Quiz Alert

- Quiz date is March 11
  - One piece of paper, both sides, allowed.
- An assignment on photometric stereo will be due around March 7.
- Assignment 5 will be due right after the break.

Lambertian surfaces

- Surface brightness is only a function of the foreshortening of the incident light (the more oblique it is, the less bright the surface).
- Question: Is the moon a Lambertian reflector?

Lambertian Reflection

Most the world is not Lambertian

Lambertian assumption failures
  - Rough surfaces--important example--the moon is not Lambertian
  - Dielectrics (plastics, many paints)
  - Metallic surfaces
  - Skin
  - Mirrors

Ideal Mirrors

The opposite extreme case from Lambertian is a mirror.

Instead of going everyway equally, the reflected light goes exactly one way.
Reflection Direction

\[ \hat{s} + \hat{r} = k \hat{n} \]
\[ \hat{n} \cdot \hat{s} + \hat{n} \cdot \hat{r} = k \Rightarrow k = 2 \hat{n} \cdot \hat{s} \]
So \[ \hat{r} = 2(\hat{n} \cdot \hat{s})\hat{n} - \hat{s} \]

The three vectors are coplanar!

Optional--Just in case you need it for something!

Specular surfaces

- Another important class of surfaces is specular (somewhat mirror-like).
- Specular surfaces reflect a significant amount of energy in the specular (mirror) direction.
- A significant amount may also be reflected in a direction roughly in the mirror direction (specular lobe).
- Typically there is a diffuse component as well.

Standard nearby point source model (Lambertian)

If the point source is close, moving around in the scene changes the distance to the source.

\[ \rho_d(X) \left( \frac{\hat{n}(X) \cdot s(X)}{|X - X_s|^2} \right) \]

\[ X \] is the location in the world
\[ X_s \] is the location of the source
\[ S \] is the strength of the source

\[ s(X) = s(5X_1, X) = S\hat{s}(X_1, X) = S \frac{X_1 - X}{|X_1 - X|} \]
\[ \rho_d(X) \] is the reflectance ratio at \( X \).
Standard distant point source model

- If the source is far away, this formula reduces to the same as
  the Lambertian formula from before:

  \[ |X - X_s| \approx R \]  
  (distance does not change much)

  and \[ s(X) \approx S \]  
  (nor does direction)

  if we let \( S_d = \left( \frac{S}{R} \right) \)

  we get \( \rho_c(X) (\hat{n}(X) \cdot S_d) \)  
  (as before)