

# NIGHT PHOTOGRAPHY



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CS178

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# NIGHT PHOTOGRAPHY

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- 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

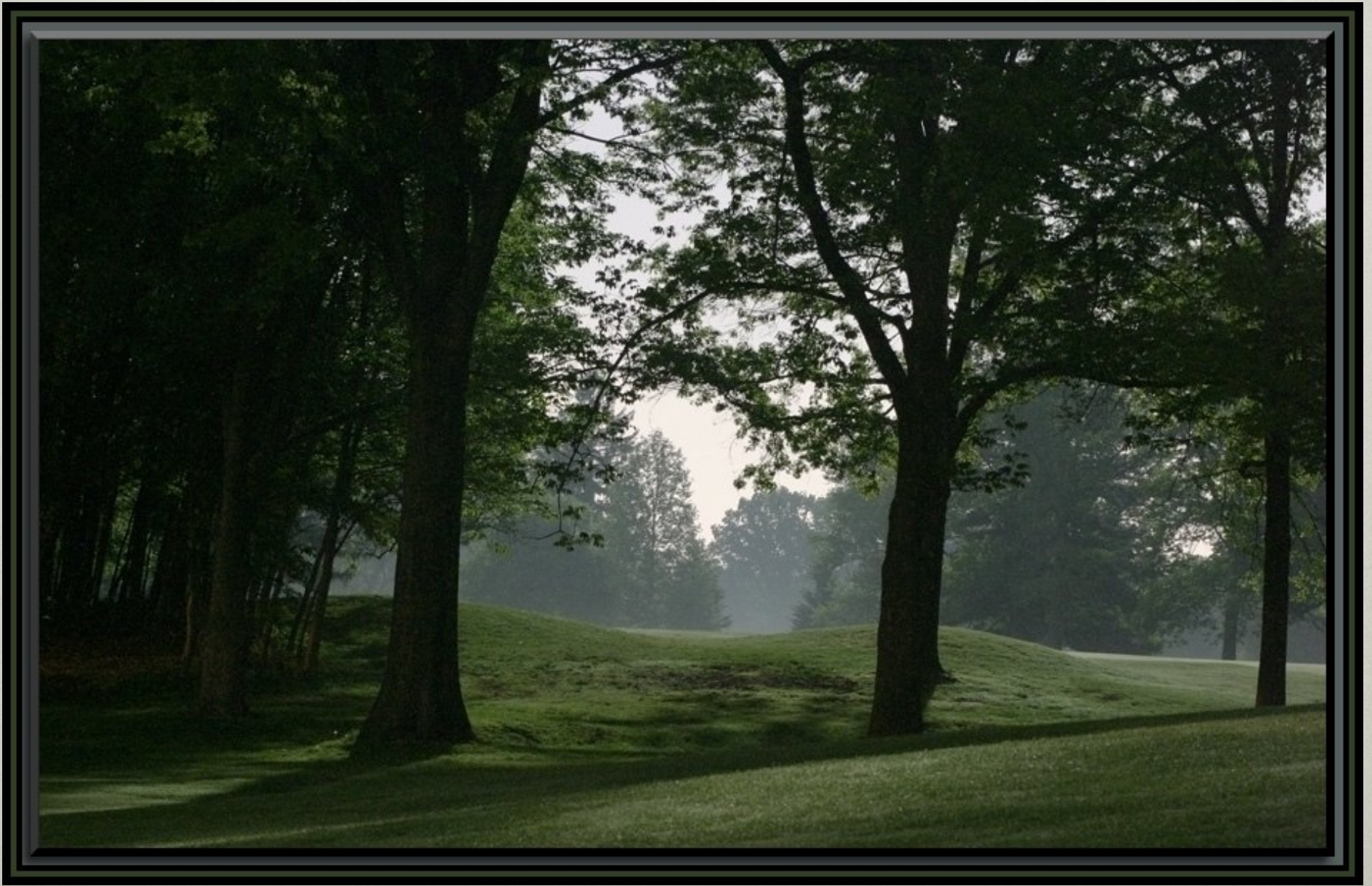
# CITIES AT NIGHT

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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

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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

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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

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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

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

# CHALLENGES

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- 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

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- 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

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- Some objects are tiny:

~10,000mm



- Some objects are bigger:

~1,000mm



- Some “objects” are huge:

~25mm



# IMAGE STACKING

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- 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

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- 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

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- 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



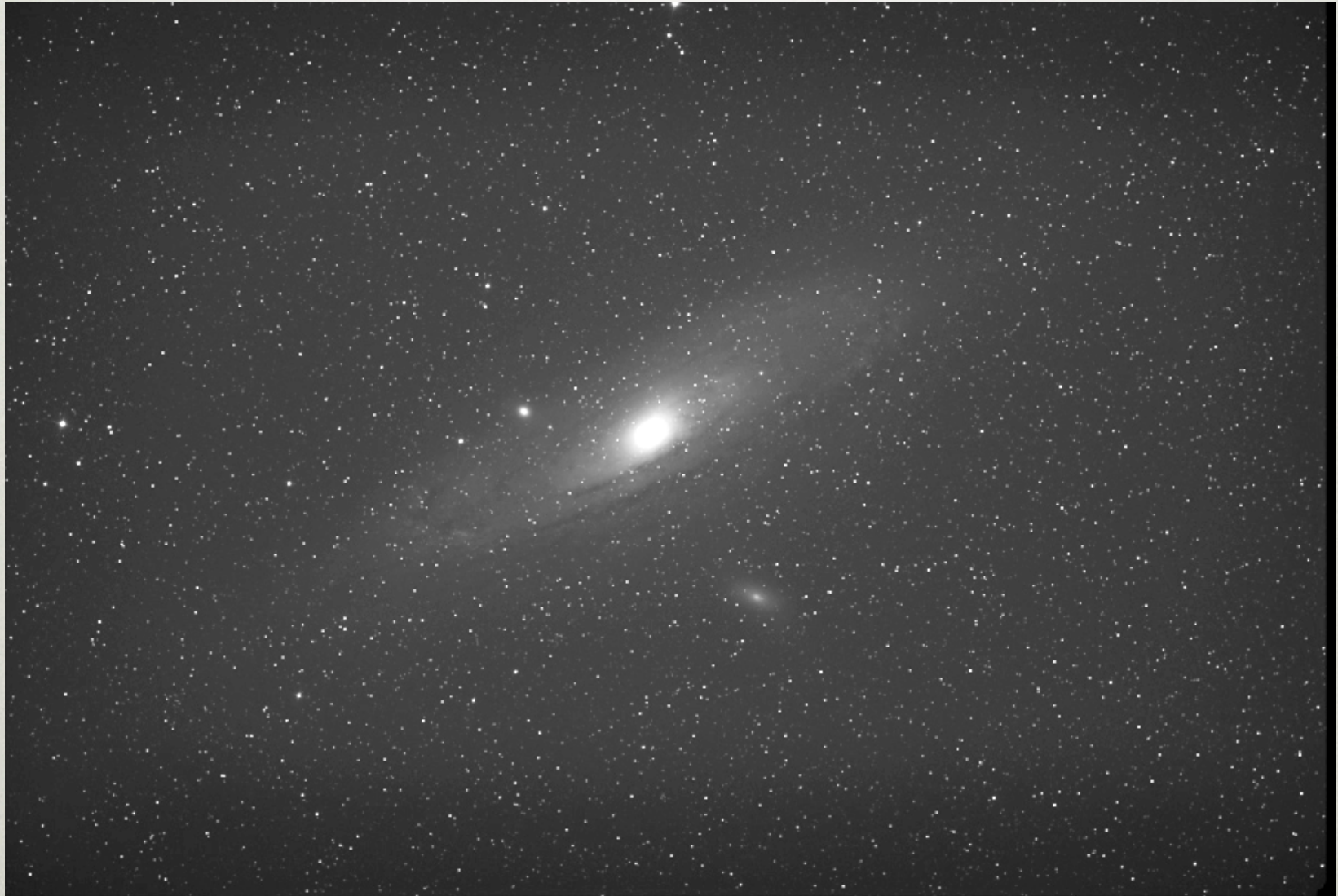
Winter Milky Way from Sea Level, Hawaii  
Canon 5DII, 10 images with Zeiss 21/2.8 at f/4, 6 min each

# ANDROMEDA: SINGLE IMAGE



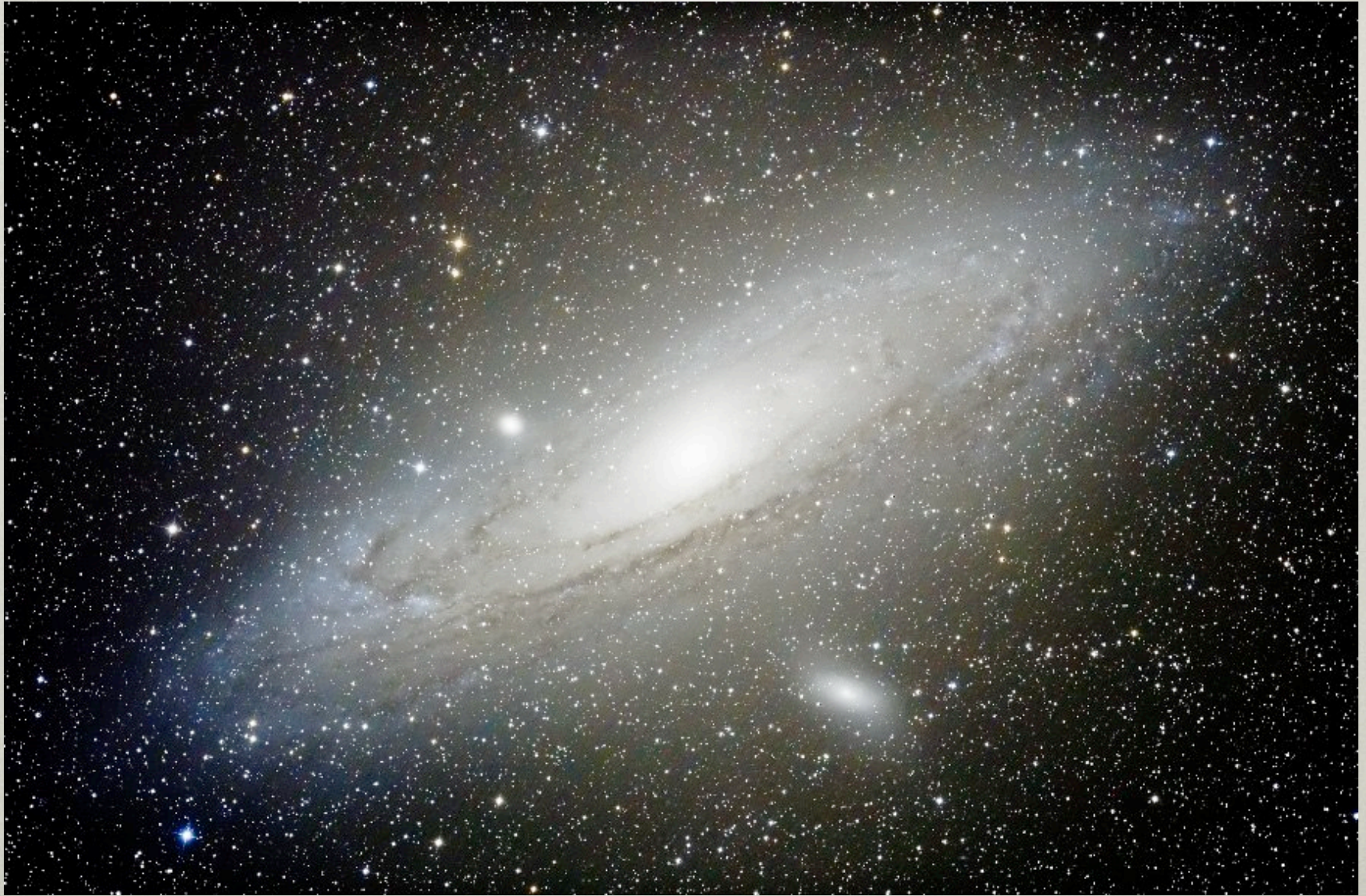
Canon XTi, 500mm f/2.8, 1 image at 3 minutes

# ANDROMEDA: AUTO LEVELS



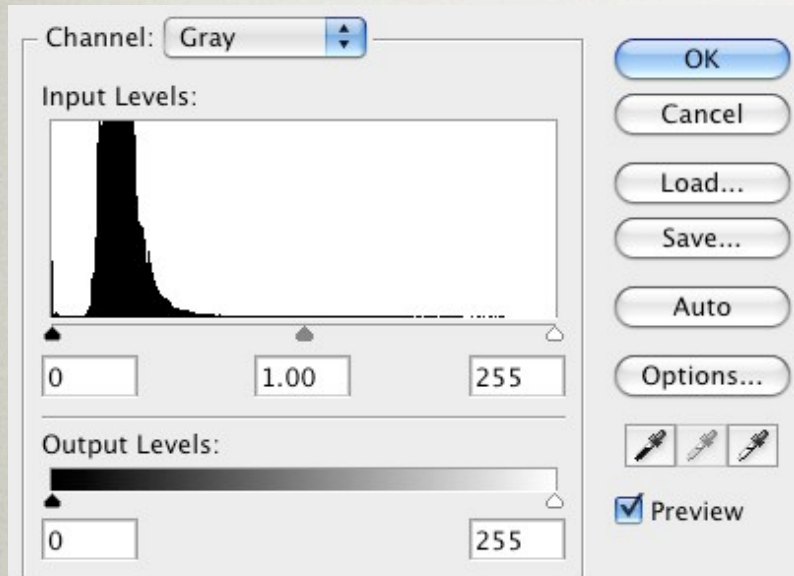
Canon XTi, 500mm f/2.8, 1 image at 3 minutes

# ANDROMEDA: STACK, PROCESS

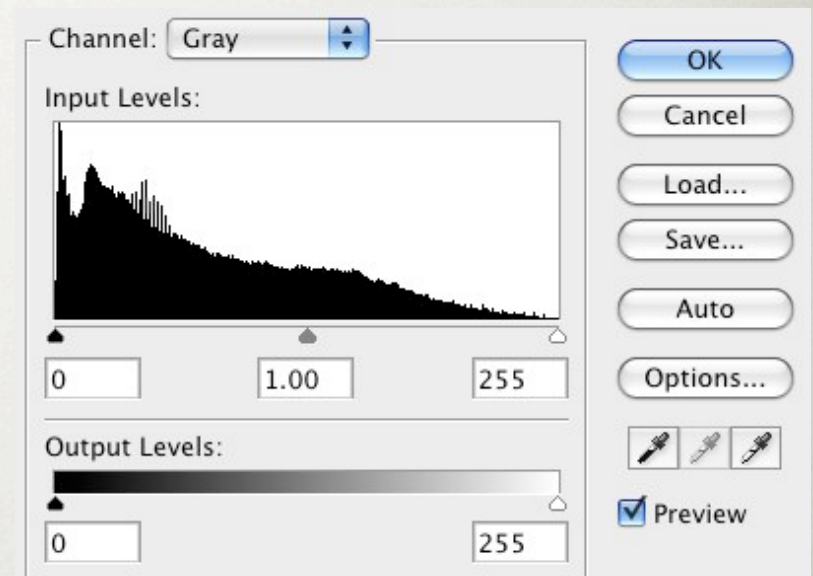
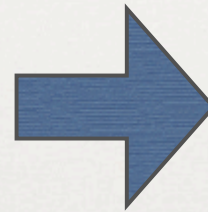


Canon XTi, 500mm f/2.8, 60 images at 3 minutes each

# HISTOGRAM COMPARISON



Original



Final

# HORSEHEAD NEBULA





# PANORAMAS!

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- 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