
What cameras can do for you... and how they do it!

Kris Clark

Girls Who Build - Cameras

June 4, 2016



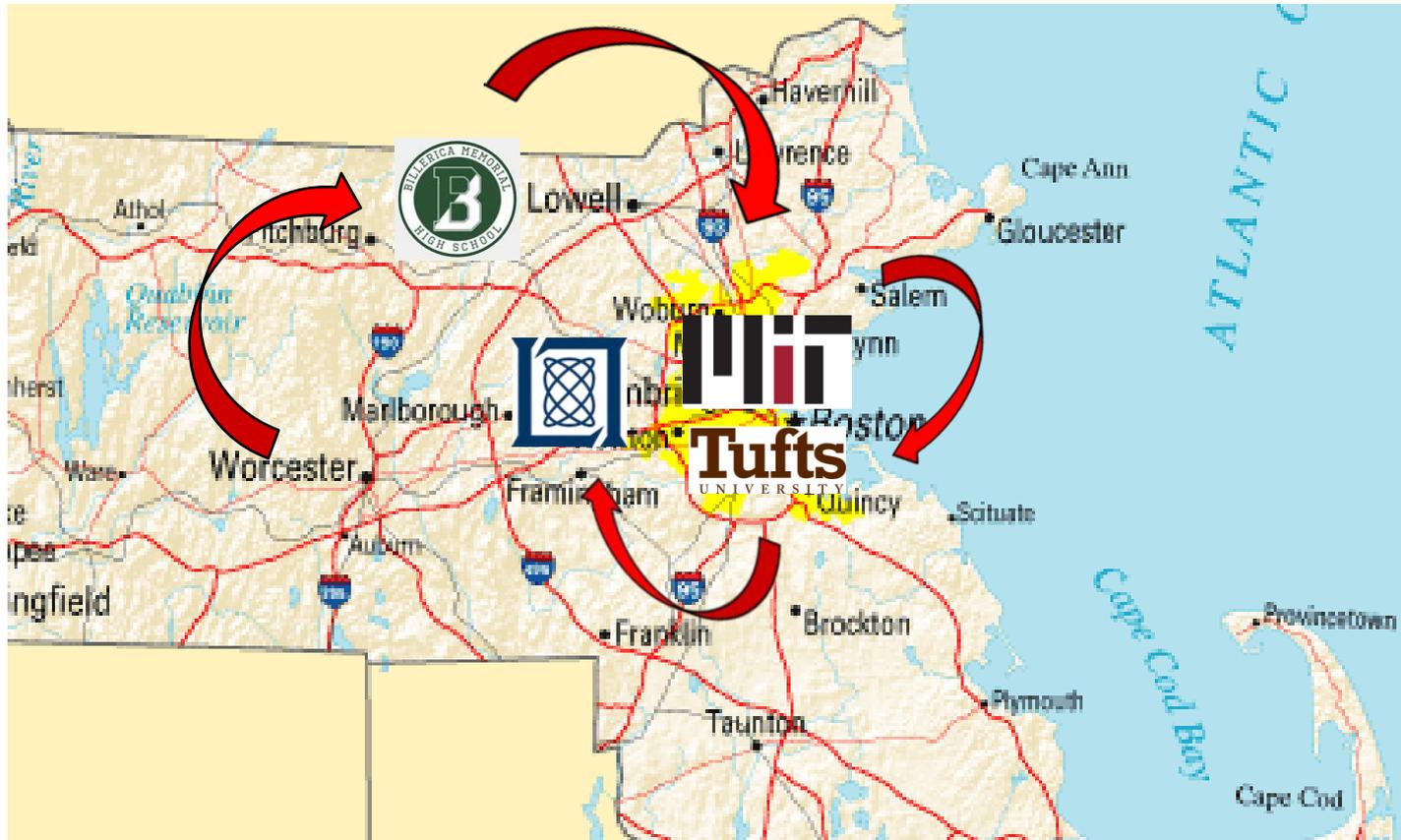


Outline

- **A very small bit about me**
- **What is a camera?**
- **What can cameras do?**
- **What can you do with cameras?**



How I got here..



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What is a camera?

A camera is an *optical* instrument for recording or capturing *images*

Two basic components needed:

Something to focus energy

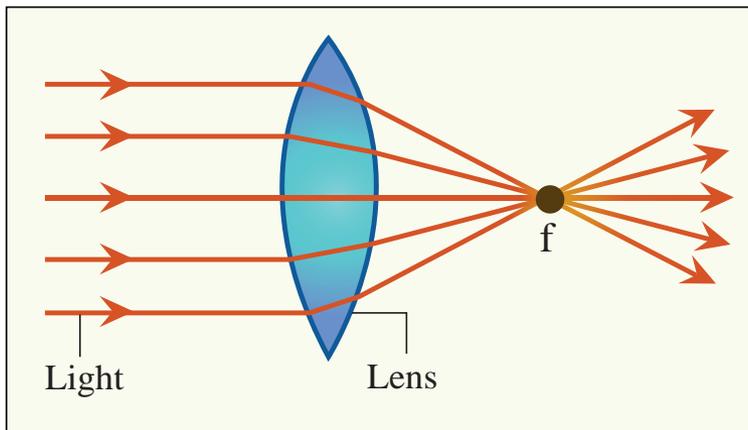
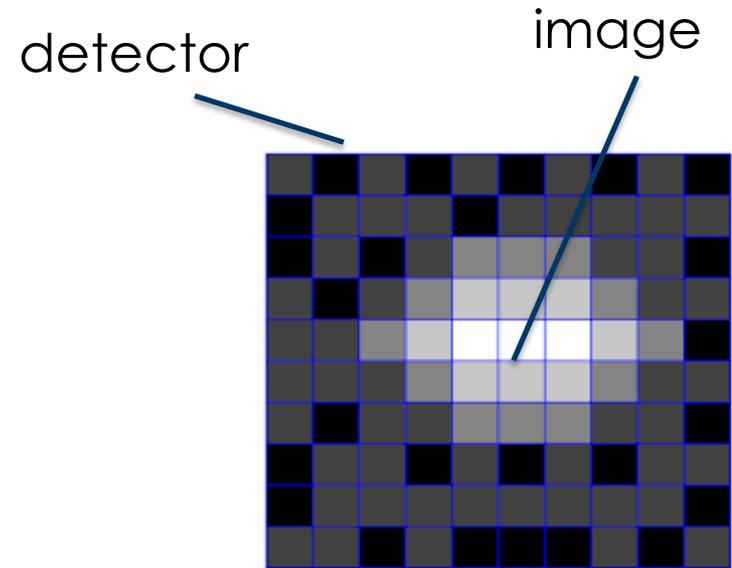


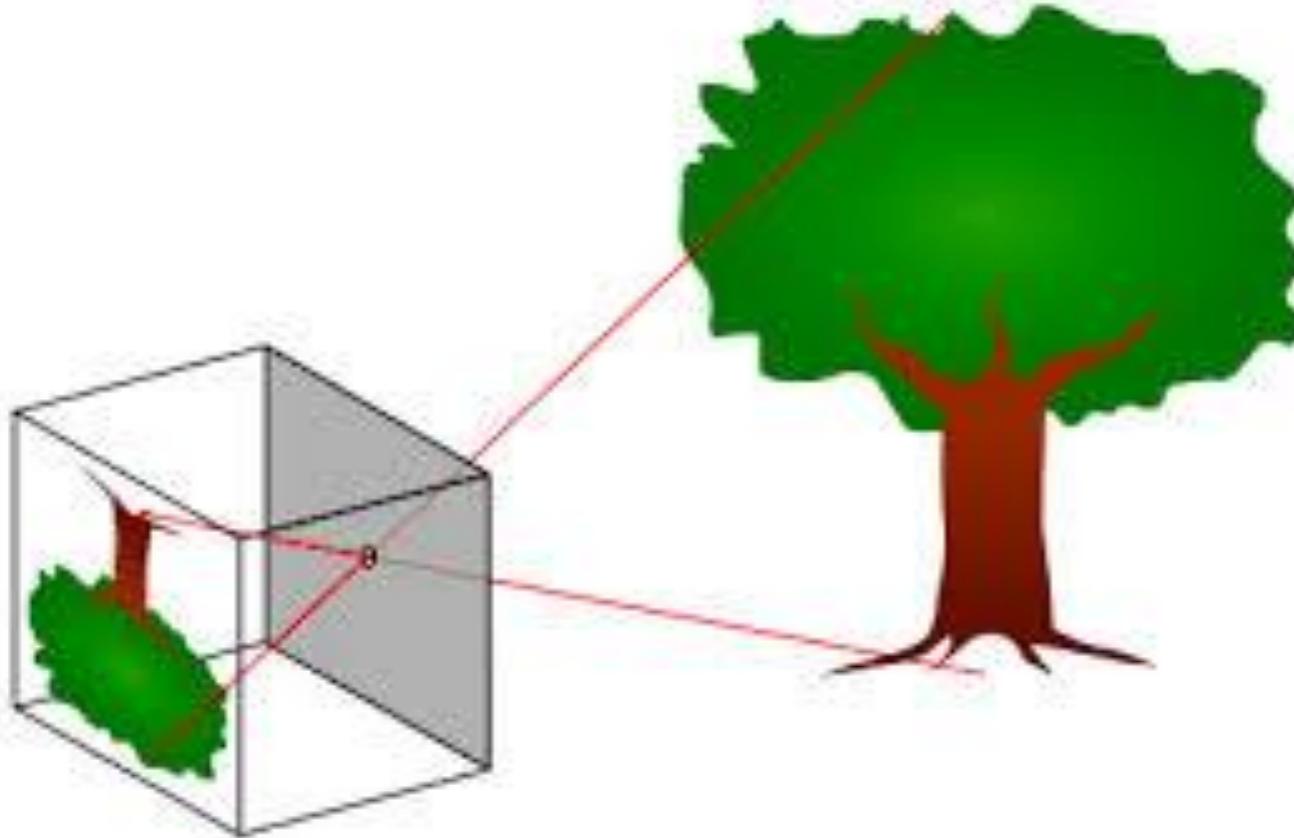
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Something to detect/record energy





The Simplest Camera



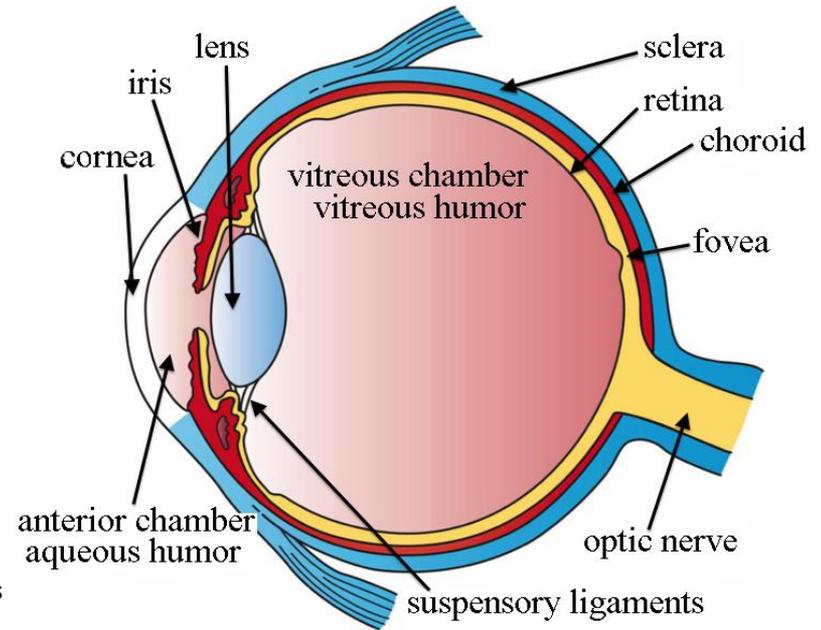
Pinhole Camera

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Some Camera Examples



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Phone camera

- Multiple lenses
- Digital detector
- Software for image processing

Eyes are a great example

- Lens focuses light onto retina
- Retina detects light
- Brain does image processing

Can you give examples of other cameras?



Cameras – they are not just for the visible!

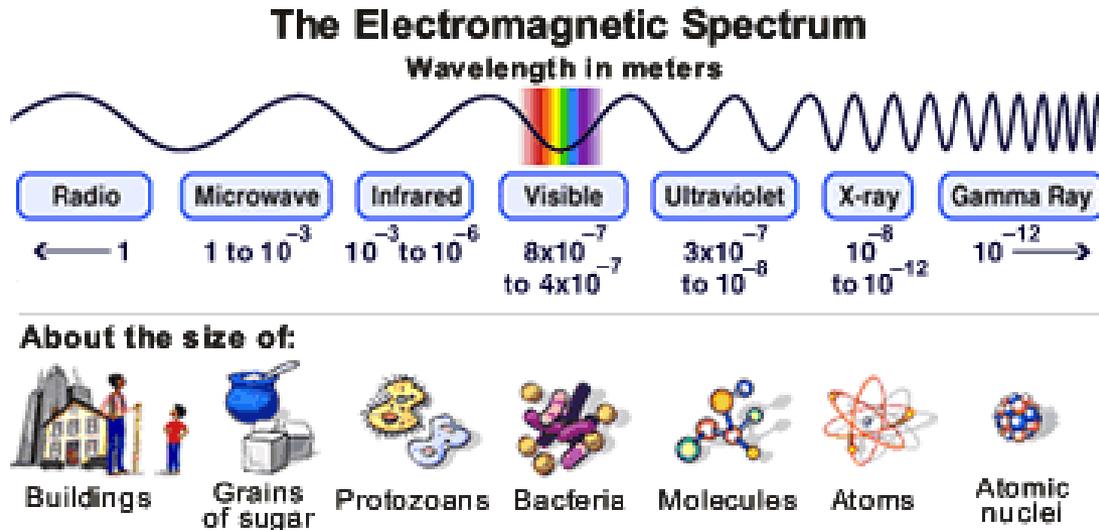


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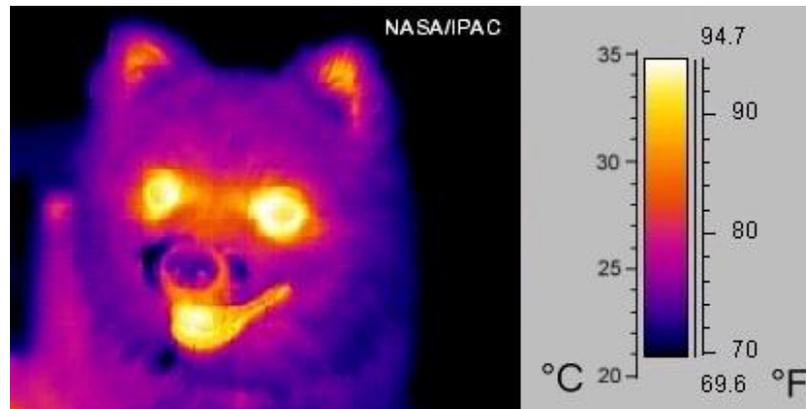


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Other Examples

- **Medical imaging (PillCam)**
- **Homeland Security (Security Cameras)**
- **Traffic Regulation (Traffic Cameras)**
- **Weather sensing (Radar Imaging)**
- **Space Exploration (Telescope Imaging)**



What can cameras do?

- **We've talked about several examples**
- **Cameras are used in many ways in many industries**
- **I'd like to show you the camera system on my current program...TESS**



Courtesy of NASA/Goddard Space Flight Center.
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Transiting Exoplanet Survey Satellite (TESS)

TESS Goal: Find the *Nearest Earth-Like Planets*

- **NASA Explorer Mission**
 - December 2017 Launch
 - 2 year mission

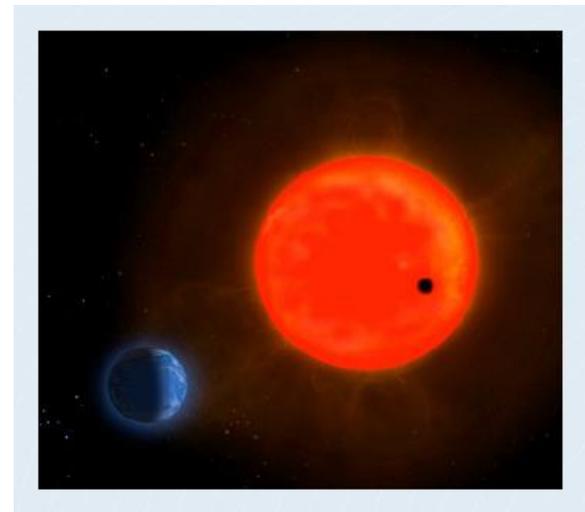


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Transit Method

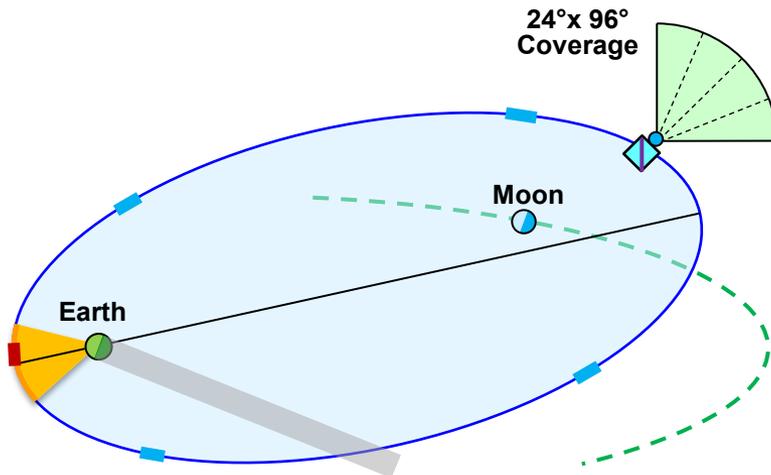


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TESS Orbit and Sky Coverage

- Highly Elliptical Orbit – 2 orbits for every moon orbit
- Wide field-of-view and step stare observing provide near full sky coverage



TESS Orbit

TESS 2-year sky coverage map

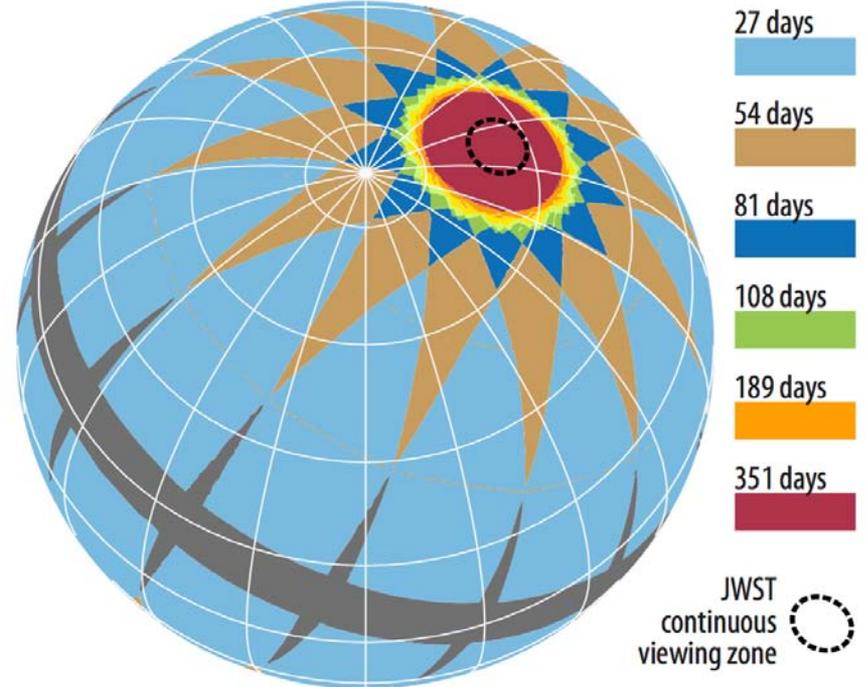


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TESS Orbit and Sky Scan

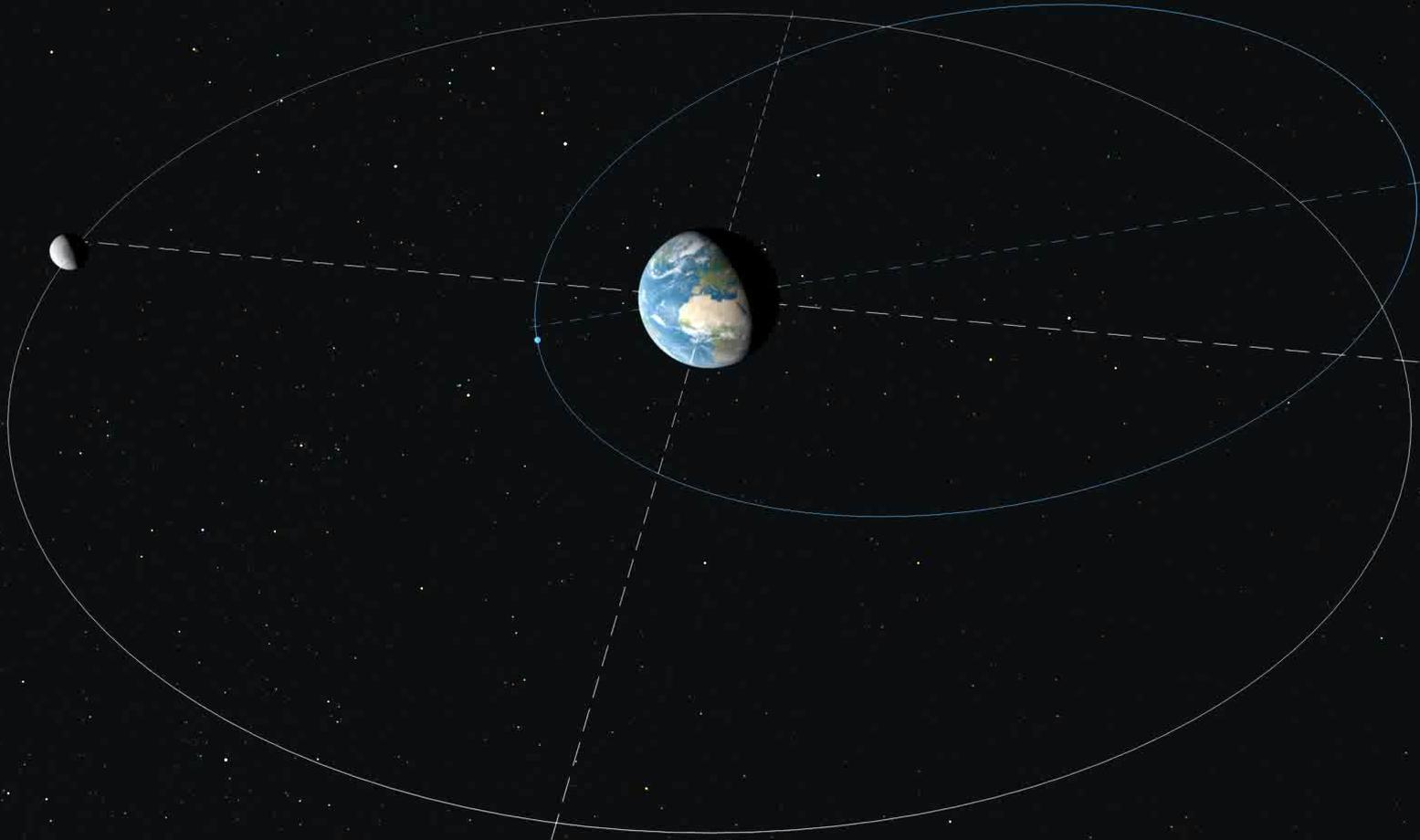
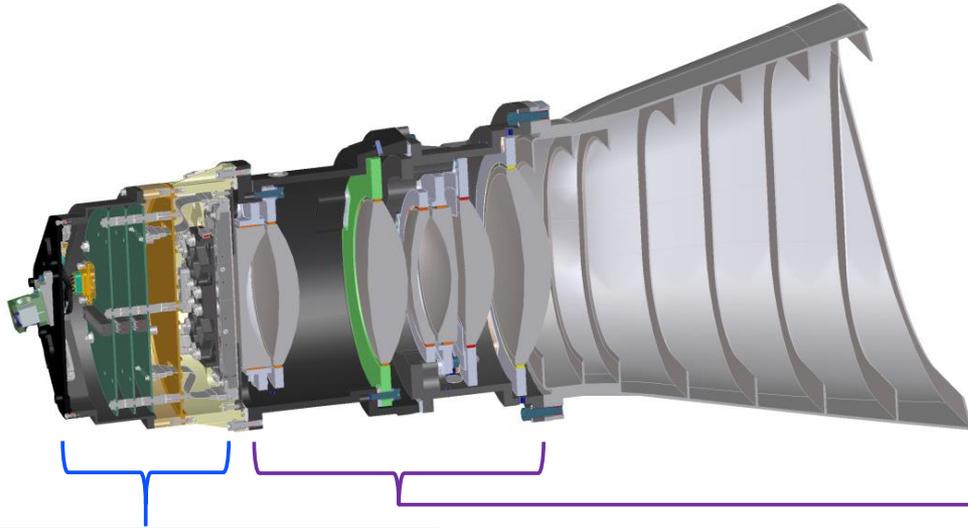


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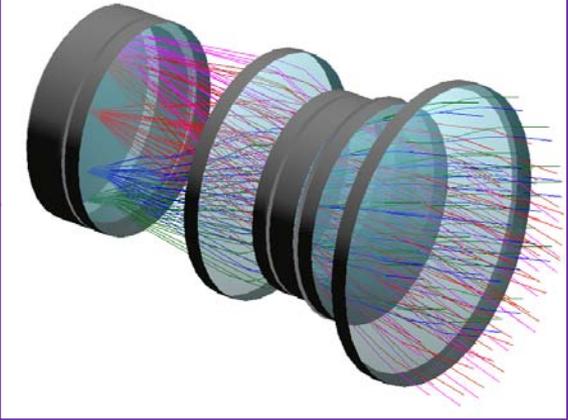


TESS Camera Design



Lens

- Seven Elements
- Different glasses
- 500 - 1000 nm



Detector

- 4096 x 4096 pixels
- Silicon CCD
- 400 - 1000 nm

TESS is a sensitive light collector, not a high definition imager, and operates in a very cold environment

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TESS Piece of the Exoplanet Puzzle

Kepler

- Estimate statistical population of exoplanets



TESS

- Provide catalog of exoplanets for further observation

James Webb Space Telescope (JWST)

- Atmospheric characterization of exoplanets

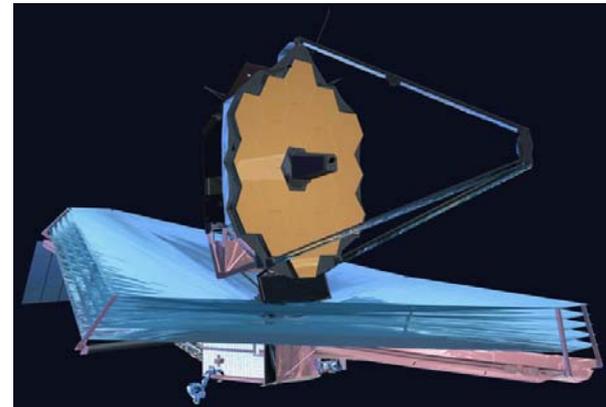


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What can you do with cameras?

- So many types of cameras
- Used in so many fields
- Chances are understanding cameras will help you in whatever field you choose
- If you really get into it – you could design new types of cameras and figure out how to build them for use in the real world.



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What you can do with cameras right now...

HAVE FUN!!!

Resource: Girls Who Build Cameras

Kristen Railey

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