CS230 : Computer Graphics

Lighting and Shading

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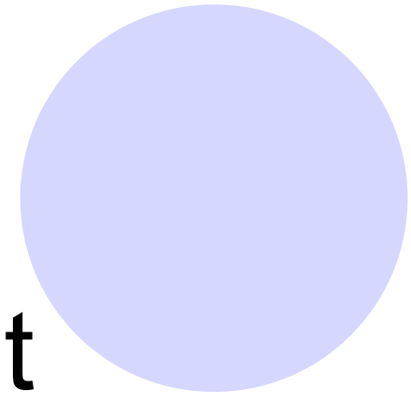
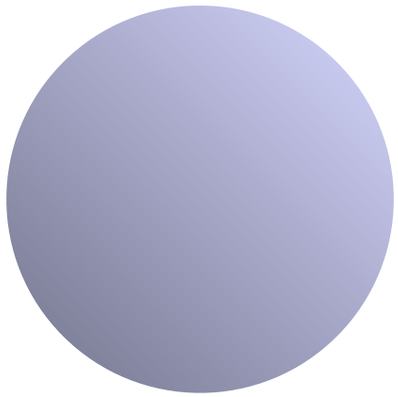
Why we need shading

- Suppose we build a model of a sphere using many polygons and color each the same color. We get something like

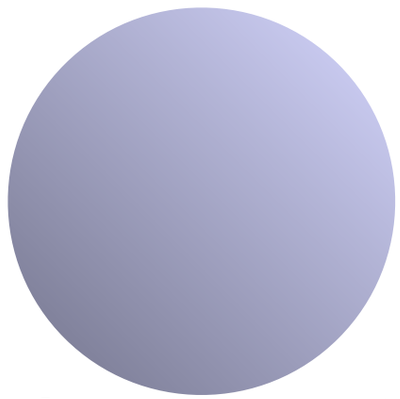


- But we want



Shading

- Why does the image of a real sphere look like



- Light-material interactions cause each point to have a different color or shade
- Need to consider
  - Light sources
  - Material properties
  - Location of viewer
  - Surface orientation (normal)

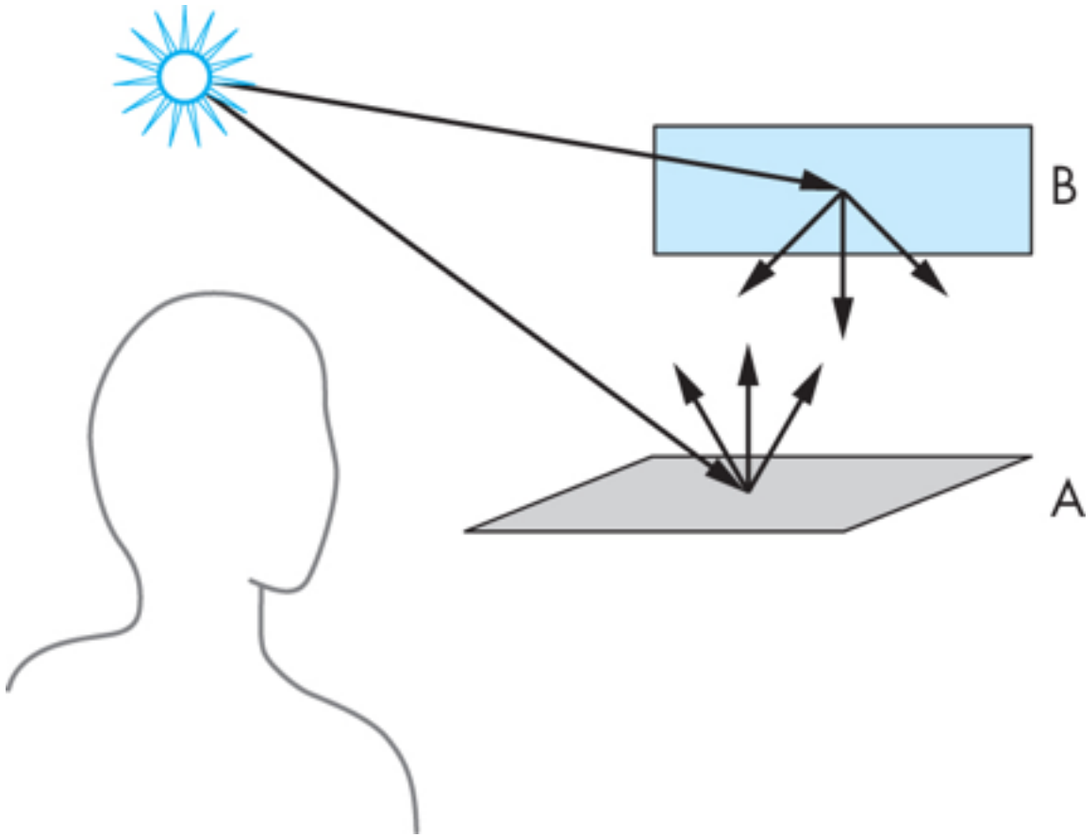
General rendering

- The most general approach is based on physics - using principles such as conservation of energy

- a surface either **emits** light (e.g., light bulb) or **reflects** light for other illumination sources, or both

- light interaction with materials is **recursive**

- the **rendering equation** is an integral equation describing the limit of this recursive process

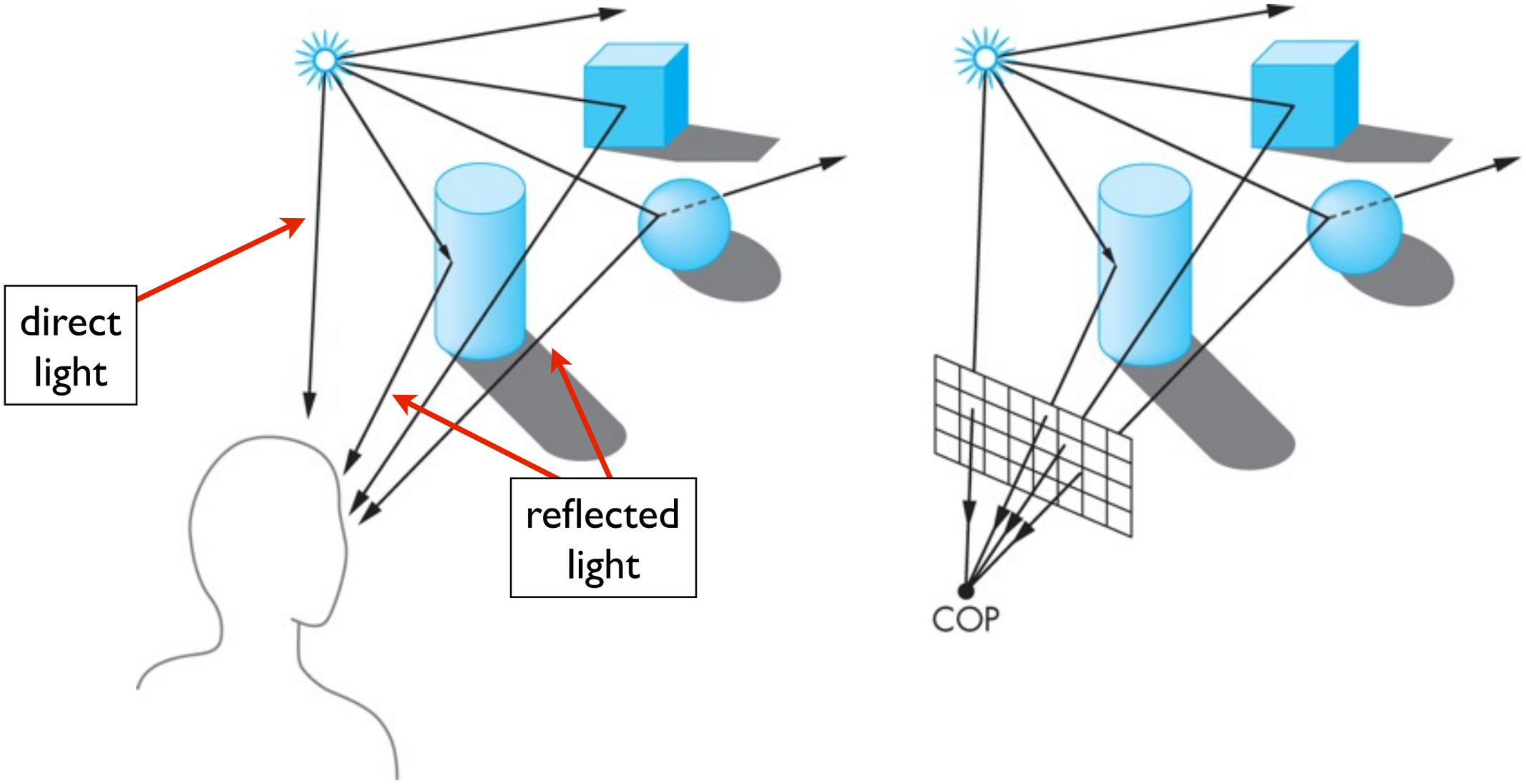


[Angel and Shreiner]

Fast local shading models

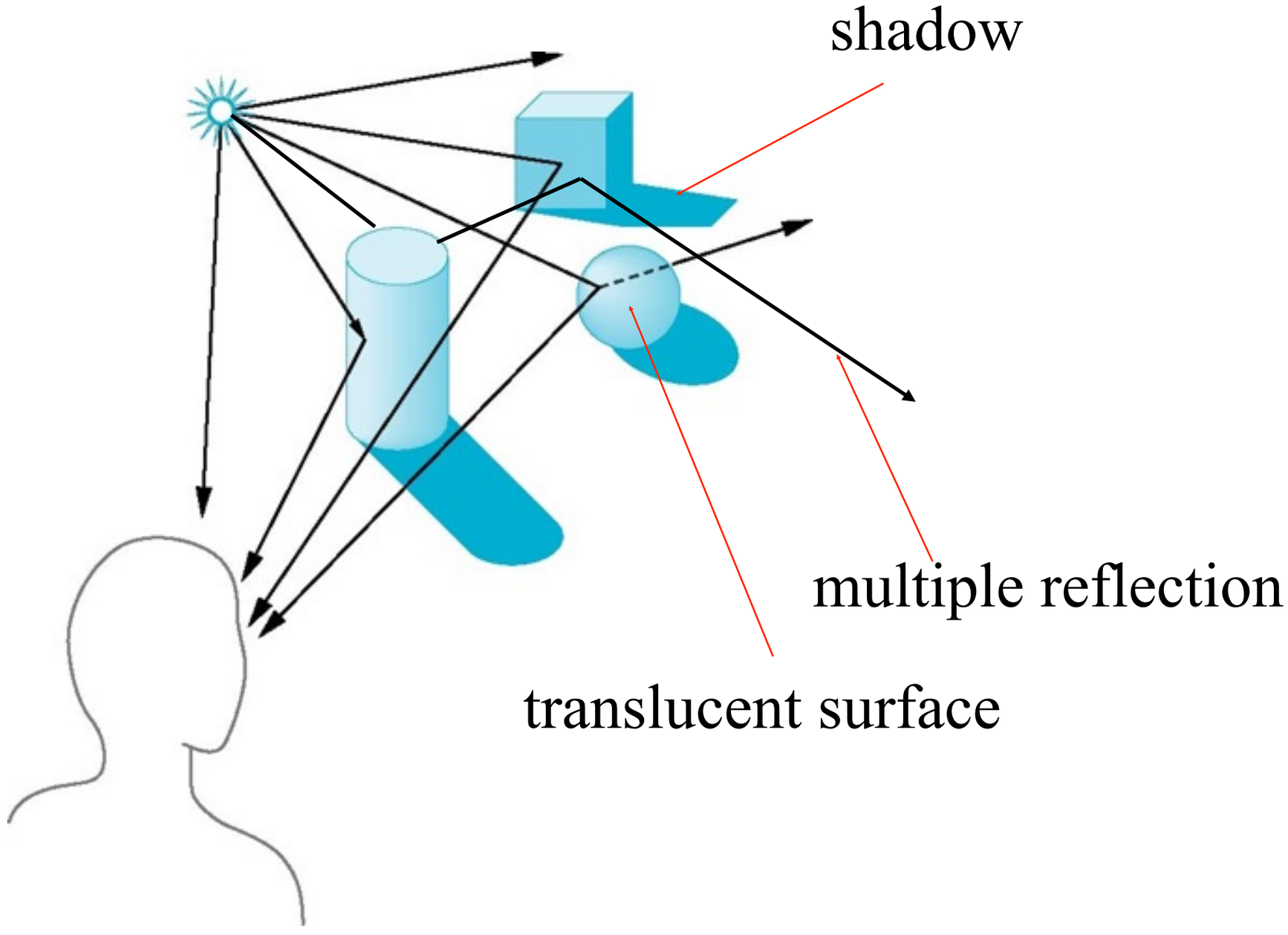
- the rendering equation can't be solved analytically
- numerical methods aren't fast enough for real-time
- we'll use a **local** model where shade at a point is independent of other surfaces
- use **Phong reflection model**
  - shading based on local light-material interactions

Local shading model



[Angel and Shreiner]

Global Effects



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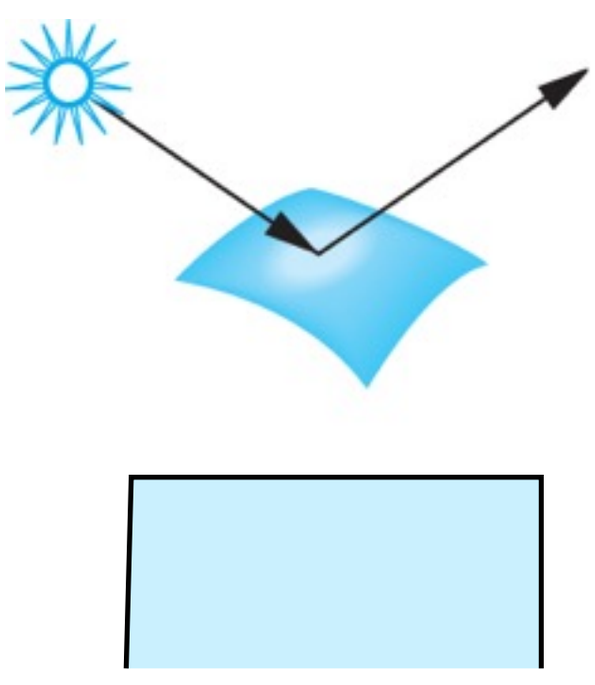
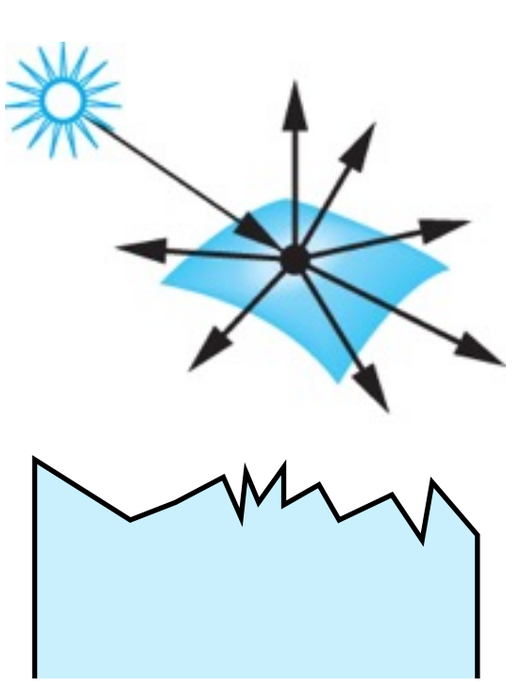
Light-material interactions

at a surface, light is absorbed, reflected, or transmitted

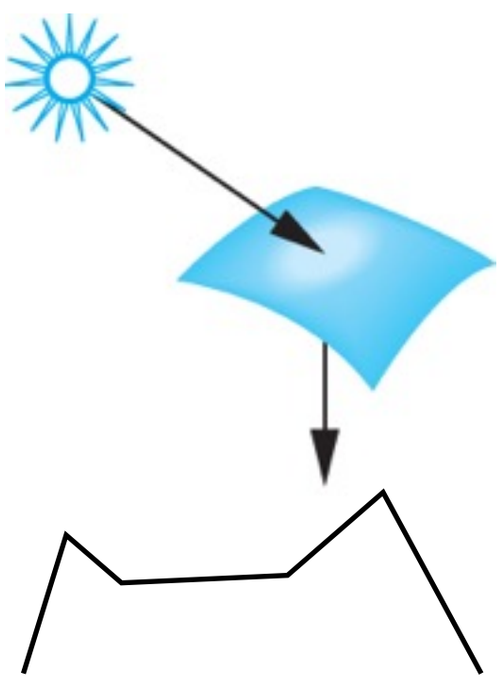
specular



diffuse



translucent



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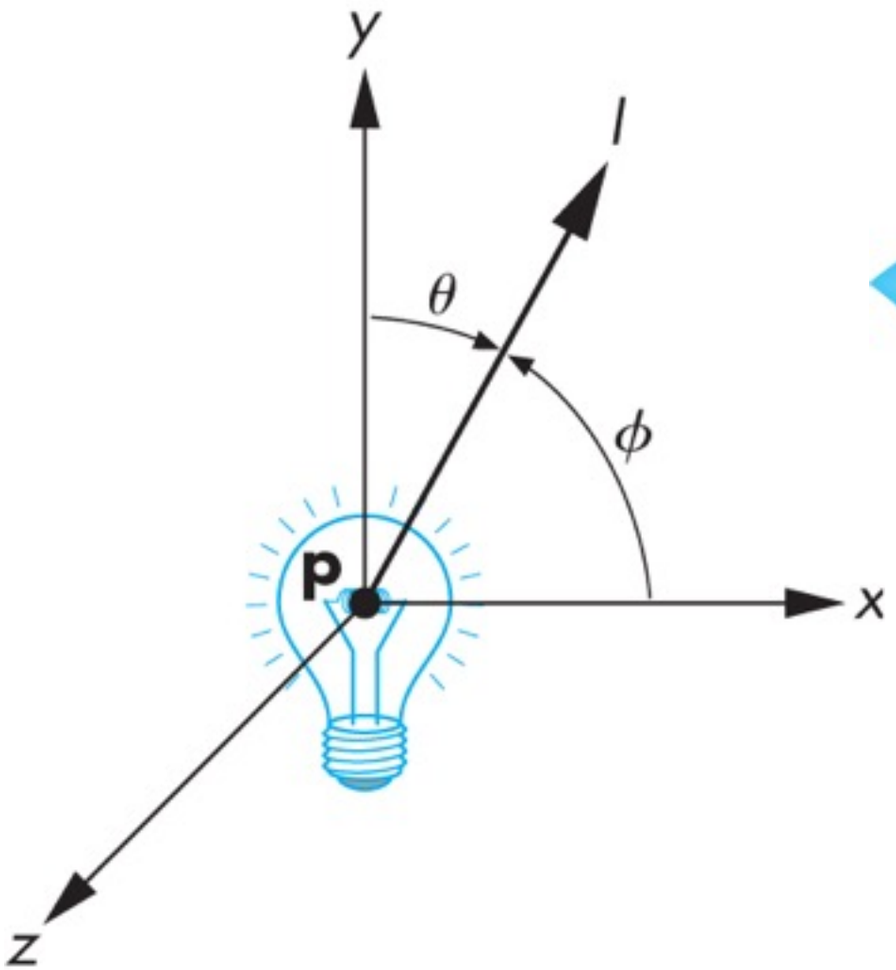
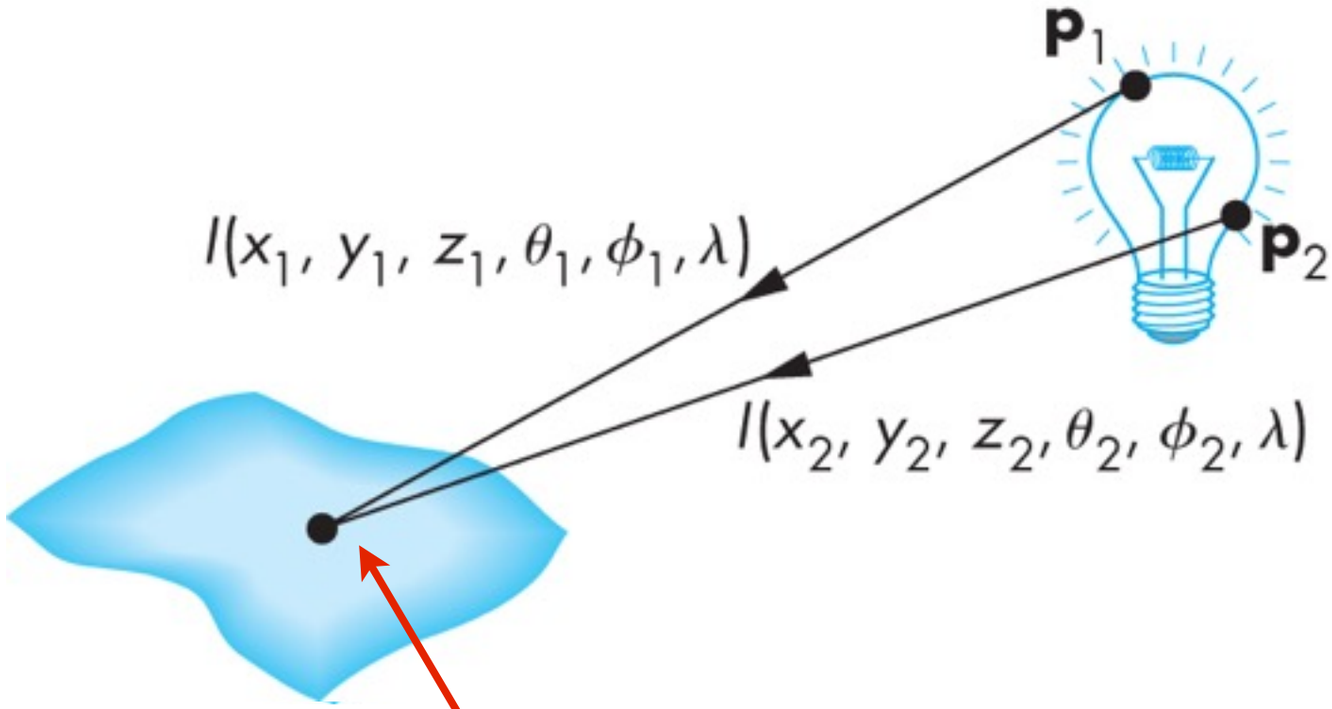
General light source

Illumination function:

$$l(x, y, z, \theta, \phi, \lambda)$$





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integrate contributions from all sources to shade the point