What is Stray Light?

- Stray light is unwanted light in an optical system
  - It’s familiar to most of us as “lens flare” that occurs when taking a picture facing the sun
- It occurs anytime an image is formed, is usually unintended, and is impossible to eliminate completely
- It is the result of physical processes directing light through unintended paths

Diffraction from the aperture stop
Scattering from surface roughness and particulates
Ghost reflections from lenses
Bidirectional Scattering Distribution Function (BSDF, cont.)

• The BSDF of any real surface must fall between two unobtainable but mathematically convenient ideal types:
  • Lambertian: light is uniformly reflected in all directions
  • Specular: light is reflected only in the specular direction, where BSDF=∞

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Example of Stray Light Artifacts from Ghost Reflections (cont.)

- Polychromatic FRED simulation of ghost reflection artifacts in the zoom lens with the 7-layer AR coating, due to the sun just outside the lower-left corner of the FOV (at about 14° from FOV center)
  - Chromatic effects are due to reflections from AR coatings at high $\theta$, and are common, note resemblance to cover photo
Design of Vanes for Main Baffles (cont.)

1. Draw a ray between the +y edge of the entrance aperture and the +y edge of the collector. This ray defines a “keep-out” zone that prevents the FOV of collector from being vignette.

2. Draw a ray from the −y edge of the critical portion of the collector to the +y corner of the main baffle.

3. Place a baffle at the intersection point between the rays from step 1 and step 2.

4. Draw a ray from the −y edge of the entrance aperture to the +y edge of the second baffle vane aperture.

5. Draw a ray from the intersection point between the ray from step 4 and the main baffle to the −y edge of the critical portion of the collector.

6. Place a baffle at the intersection point between the ray from step 1 and the ray from step 5.

7. Repeat steps 4-6 until the end of the main baffle is reached.
Comparison of Predicted and Measured System Stray Light

Using the techniques presented in this course, the irradiance due to stray light in the MakCass due to the moon was predicted in FRED and compared to measured

- The moon was used as the stray light source because this is an astronomical telescope
- Requirement set to 1 greyscale bit
- Results agree to within 60%

![Graph showing comparison of predicted and measured irradiance](image)

Artifacts From the Moon at 15° Off-Axis From the LL Corner