Night Photography

Jesse Levinson
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 don’t 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 you’re not handholding
Twilight

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

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Twilight

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

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Twilight

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

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

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Cities at Night

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

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

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Early Morning

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

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

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Starry Nights

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

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

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Starry Nights

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

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Super long exposures

• Don’t want 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

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Starry Nights

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

Thursday, May 3, 2012
Starry Nights

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

Thursday, May 3, 2012
Astrophotography

- Capturing images of the sky
- There are amazing things out there!
- Good targets: star clusters, nebulae, 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:
  \(~10,000\text{mm}\)

• Some objects are bigger:
  \(~1,000\text{mm}\)

• Some “objects” are huge:
  \(~25\text{mm}\)
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

Thursday, May 3, 2012
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: Stack, Process

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

Original

Final

Thursday, May 3, 2012
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