CMSC427
L08P4: Shading
Local Models

Credit: slides from Dr. Zwicker

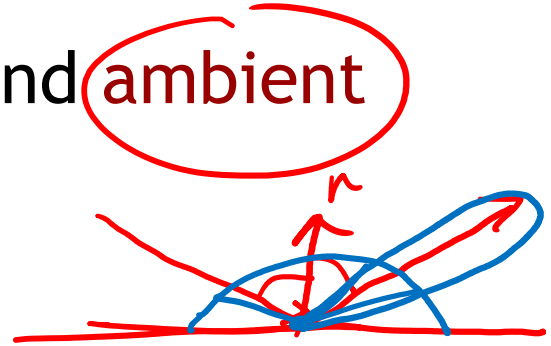
Today

Shading

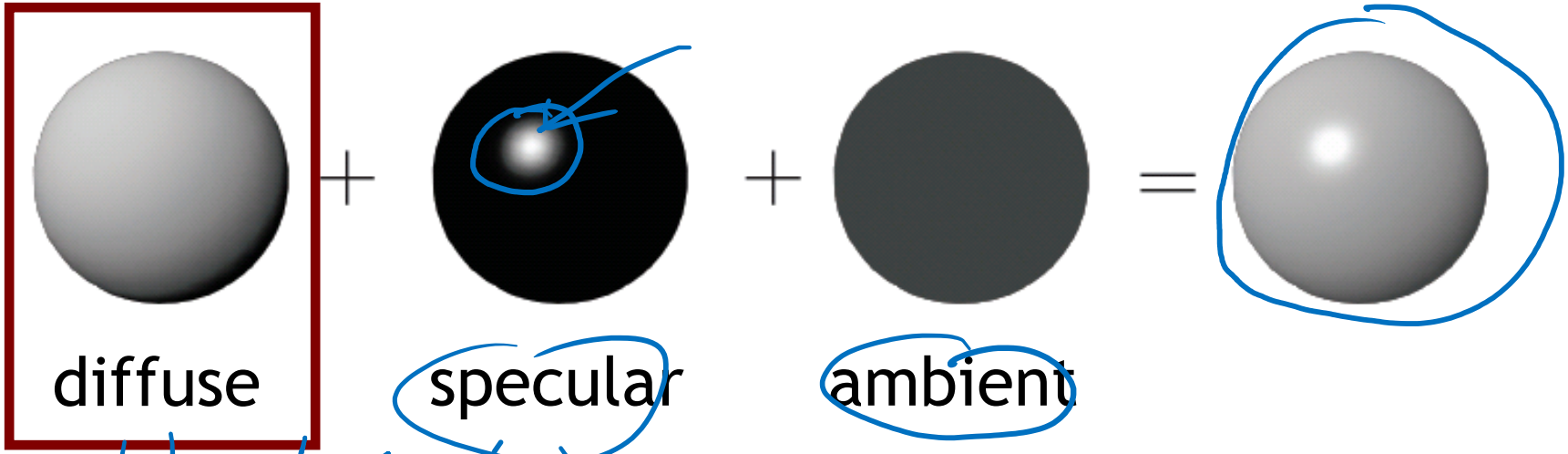
- Introduction
- Radiometry & BRDFs
- Local shading models
- Light sources
- Shading strategies

Simplified model

- BRDF is sum of diffuse, specular, and ambient components
  - Covers a large class of real surfaces
  - Each is simple analytical function

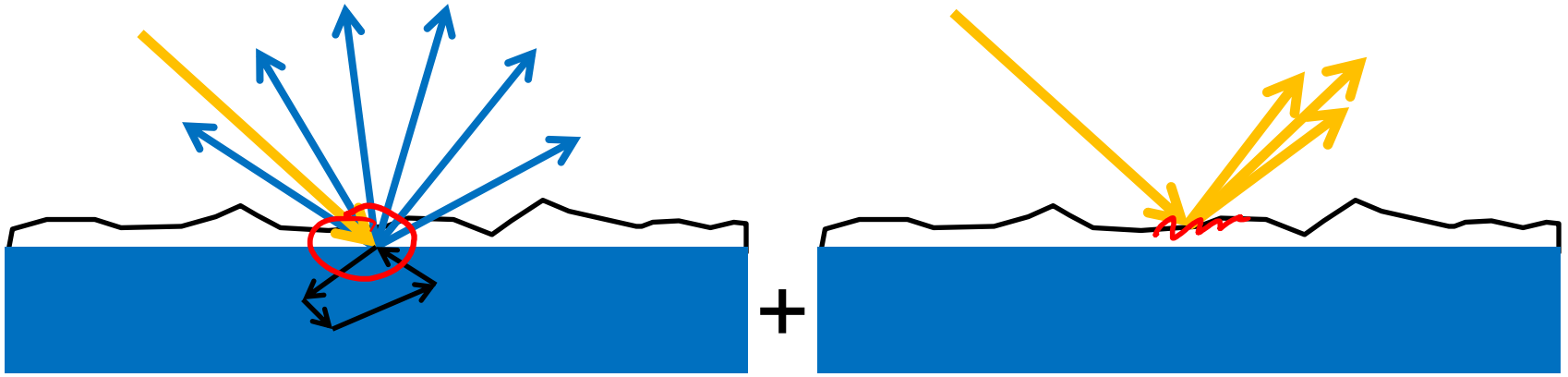


- Incident light from discrete set of light sources (discrete set of directions)
- Model is not completely physically justified!

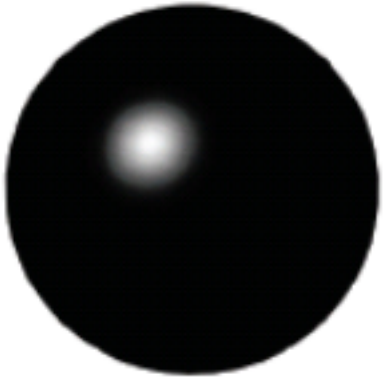


Simplified physical model

- Approximate model for two-layer materials
- Subsurface scattering leading to diffuse reflection on bottom layer
- Mirror reflection on (rough) top layer



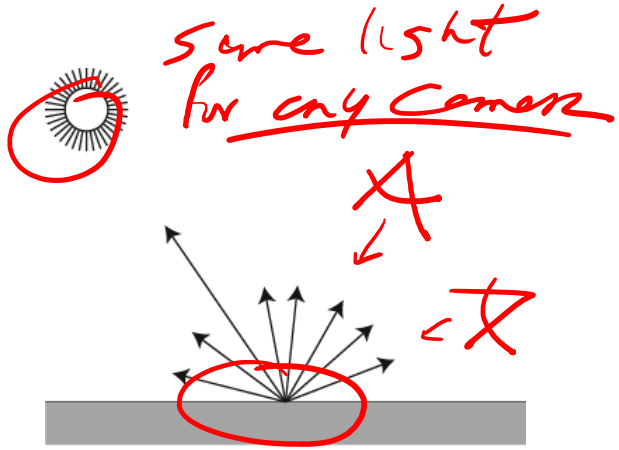
diffuse



specular

Diffuse reflection

- Ideal diffuse material reflects light equally in all directions
  - Also called Lambertian surfaces
    http://en.wikipedia.org/wiki/Lambert's_cosine_law
- View-independent
  - Surface looks the same independent of viewing direction
- Matte, not shiny materials
  - Paper
  - Unfinished wood
  - Unpolished stone

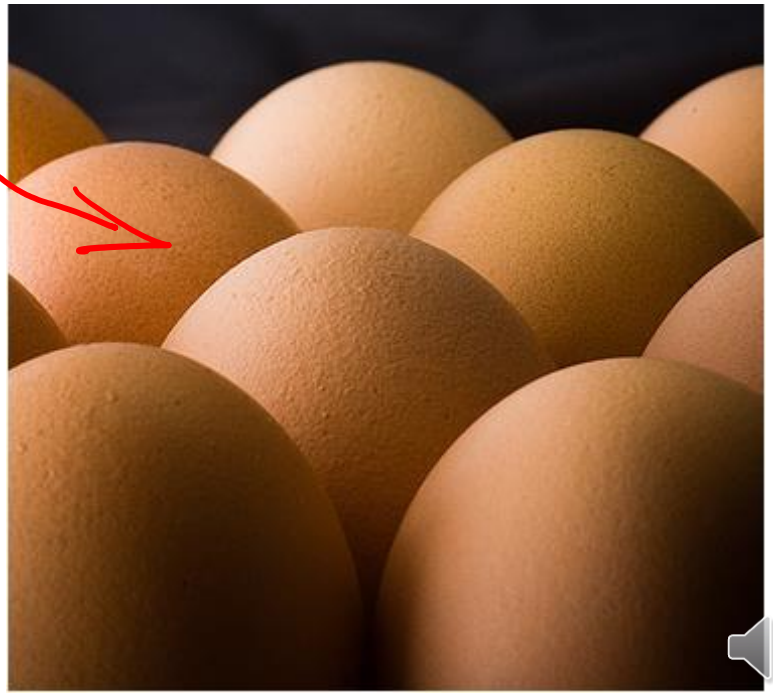


Diffuse reflection

Diffuse sphere

Diffuse reflection

- “Radiance reflected by a diffuse (“Lambertian”) surface is constant over all directions“
- Hm, why do we see brightness variations over diffuse surfaces ?

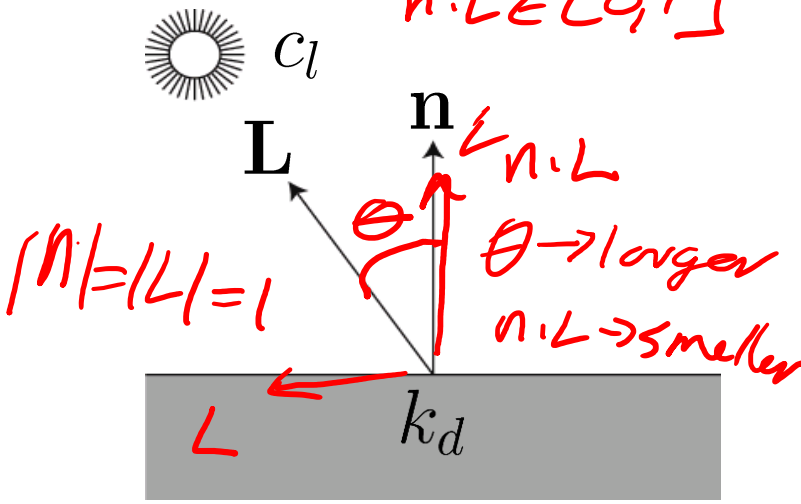


Diffuse reflection

- Given
  - Light color (radiance) c_l
  - Unit surface normal $\mathbf{n}$
  - One light source, unit light direction $\mathbf{L}$
  - Material diffuse reflectance (material color) k_d
- Diffuse reflection c_d

$$c_d = c_l(\mathbf{n} \cdot \mathbf{L})k_d$$

Cosine between normal and light, converts radiance to incident irradiance



Diffuse reflection

Notes on $c_d = c_l(\mathbf{n} \cdot \mathbf{L})k_d$

- Parameters k_d, c_l are r,g,b vectors
- c_l: radiance of light source
- $c_l(\mathbf{n} \cdot \mathbf{L})$: irradiance on surface
- k_d is diffuse BRDF, a constant!
- Compute r,g,b values of reflected color c_d separately

Diffuse reflection

- Provides visual cues
  - Surface curvature
  - Depth variation

Lambertian (diffuse) sphere under different lighting directions