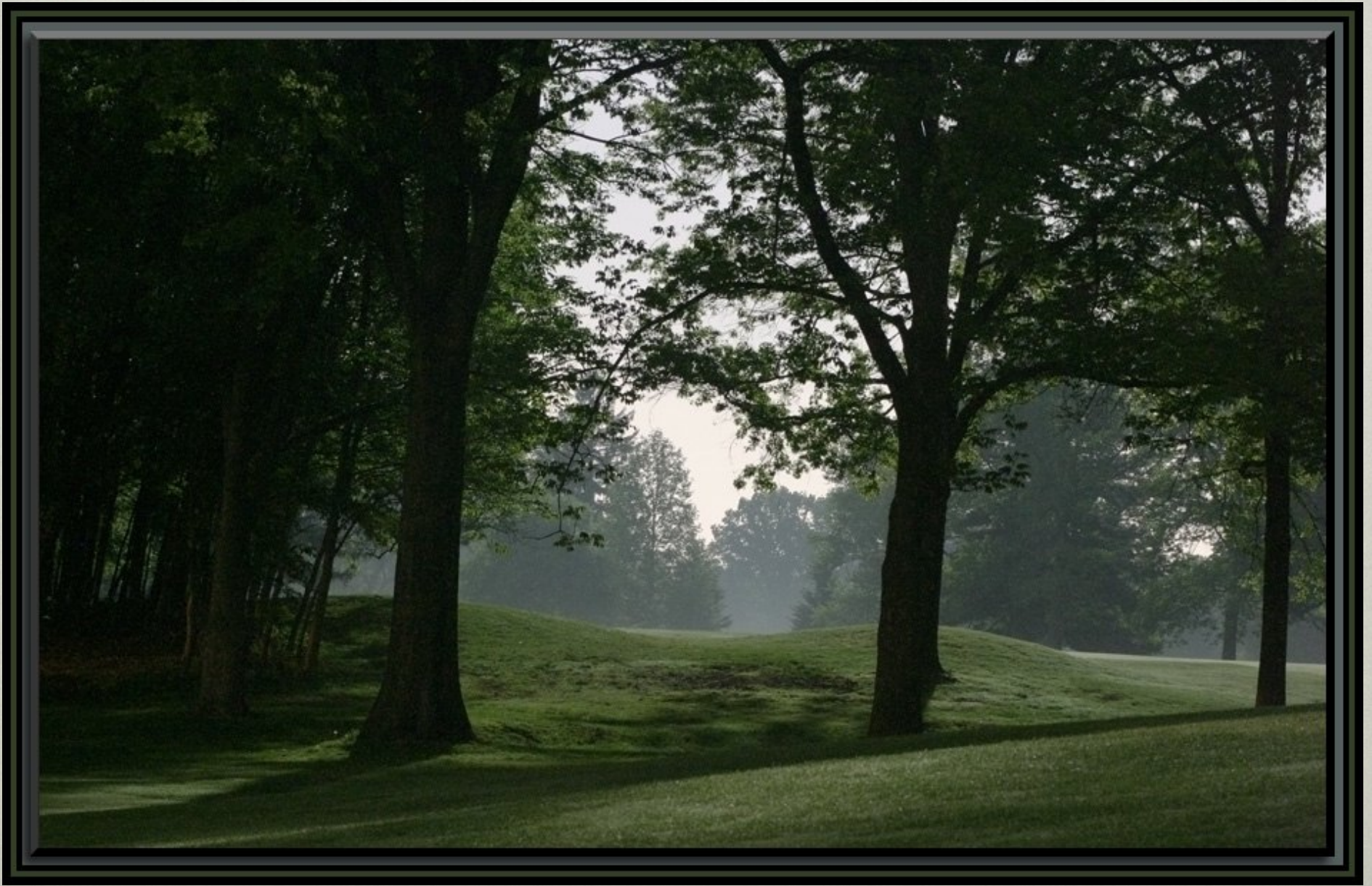Canon 5DII, 35mm f/8, 30s, ISO 100

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 panorama

Early Morning

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

Early Morning

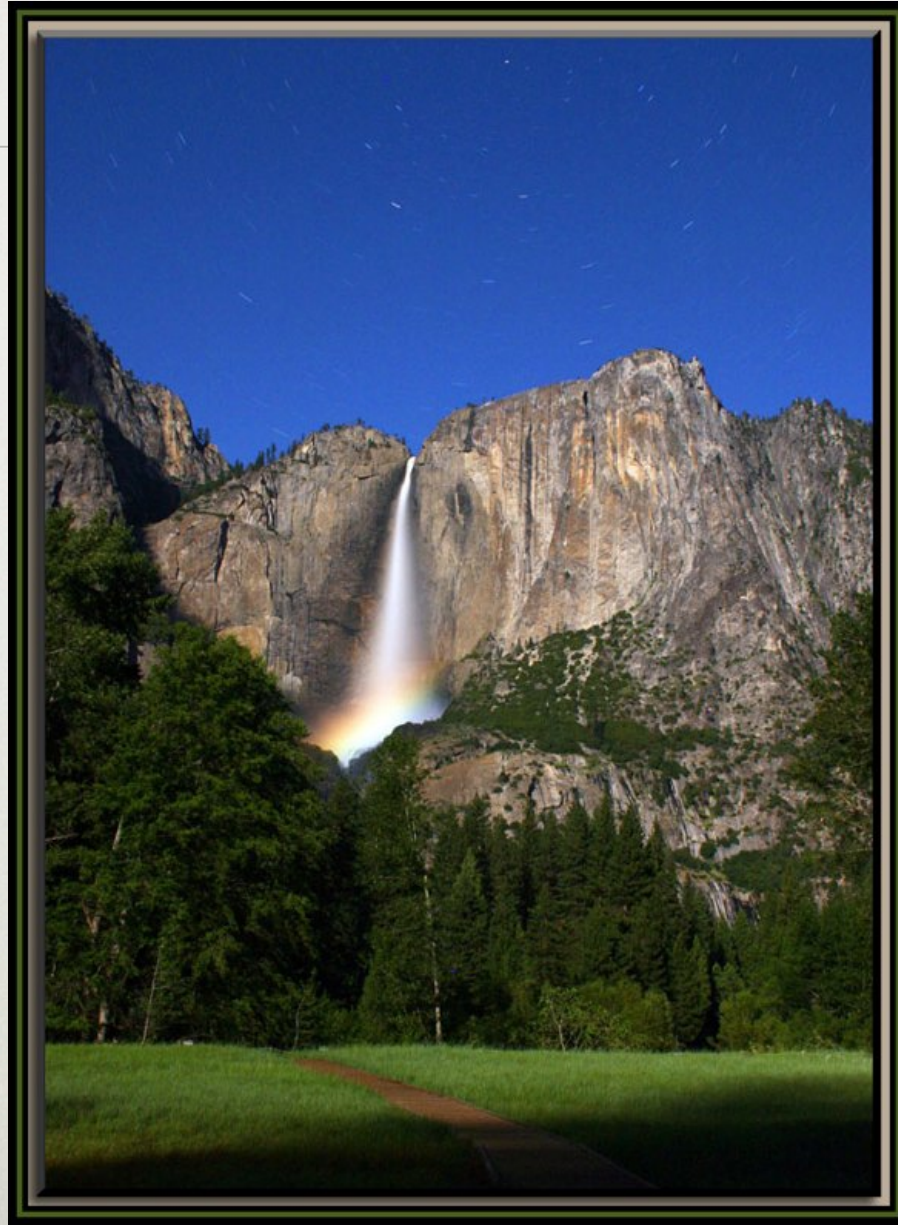Canon 10D, 70mm f/6.5, 45s, ISO 100

Starry Nights

Canon 10D, 35mm f/5.5, 30s, 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 image pano

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

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
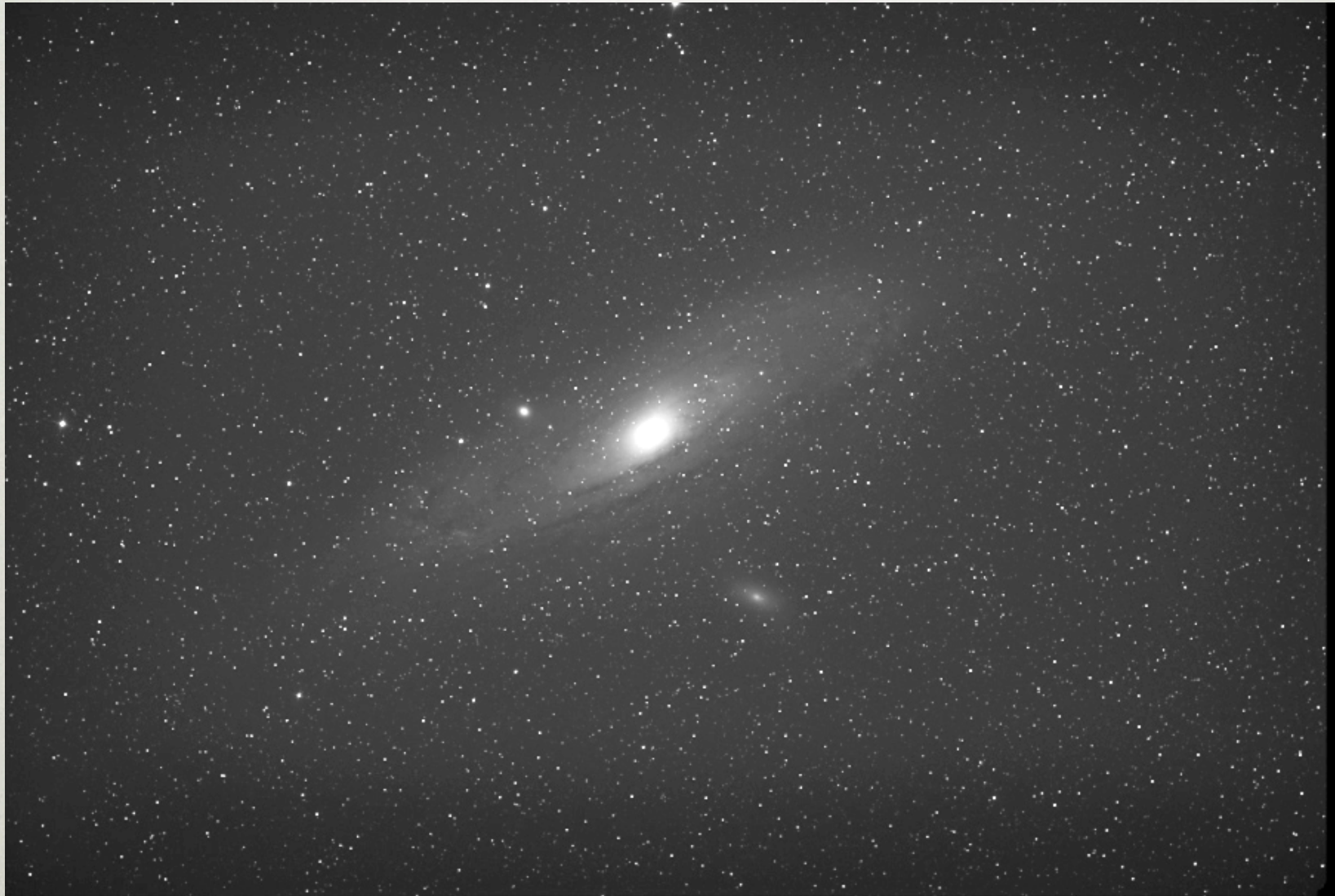Canon 5DII, 1 image with Zeiss 21/2.8 at f/4, 6 min
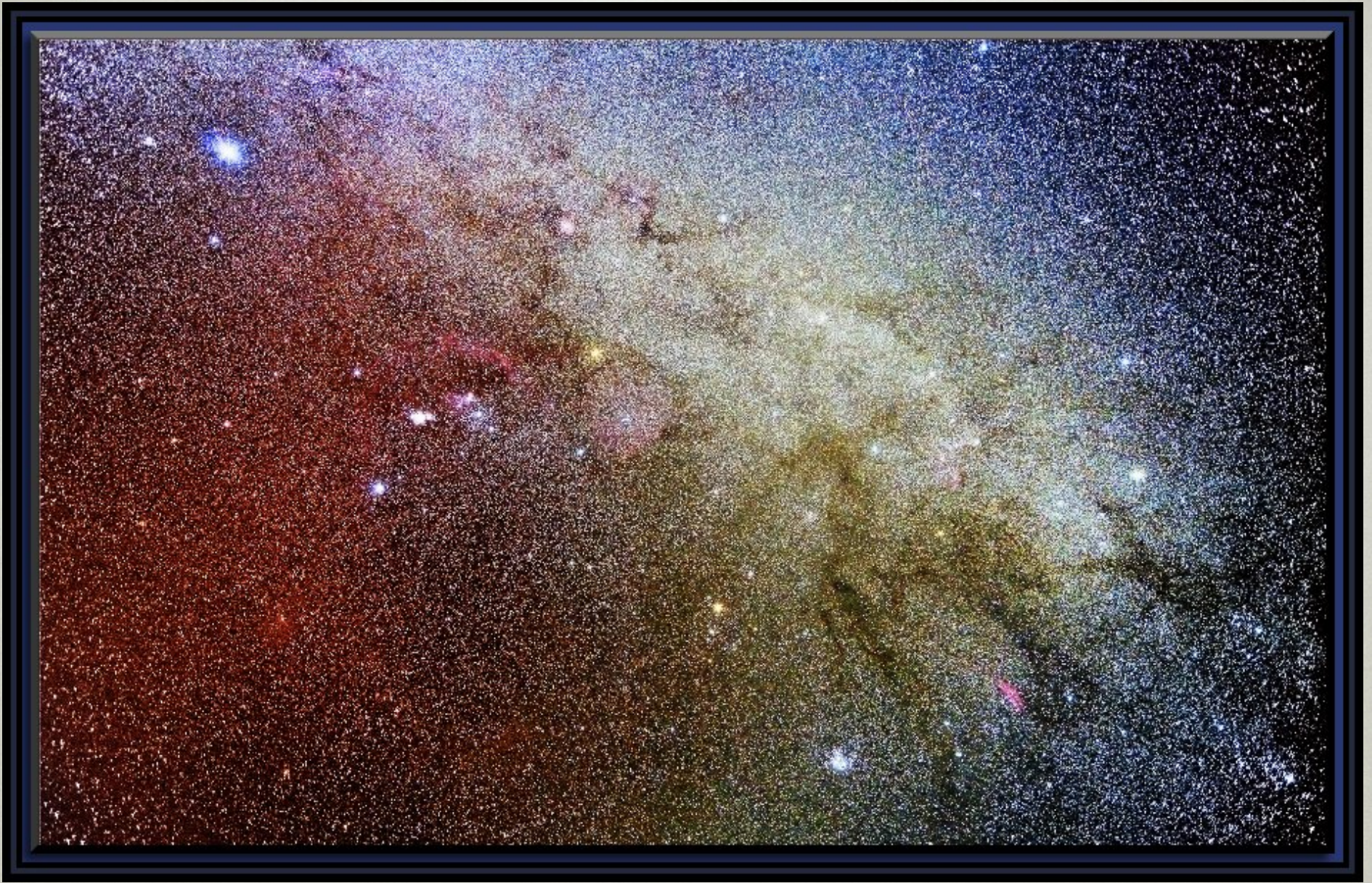
Winter Milky Way from Sea Level, Hawaii
Canon 5DII, 10 images with Zeiss 21/2.8 at f/4, 6 min each
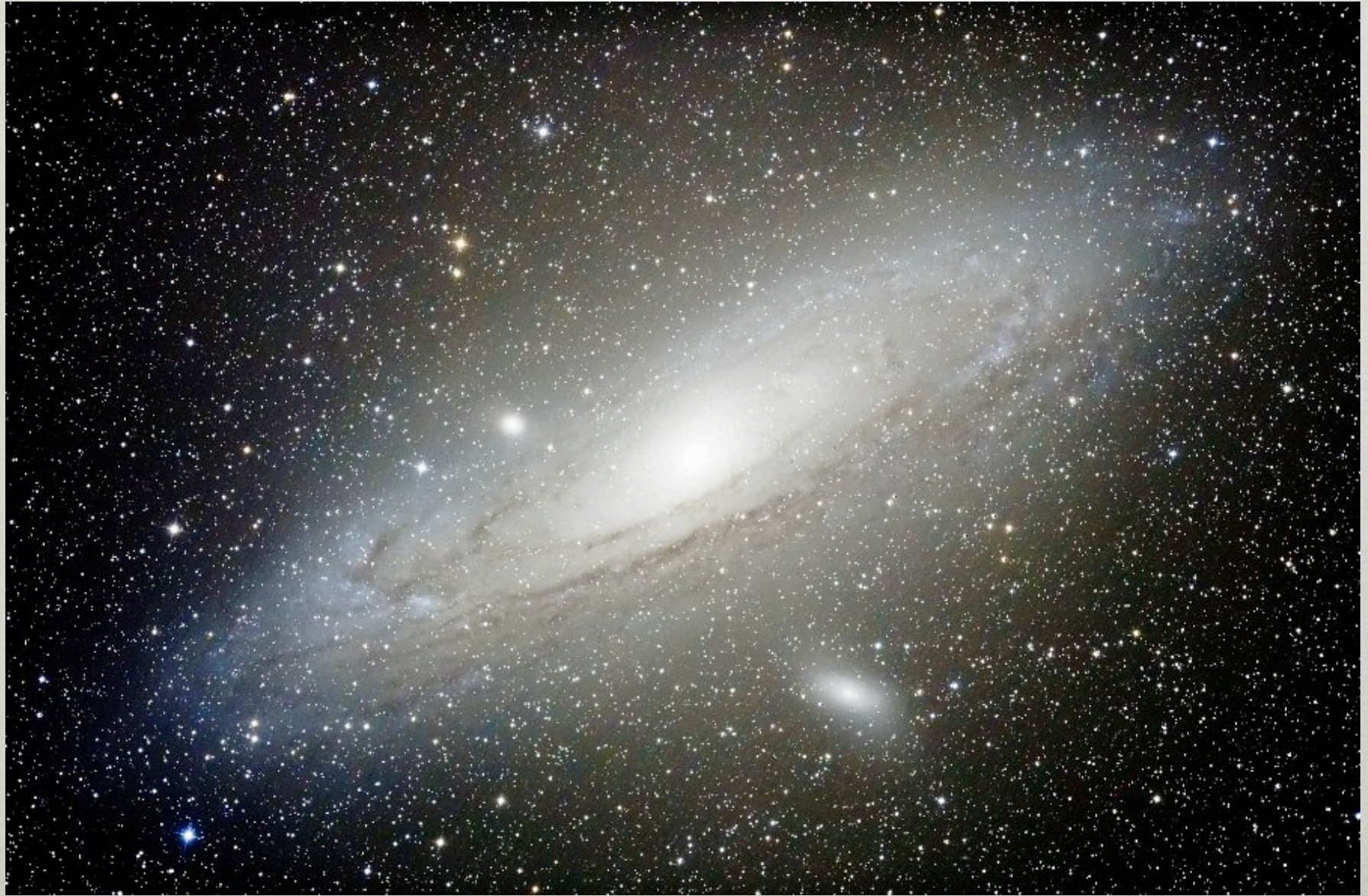
Andromeda: Single Image

Canon XTi, 500mm f/2.8, 1 image at 3 minutes
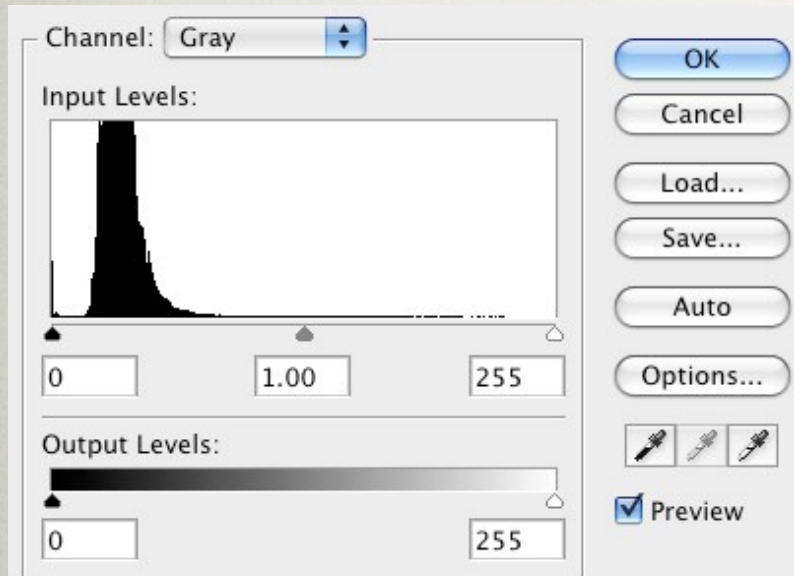
Andromeda: Auto Levels

Canon XTi, 500mm f/2.8, 1 image at 3 minutes
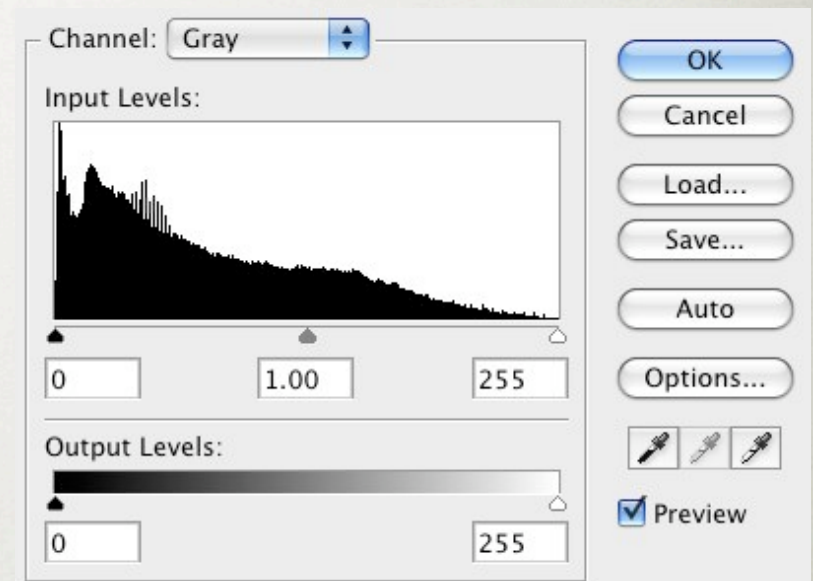
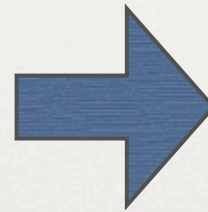# Andromeda: Stack, Process

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

Histogram Comparison

Original

Final

Horsehead Nebula

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