Night Photography

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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, 100mm f/8, 15s, 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, 100mm f/2.8, 30s, ISO 400, 2x focus stack
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:
  \(~10,000\text{mm}\)

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

- 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
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