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# Computer Graphics III

## Light reflection & BRDF – Exercises

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# Reflectance of a Lambertian surface

- Derive

$$\rho_d = \pi \cdot f_{r,d}$$

# Irradiance environment mapping

- Let us assume a scene consisting of a single convex object with Lambertian (ideally diffuse) BRDF with a constant albedo (i.e. untextured). The object is illuminated by an environment map.
- What quantity is sufficient to parameterize the outgoing radiance? That is, on which of the following quantities does the outgoing radiance depend and on which one it does not:  $\mathbf{x}$ ,  $\mathbf{n}_{\mathbf{x}}$ ,  $\omega_o$ ?

# The law of reflection

- Derive the following formula for the direction of the reflected ray

$$\omega_o = 2(\omega_i \cdot \mathbf{n})\mathbf{n} - \omega_i$$

# Physically plausible Phong BRDF

- Derive the reflectance of the Phong BRDF for a viewing direction aligned with the surface normal:

$$\rho^{\text{Phong modif}}(\omega_o) = \int \left[ \frac{n+2}{2\pi} \rho_s \cos^n \theta_r \right] \cos \theta_i \, d\omega_i, \quad \omega_o = 0$$