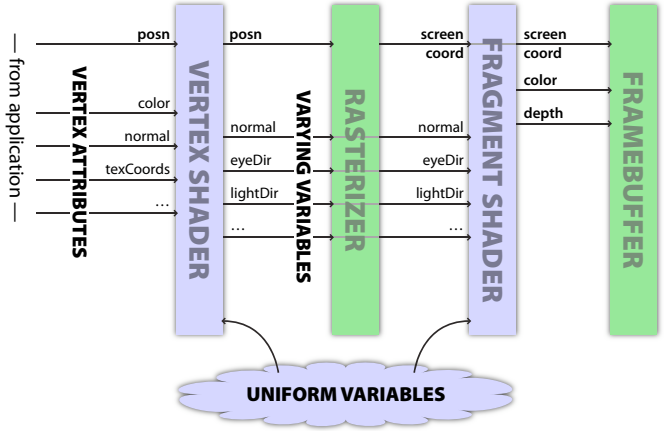
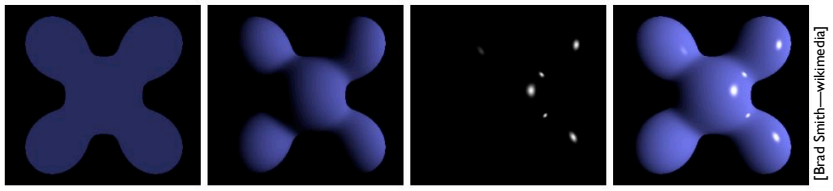
Cornell University CS 569: Interactive Computer Graphics

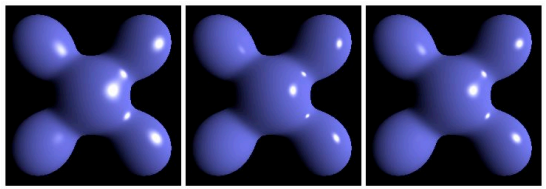
Illumination models

Lecture 3

Basic programmable shading pipeline







Cook-Torrance illumination equations

$$L_s = i_s k_s \frac{D(H)\,F(V,H)\,G(L,V,H)}{\pi\, N \cdot V}$$

$$D(H) = \frac{\exp(-(\frac{\tan\alpha}{m})^2)}{4m^2\cos^4\alpha} \qquad \cos\alpha = N \cdot H$$

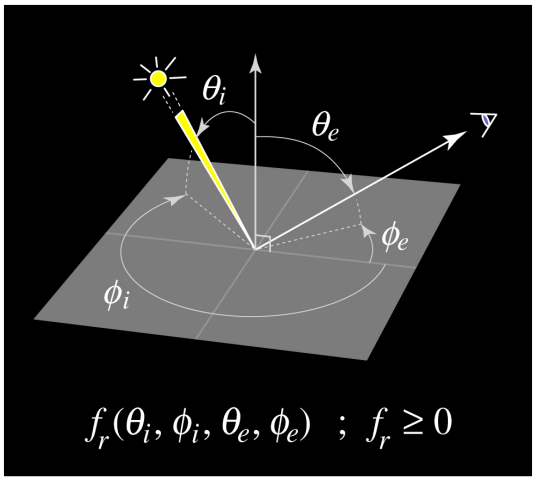
$$G(L,V,H) = \min\left(1, \frac{2(N\cdot H)(N\cdot V)}{V\cdot H}, \frac{2(N\cdot H)(N\cdot L)}{V\cdot H}\right)$$

commonly used approximation:

$$F(V,H) = R_0 + (1-R_0)(1-V\cdot H)^5$$

$$R_0 = \left(\frac{1-\eta}{1+\eta}\right)^2$$

BRDF



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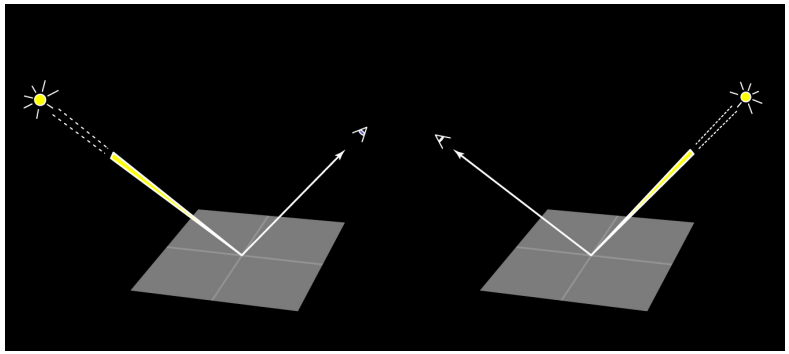
Reciprocity

- Interchanging arguments
- Physical requirement



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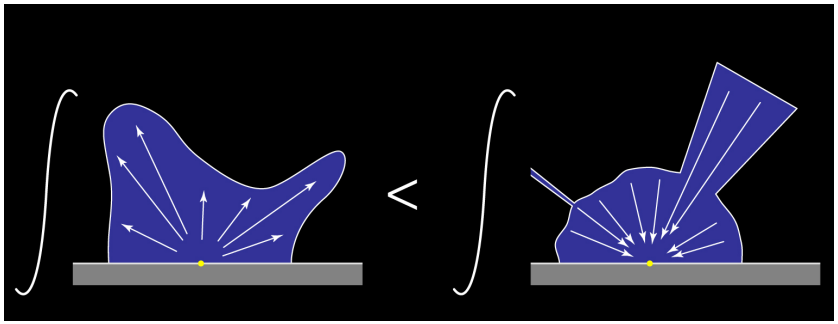
Energy Conservation

- Reflected power < incident power
- Physical requirement



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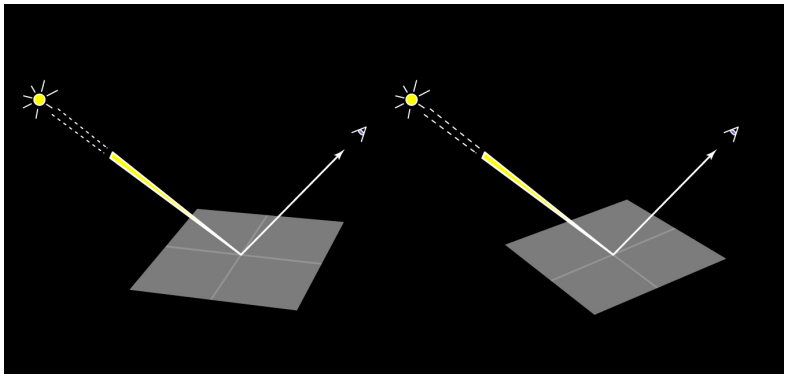
Isotropy

- In-plane rotations
- Common property; simplifying assumption



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Ward's model equations

isotropic:

$$L_s = i_s k_s \frac{\sqrt{N \cdot L}}{\sqrt{N \cdot V}} \frac{\exp(-(\frac{\tan \delta}{\alpha})^2)}{4\pi\alpha^2}$$

anisotropic:

$$L_s = i_s k_s \frac{\sqrt{N \cdot L}}{\sqrt{N \cdot V}} \frac{\exp\left(-\frac{(H \cdot X/\alpha_x)^2 + (H \cdot Y/\alpha_y)^2}{(H \cdot N)^2}\right)}{4\pi\alpha_x\alpha_y}$$

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