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 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, 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
Early Morning

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