Computer Science E-7
Exposing Digital Photography

Lecture 3: Light & Exposure
February 9, 2008

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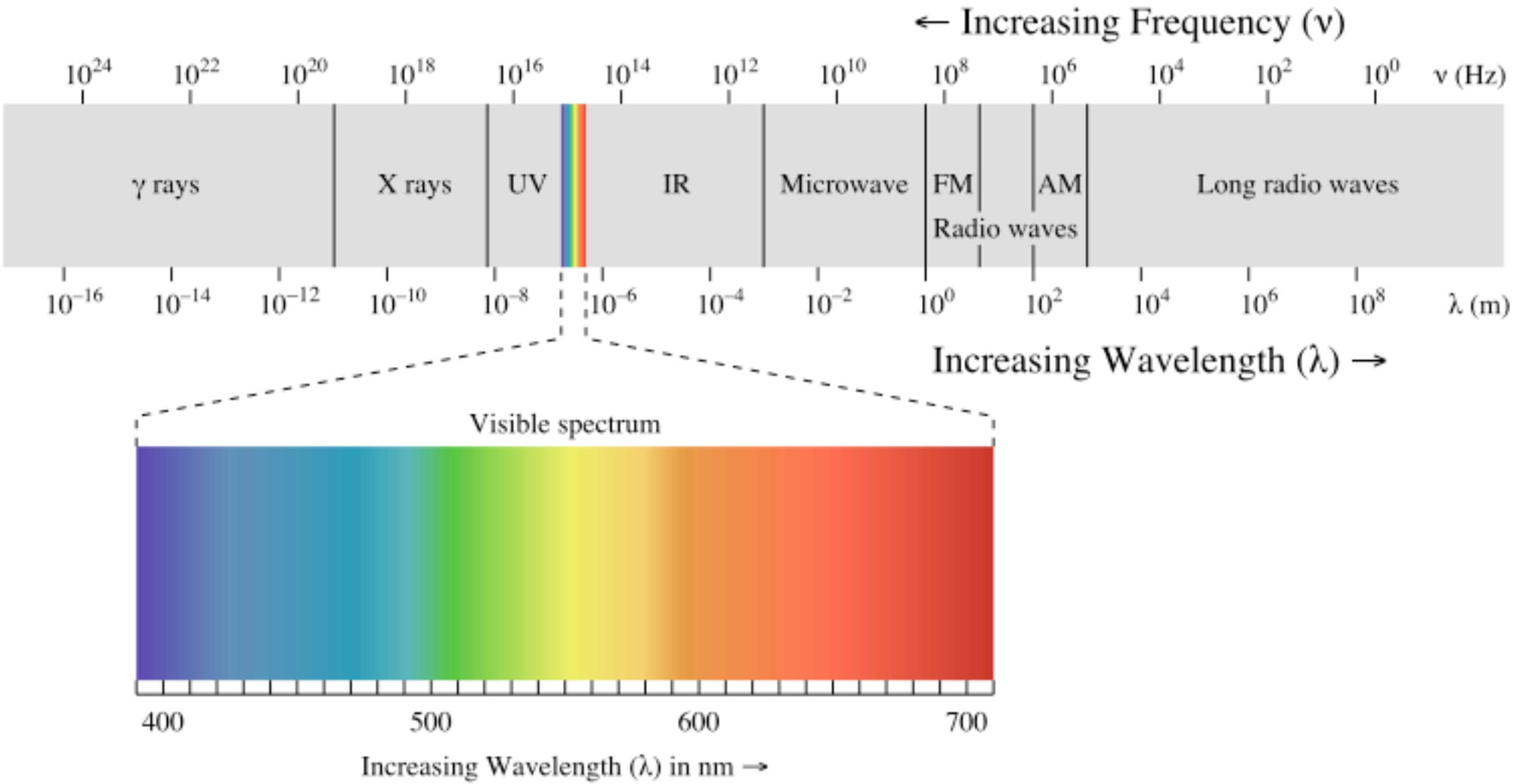


Image from http://en.wikipedia.org/wiki/Electromagnetic_radiation

Light

Properties of Waves & Particles

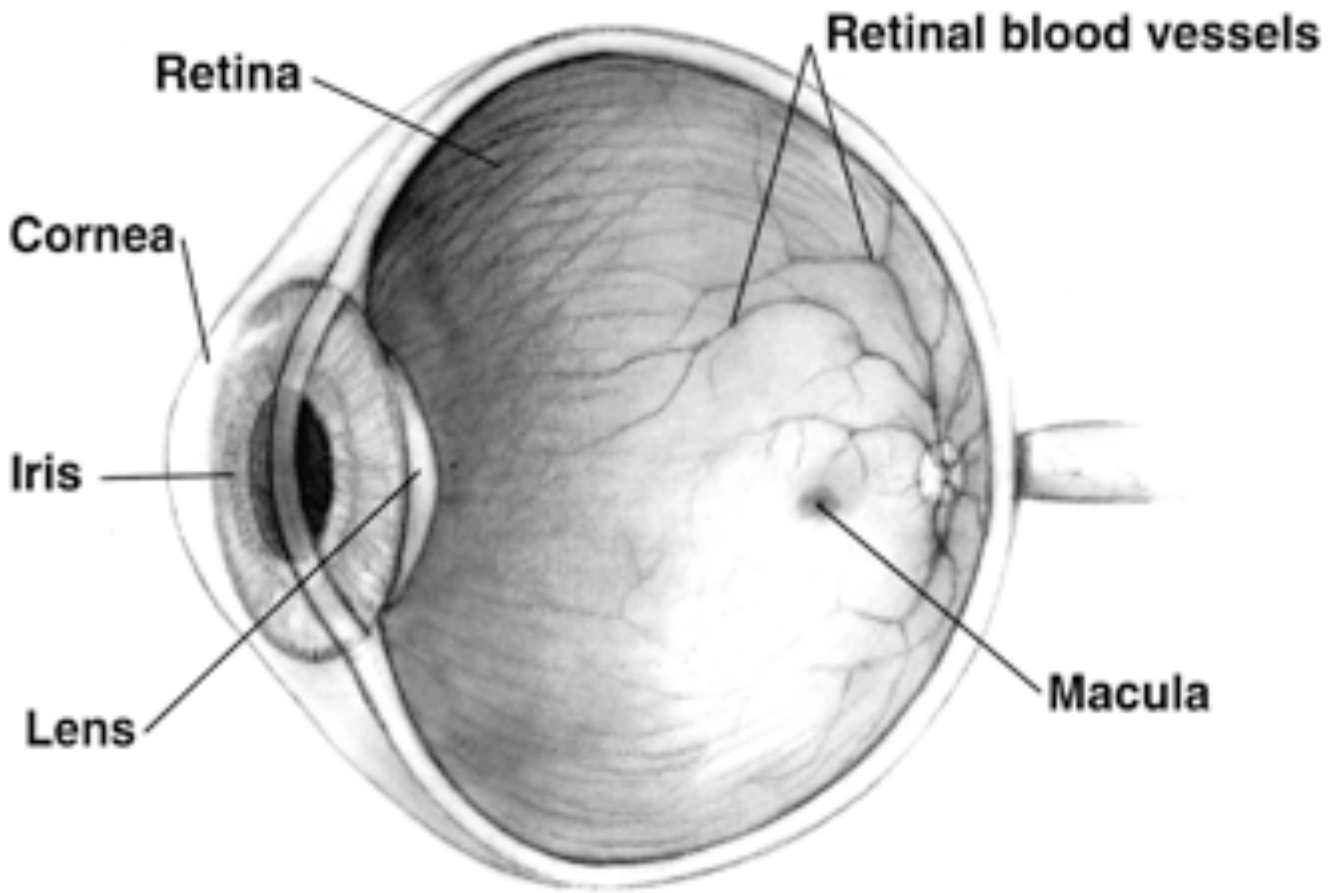


Image from http://en.wikipedia.org/wiki/Eye

The Eye

In a nutshell

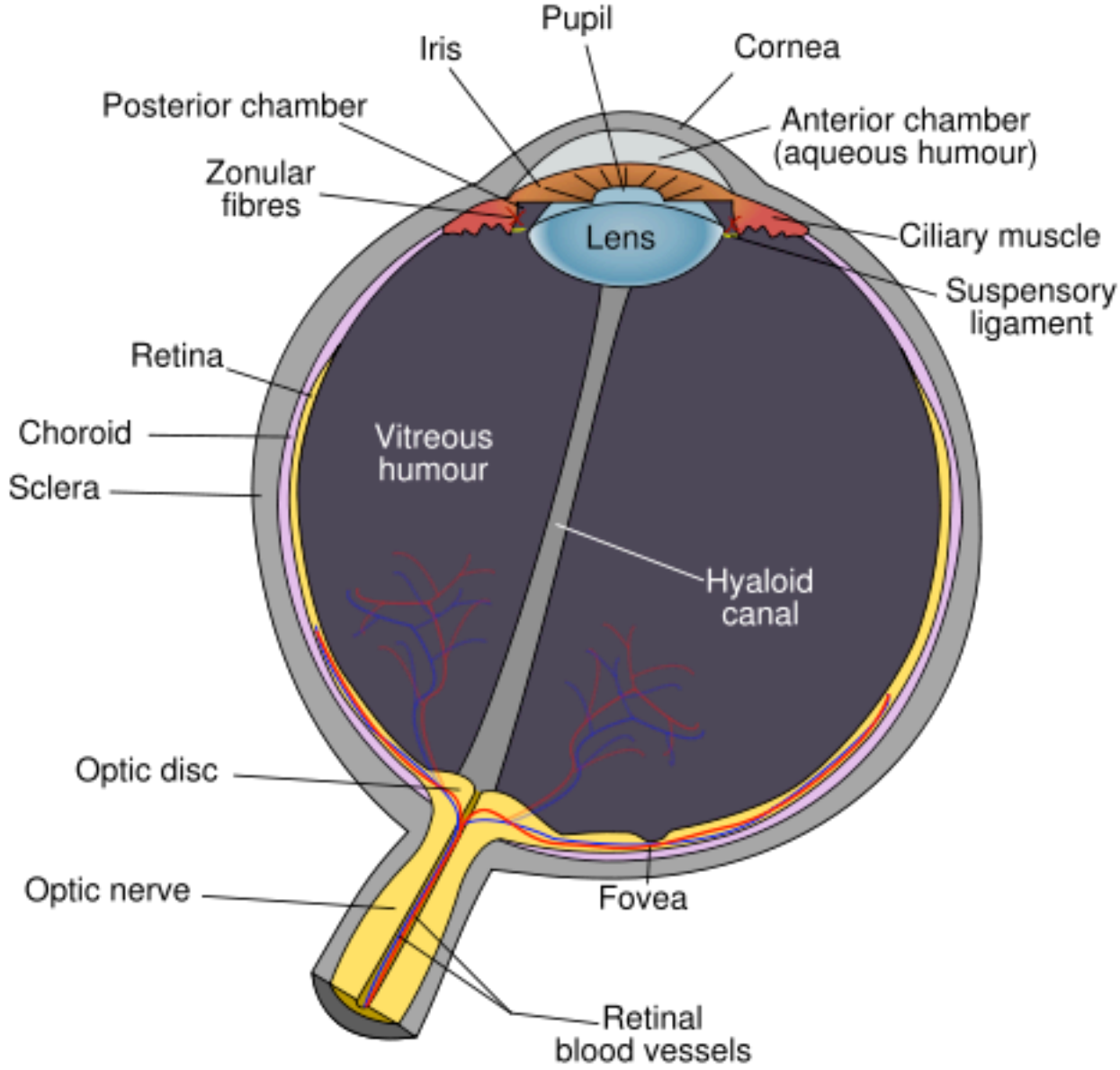


Image from http://en.wikipedia.org/wiki/Fovea

The Eye

Fovea

Rods	**Cones**
Night vision	Day vision
More sensitive to light	Less sensitive to light
Not in fovea	Concentrated in fovea
22 times as many rods than cones in retina	
Monochromatic stimulus	Trichromatic (color) stimulus
Preference to detect motion	Preference to detect detail

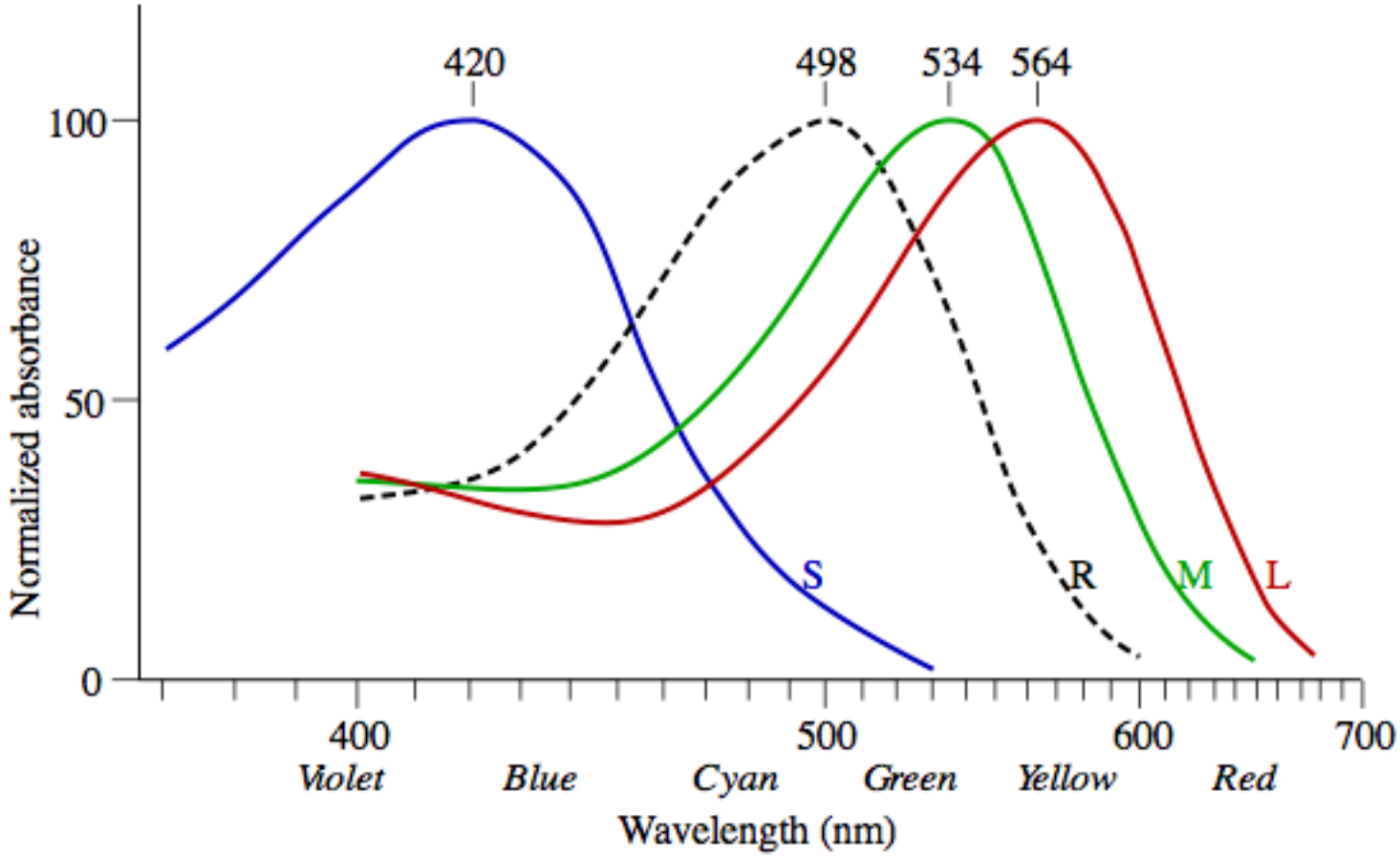
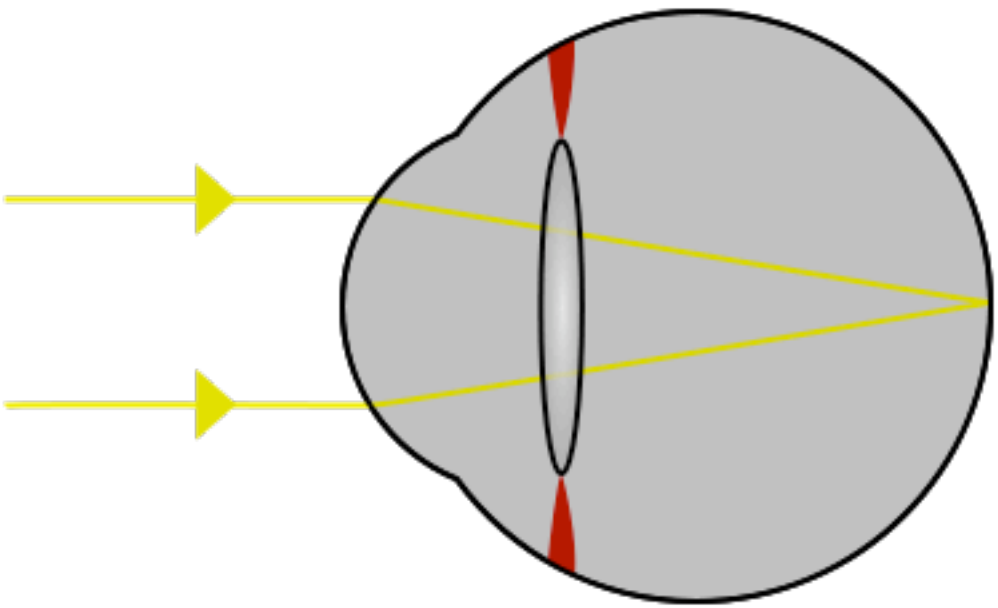
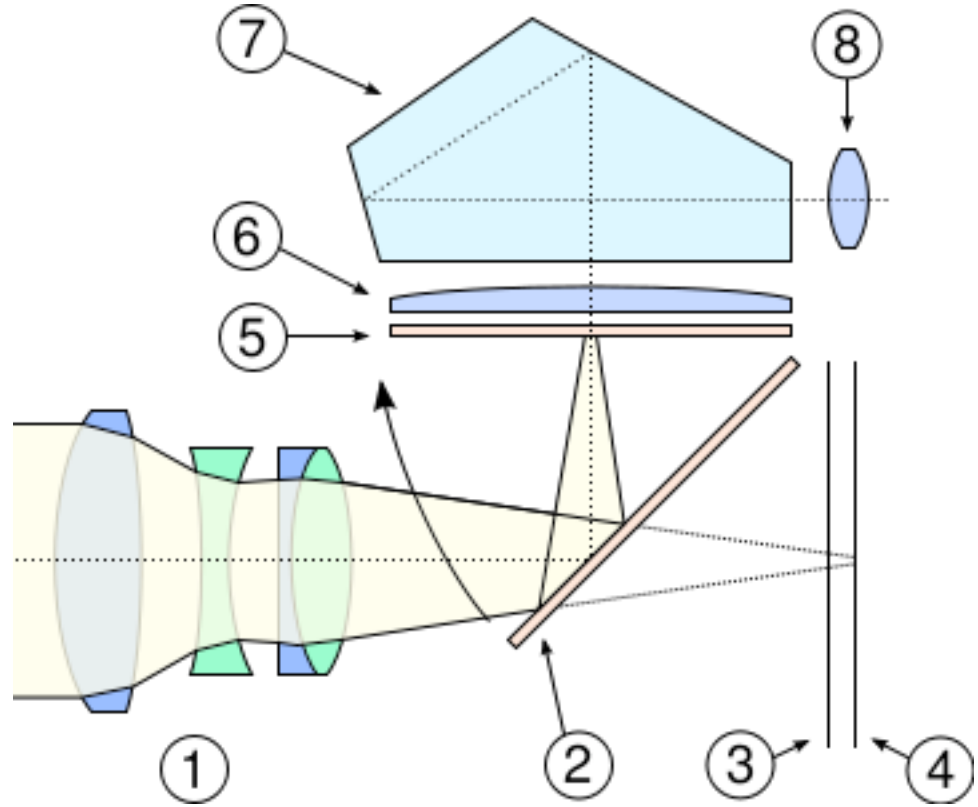


Image from http://en.wikipedia.org/wiki/Trichromacy

The Eye

Rods & Cones



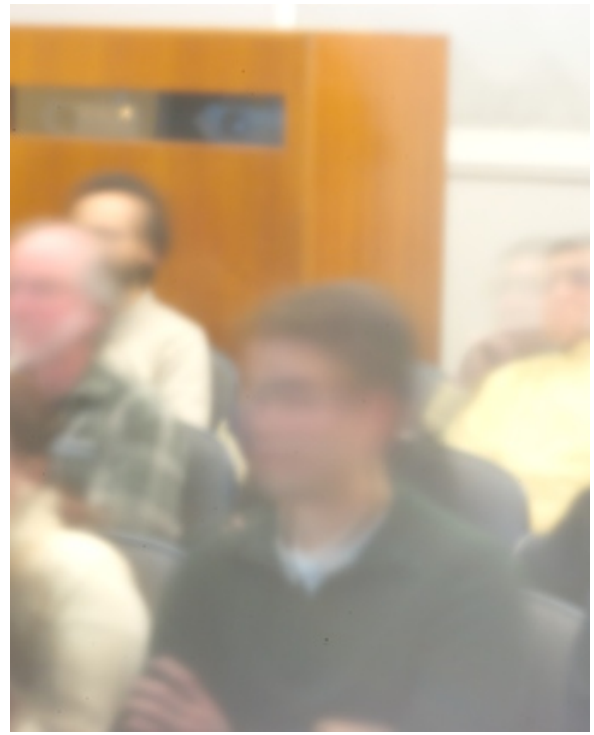


Images from http://en.wikipedia.org/wiki/Eye and http://en.wikipedia.org/wiki/Single-lens_reflex_camera

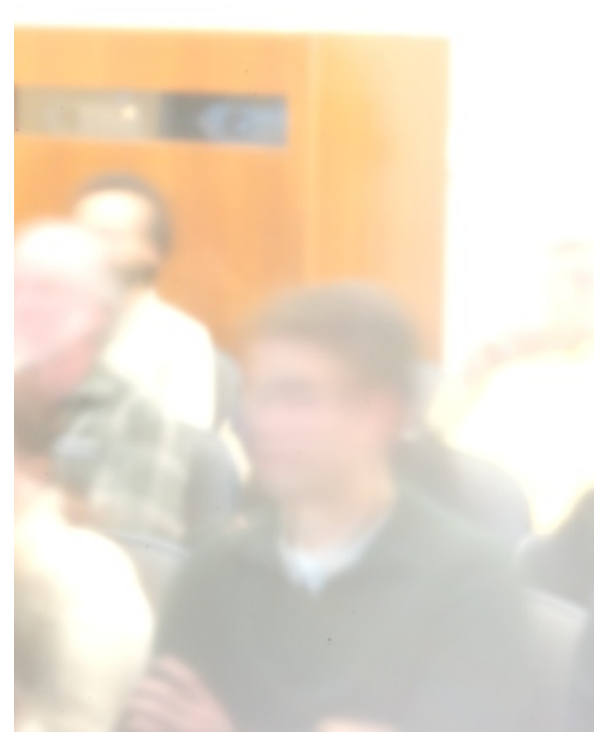
Cameras

Similarity to the Eye

+0 EV



+1 EV



+2 EV

Exposure

Stops & Exposure Value (EV)

309s, ISO 100

Photo by Dan Armendariz, 2009

Exposure

Shutter Speed

10.0s, ISO 100, f/8

Photo by Dan Armendariz, 2007

Shutter Speed

Effects

2s, ISO 100, f/13

Photo by Dan Armendariz, 2007

Shutter Speed

Effects

Shutter Speed

Stopping motion

Photo by Dan Armendariz, 2004
1/1250s, ISO 200, f/2.8

2.5s, ISO 400, f/5

Photo by Dan Armendariz, 2006

Shutter Speed

Mixing motion with still

1/1000s, ISO 400, f/5.6

Photo by Dan Armendariz, 2007

Shutter Speed

Stopping motion

ISO 100

ISO 1600

Images from http://www.dpreview.com/reviews/canonsx100is/page6.asp

Sensitivity (ISO)

Compact cameras

ISO 100

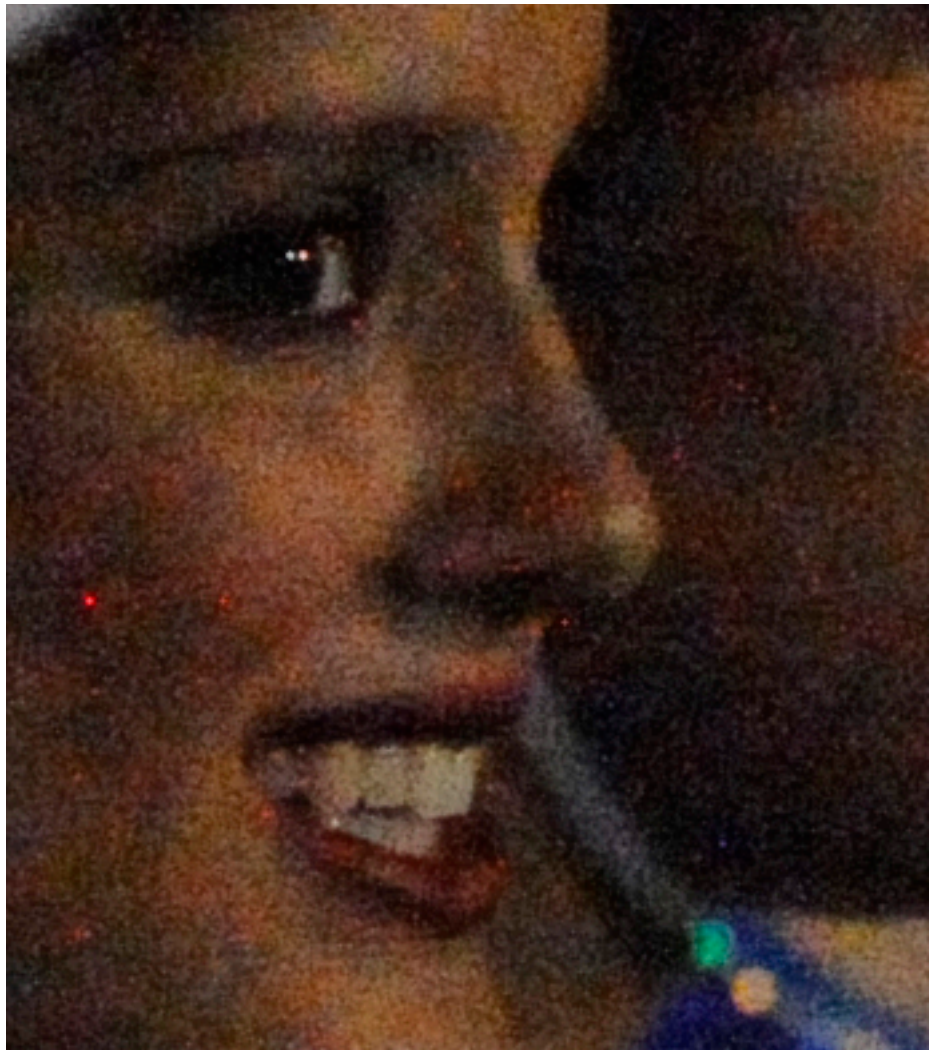
ISO 1600

Images from http://www.dpreview.com/reviews/canoneos40d/page18.asp

Sensitivity (ISO)

Digital SLRs

ISO 1600 (film)



ISO 25600 (Nikon D3)

Images from http://en.wikipedia.org/wiki/Film_speed and http://www.robgalbraith.com/bins/multi_page.asp?cid=7-8745-9153

Sensitivity (ISO)

Film vs Digital

846s, ISO 400, f/8

Photo by Dan Armendariz, 2007

Sensitivity (ISO)

Combined with Shutter Speed

336s, ISO 800, f/8 (left) 846s, ISO 400, f/8 (right)

Photos by Dan Armendariz, 2007

Sensitivity (ISO)

Combined with Shutter Speed

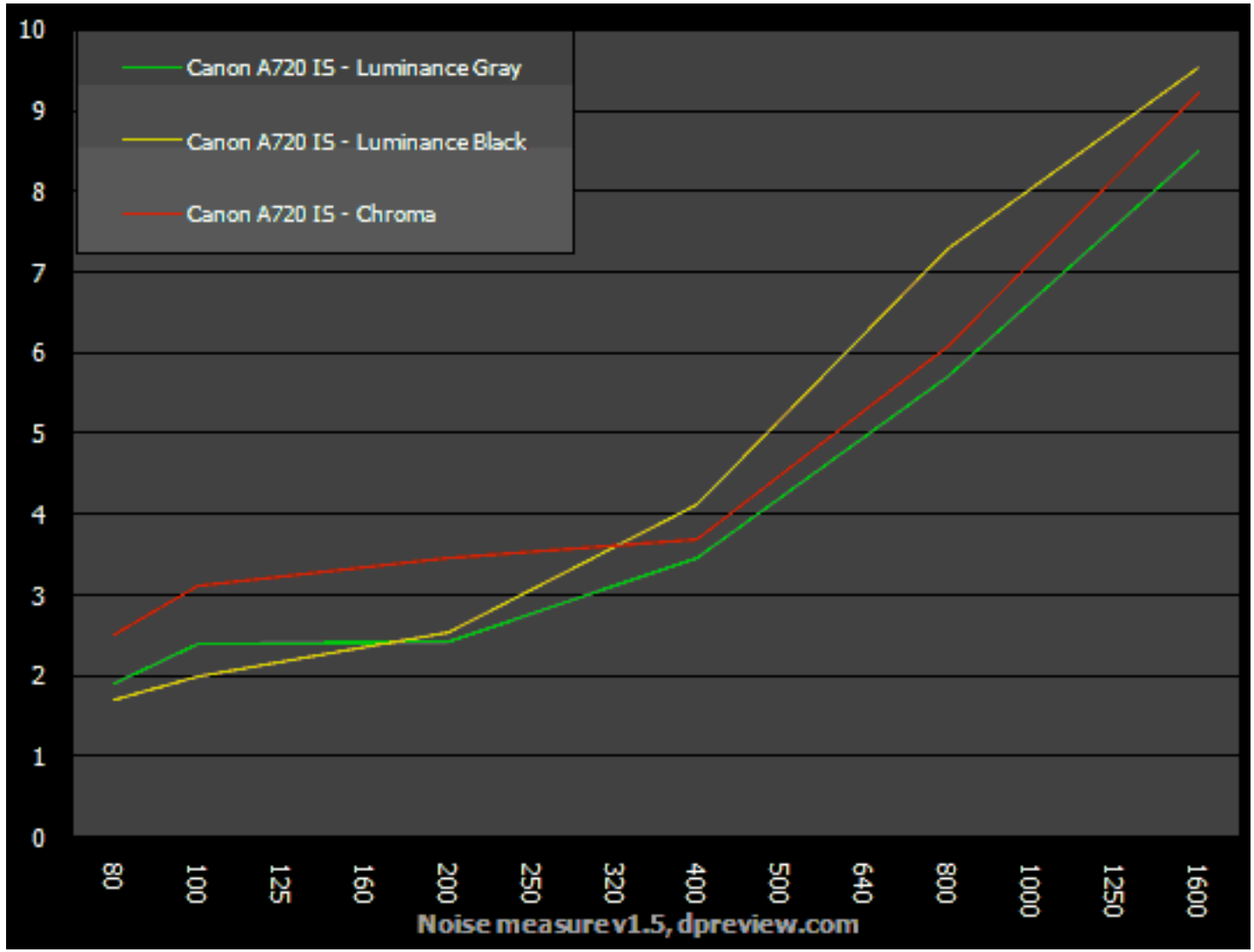
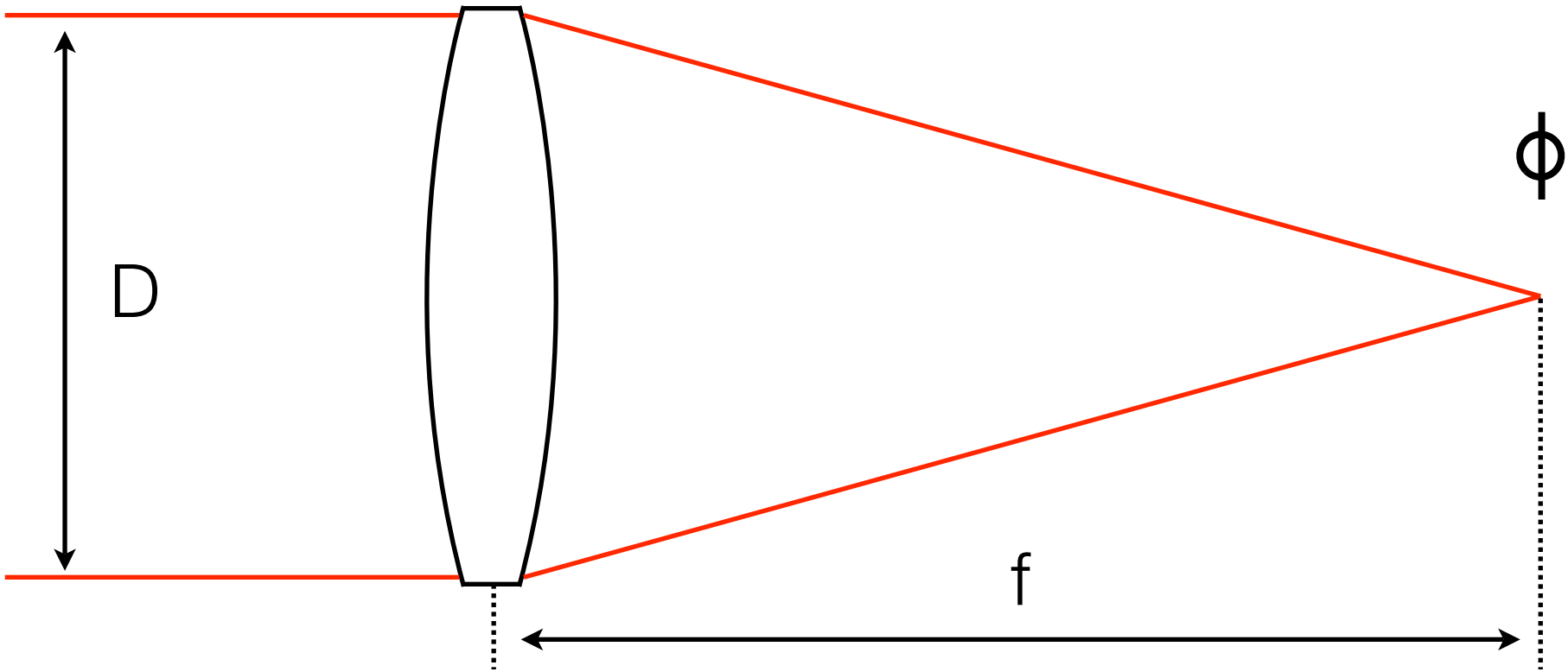


Image from http://www.dpreview.com/reviews/canona720is/page4.asp

Sensitivity (ISO)

Noise measurements

Exposure | Aperture



Aperture

F-number = f/D

1/6s, ISO 100, f/16

Photo by Dan Armendariz, 2005

Aperture

Don’t worry!

Aperture

Pinhole math

Aperture

Background blur

Photo by Dan Armendariz, 2004
1/1250s, ISO 200, f/2.8

10s, ISO 100, f/8

Photo by Dan Armendariz, 2004

Aperture

Making everything sharp

- Amount of available light

- Shutter speed
- Sensitivity (ISO)
- Aperture

Bright Sunny Day:
Shutter Speed: 1/100s
Sensitivity: ISO 100
Aperture: *f*/16

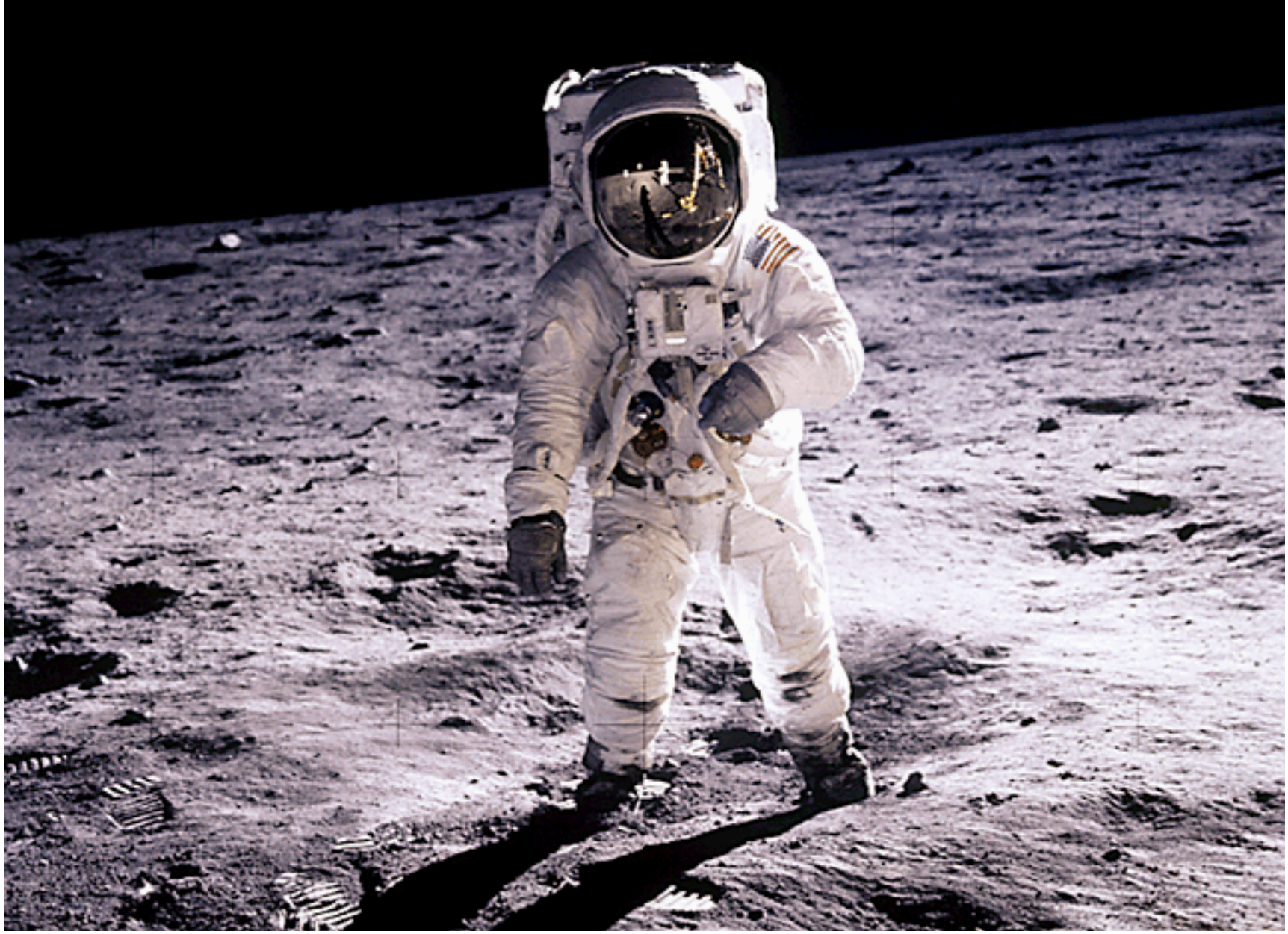


Image from http://nssdc.gsfc.nasa.gov/imgcat/html/object_page/a11_h_40_5903.html

Exposure

Moon landings

Image from http://www.jaxa.jp/press/2007/11/20071113_kaguya_e.html

Exposure

Moon landings

Exposure

Over-exposure

Photo by Dan Armendariz, 2004
1/40s, ISO 200, f/2.8

1/1000s, ISO 200, f/4.5

Photo by Dan Armendariz, 2006

Exposure

Under-exposure

1/80s, ISO 400, f/10

Photo by Dan Armendariz, 2006

Exposure

Worse: Over- & Under-exposure

Exposure

Intentional under-exposure

Photo by Dan Armendariz, 2005
8.0s, ISO 100, f/8

Exposure

Intentional over-exposure

Photo by Dan Armendariz, 2005
15.0s, ISO 100, f/16

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