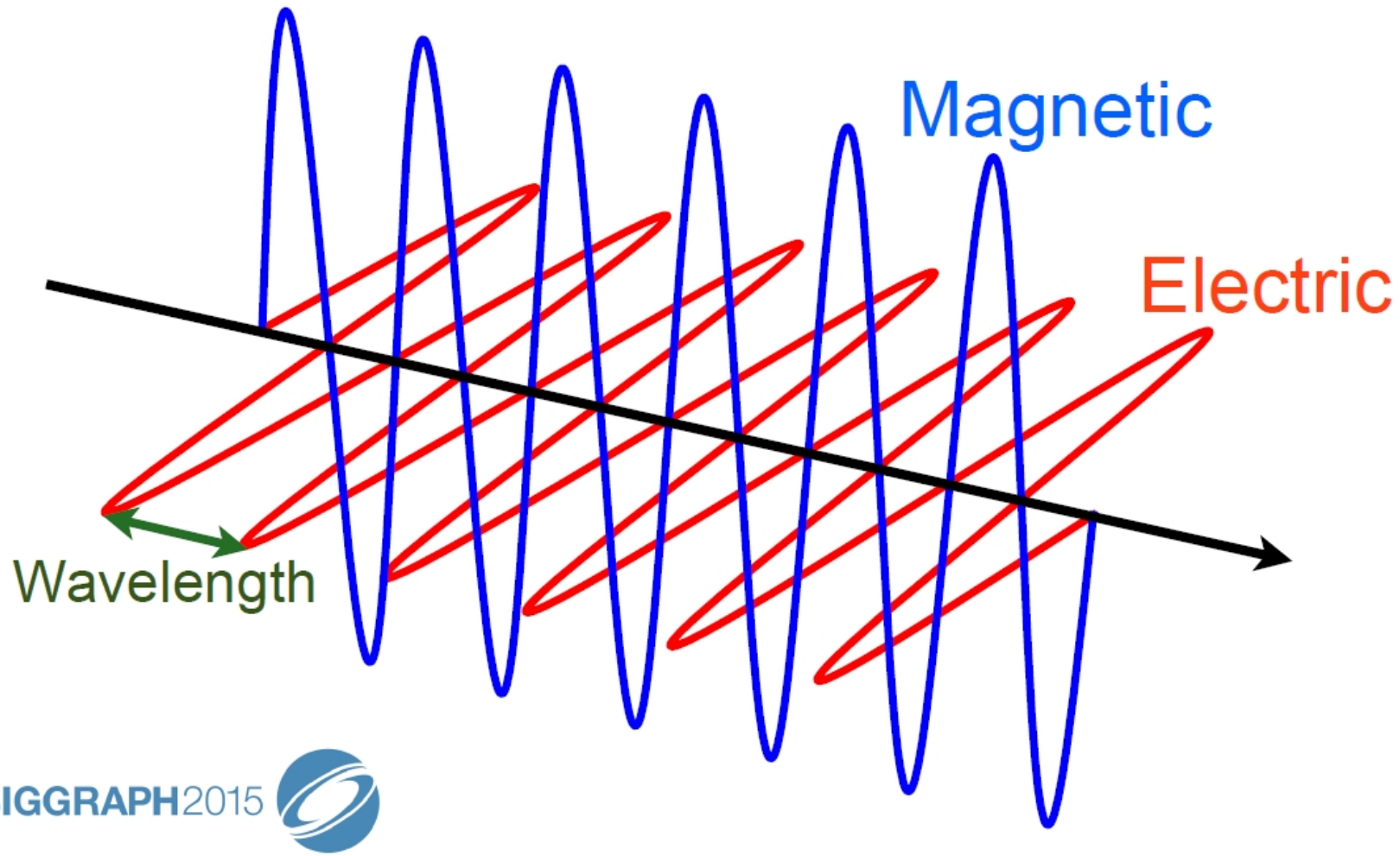
PHY250: Physics of Shading

Anabela R. Turlione

Digipen

Fall 2021

Review: What is light?



SIGGRAPH2015

In general, combination of different frequencies

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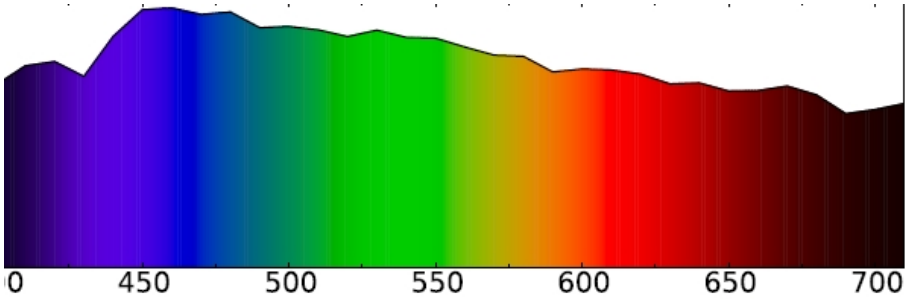
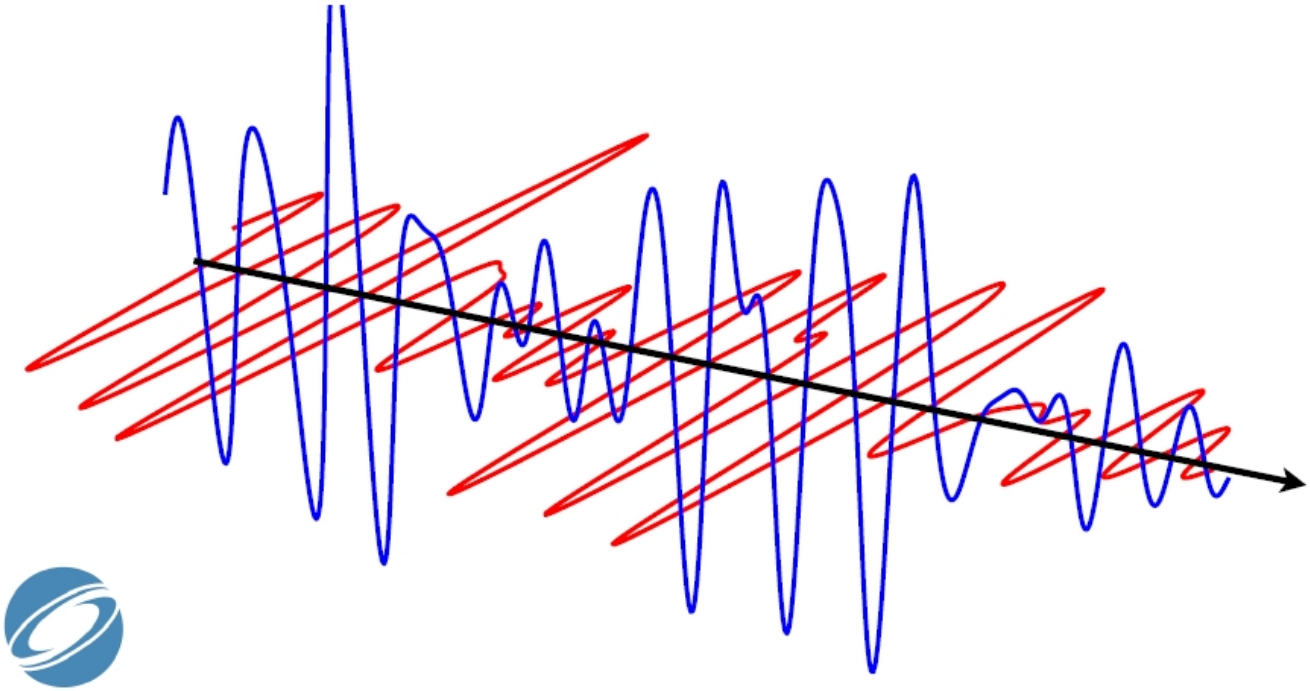
Example: white light





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Human vision reduce the infinite-dimension spectrum to a 3D space:

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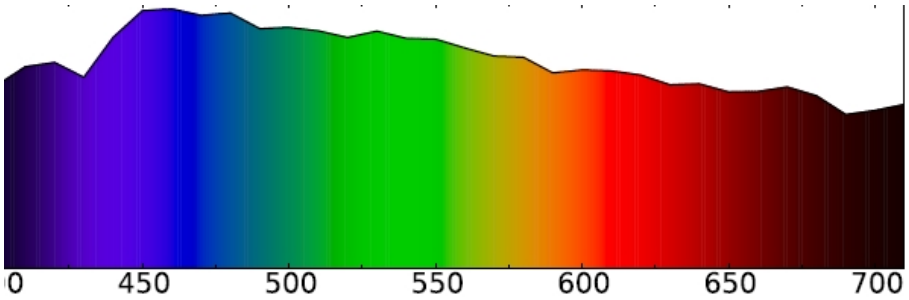

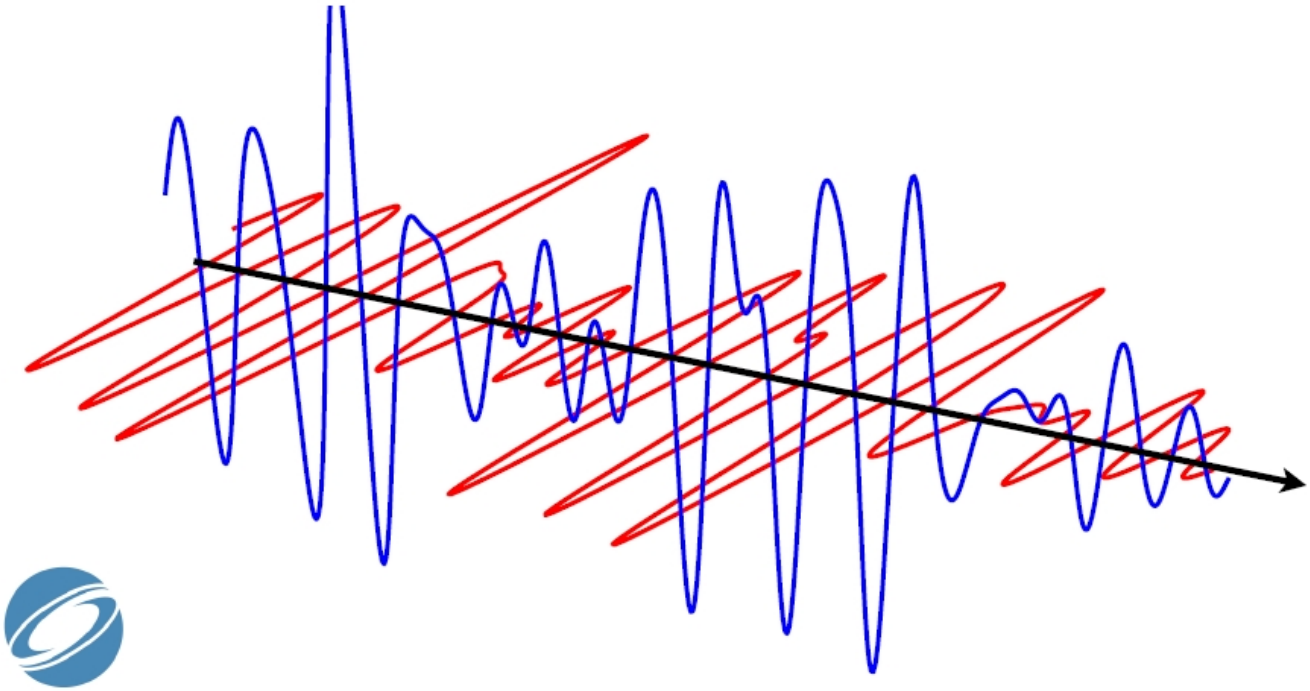

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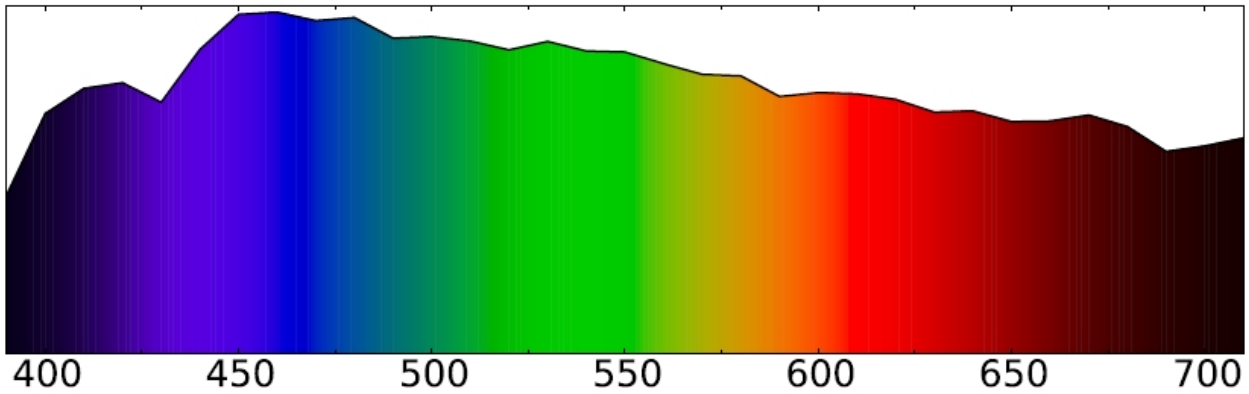
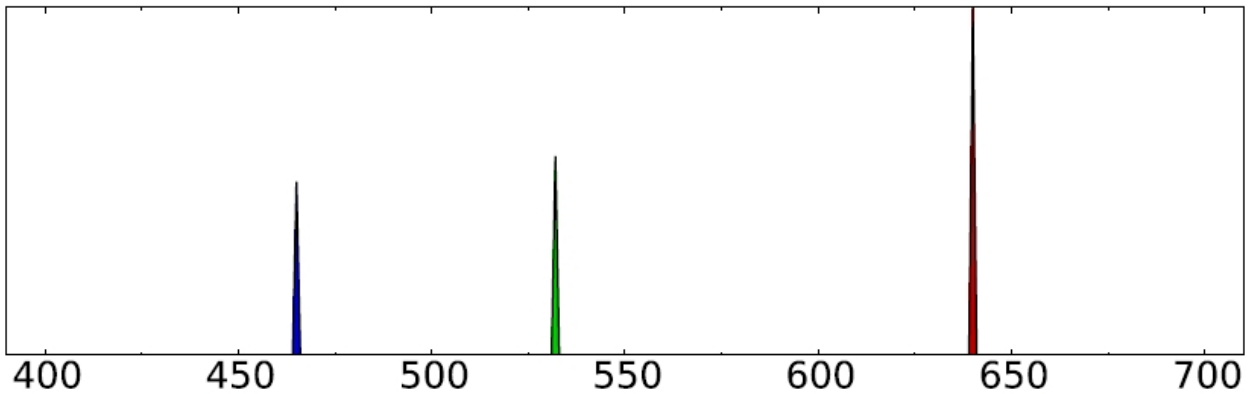
Example: both spectrums give white light





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Light interacting with materials:

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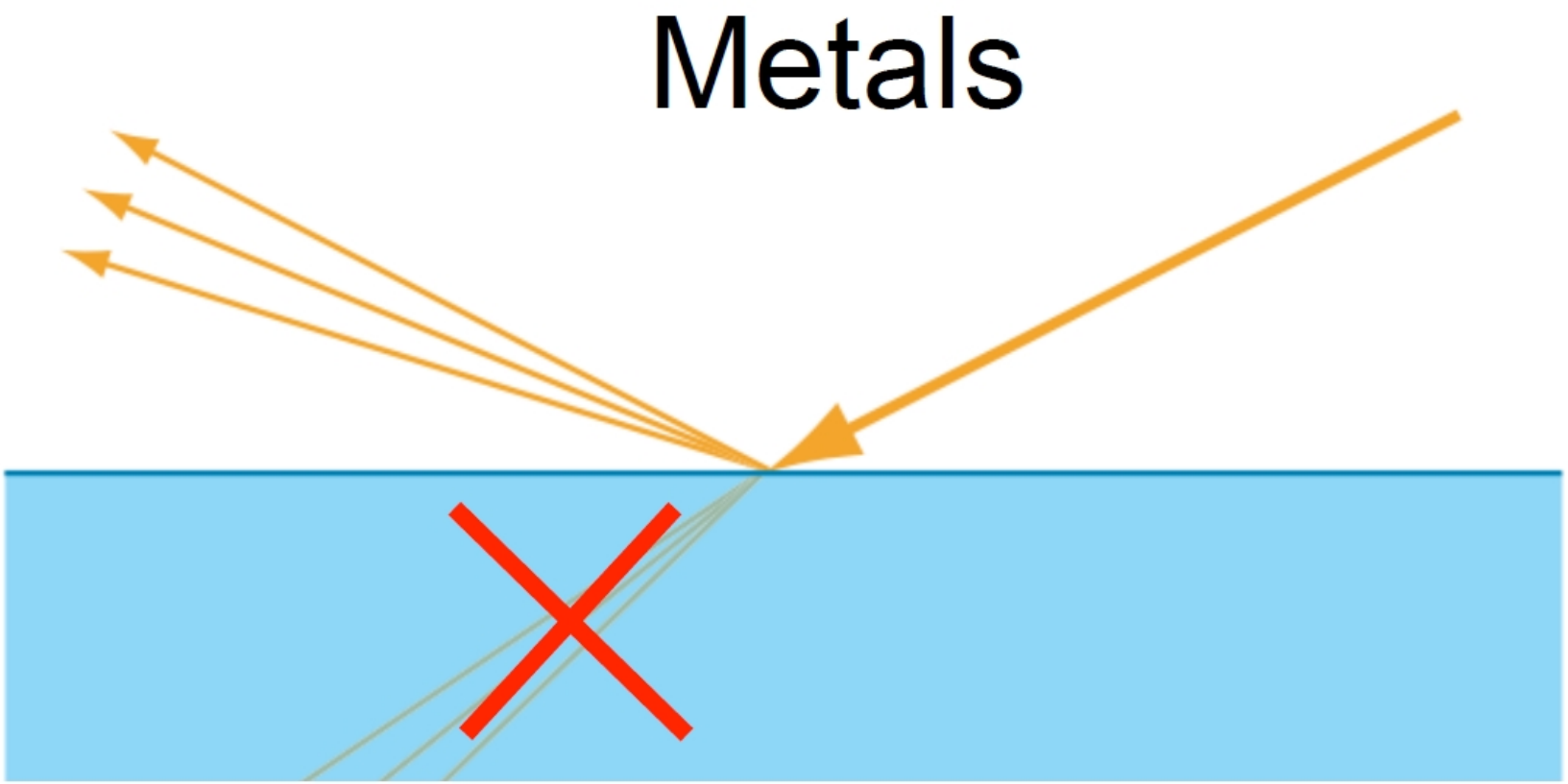

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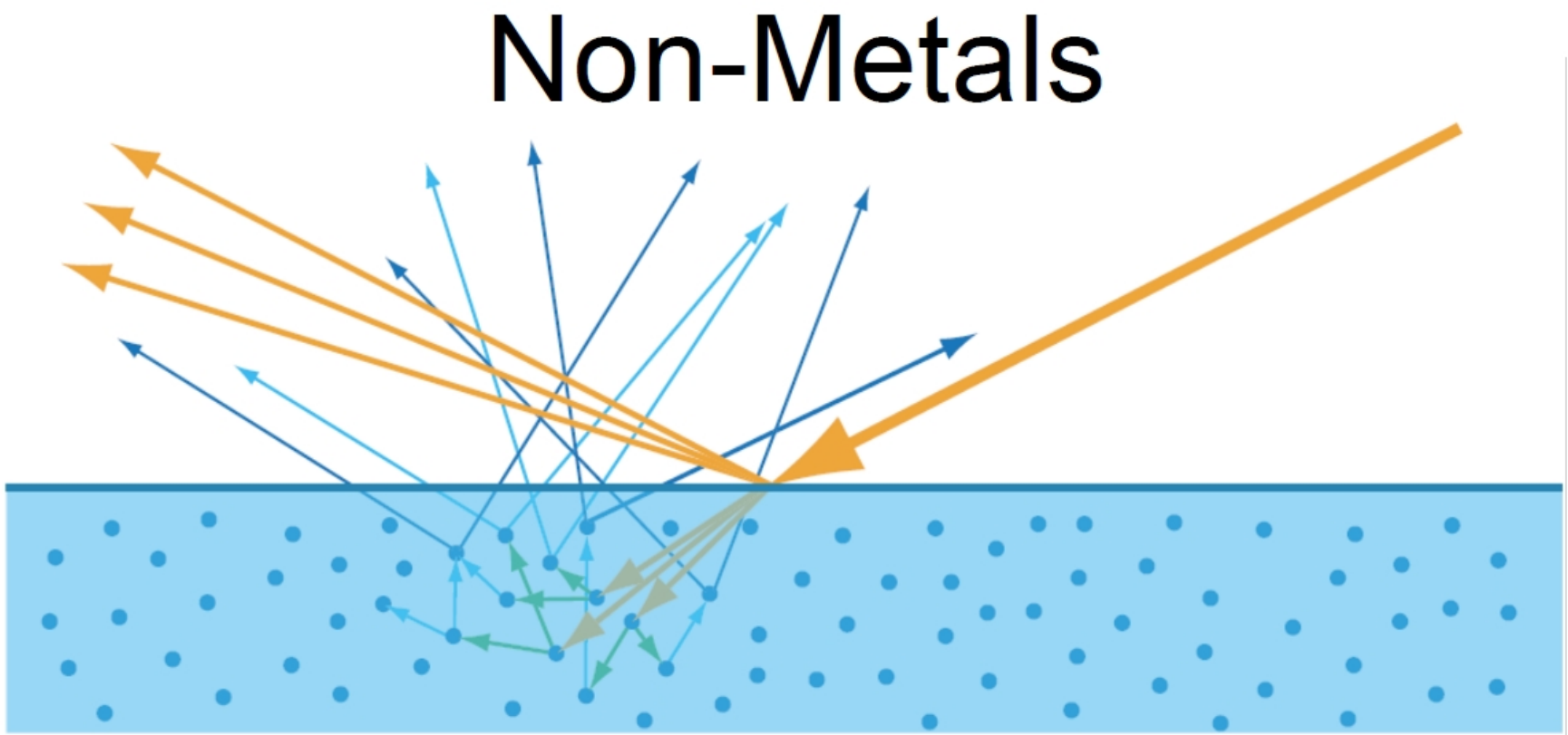

Image from "Real-Time Rendering, 3rd Edition", A K Peters 2008

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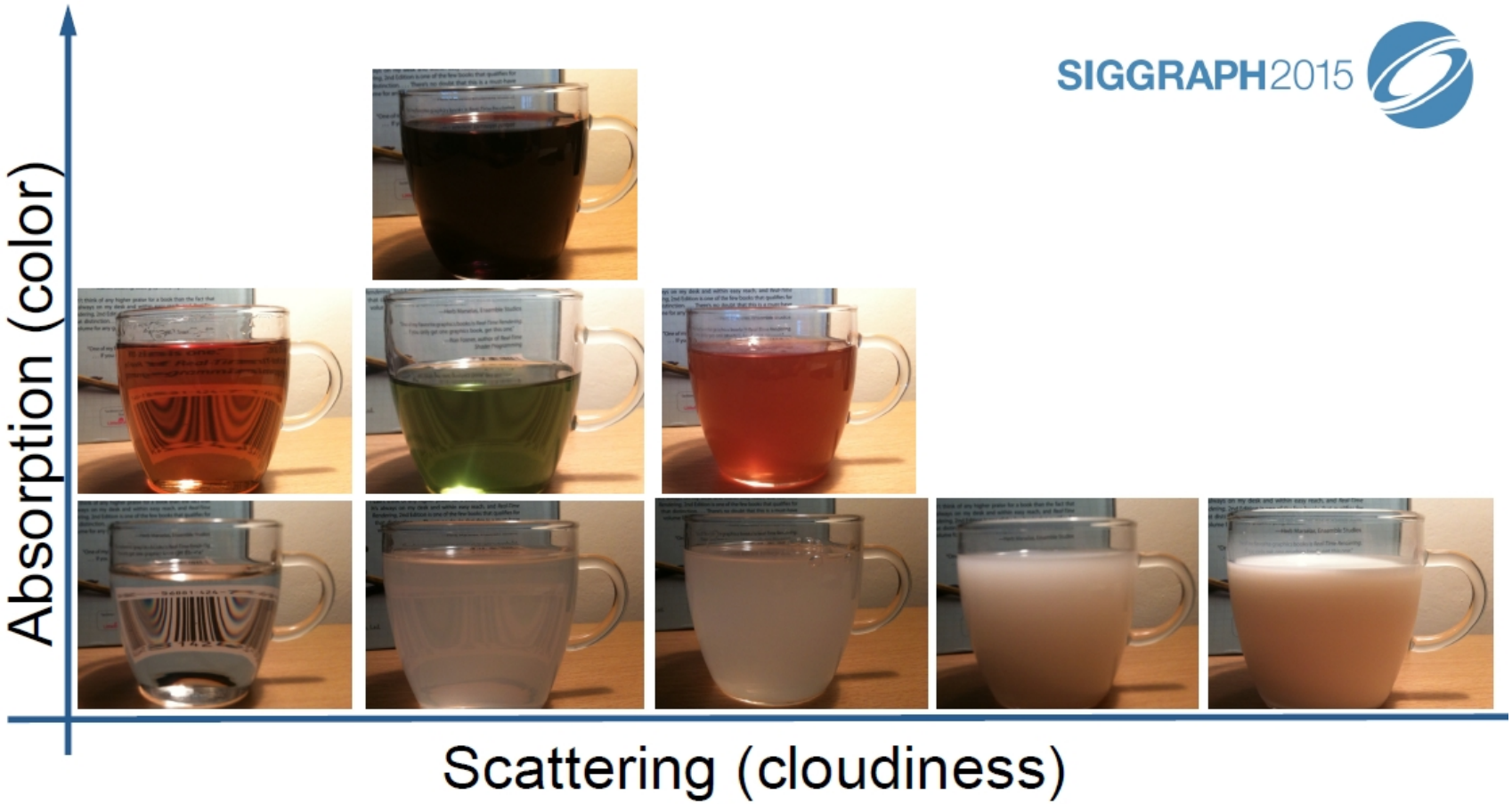
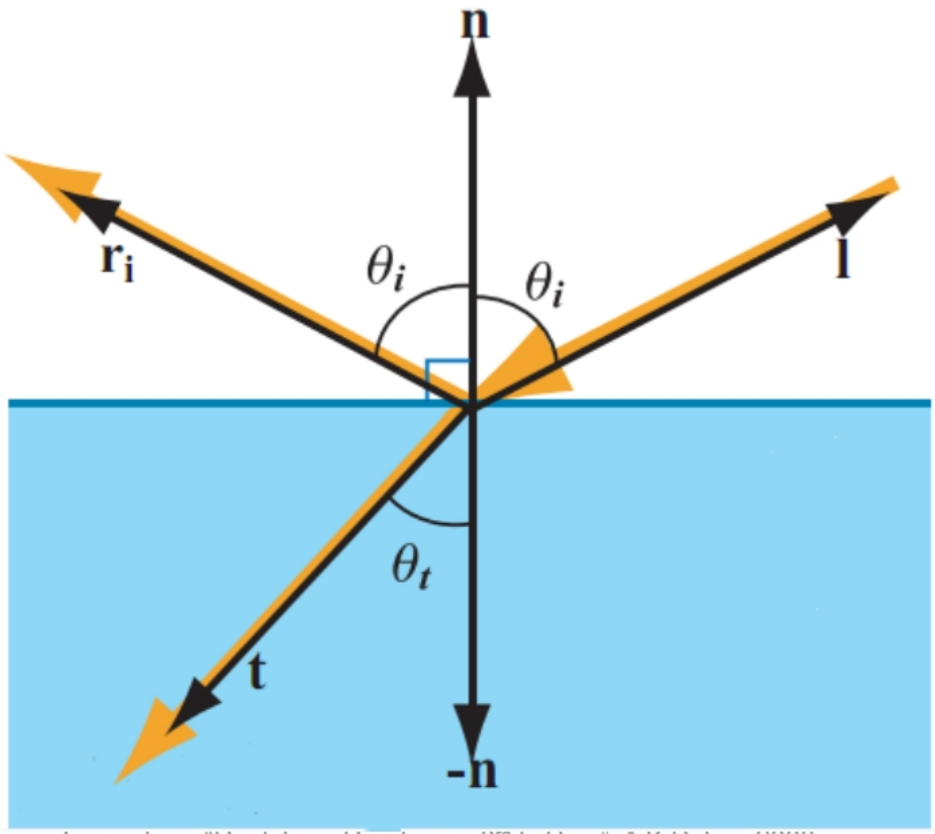
Scattering is different from Absoption



Perfectly smooth surface



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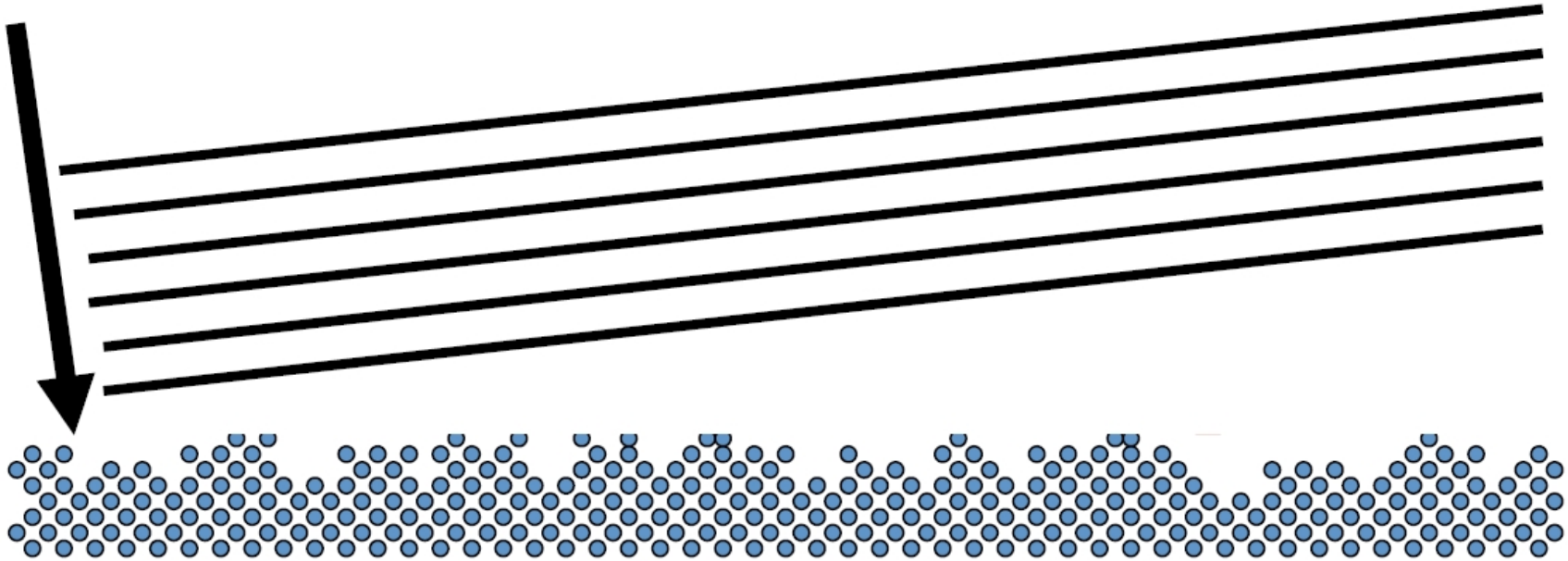
Surfaces are not perfectly smooth



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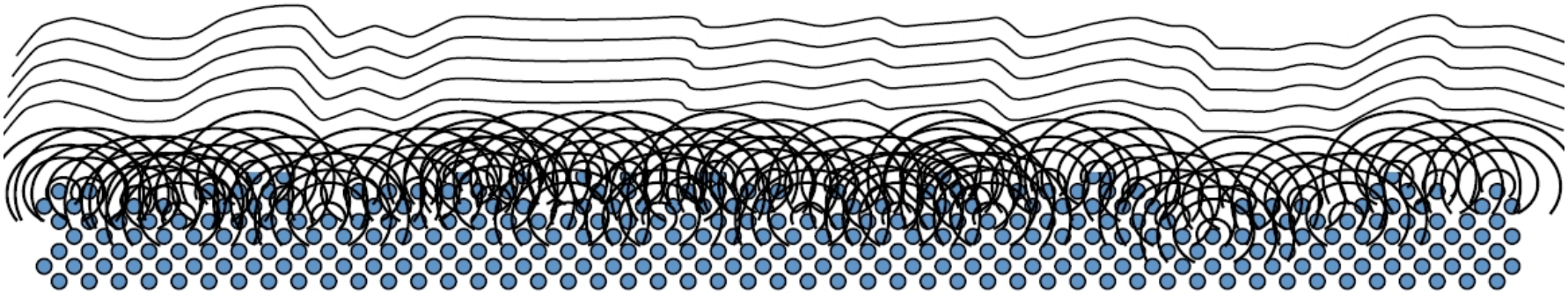
Diffraction from Optically-Smooth Surface



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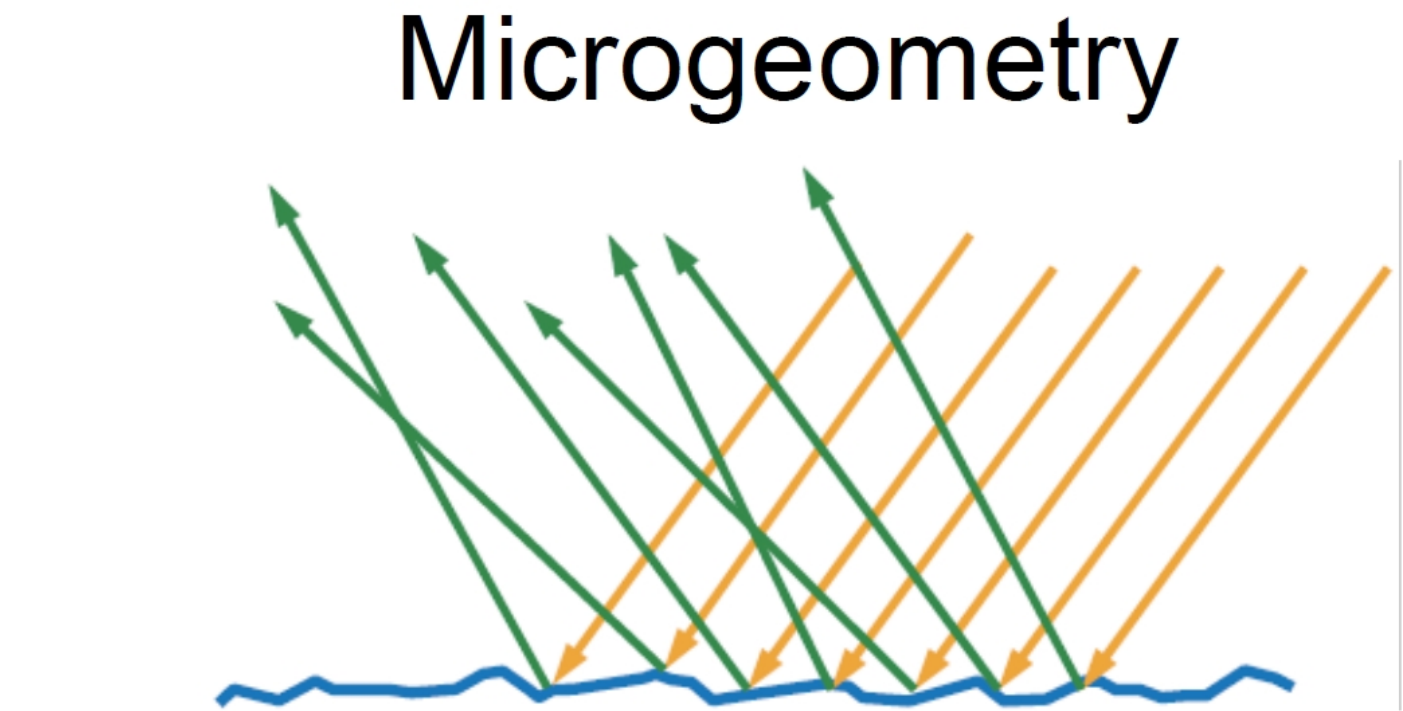

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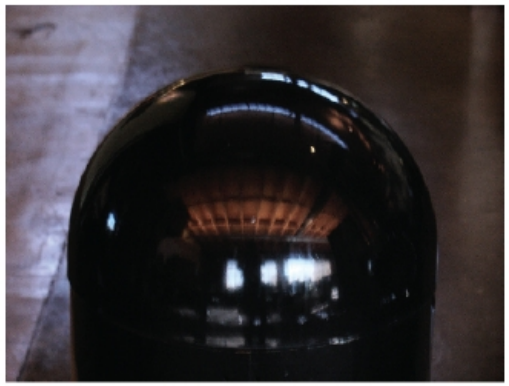
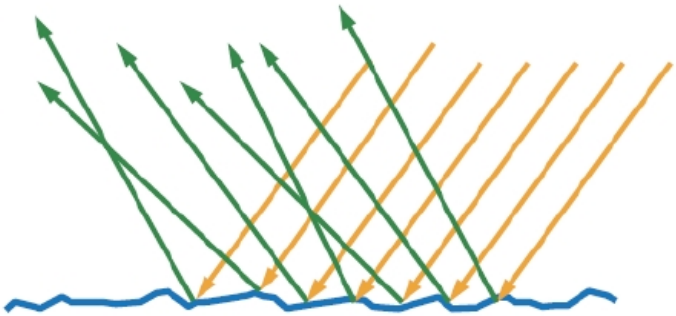
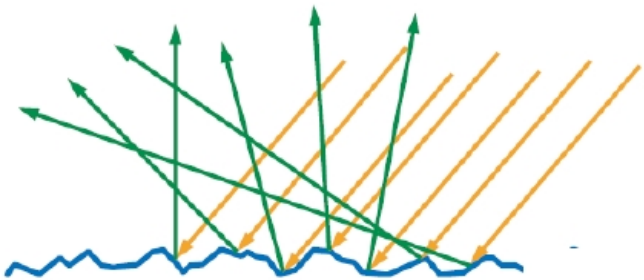
Rougher = Blurrier Reflections







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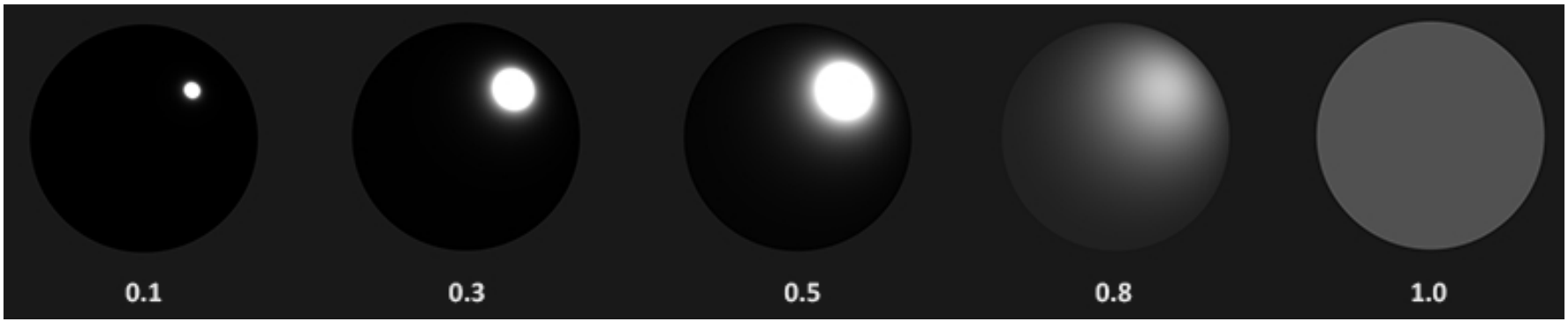
- We consider that the microfacets are small compared to the pixels.

Roughness parameter



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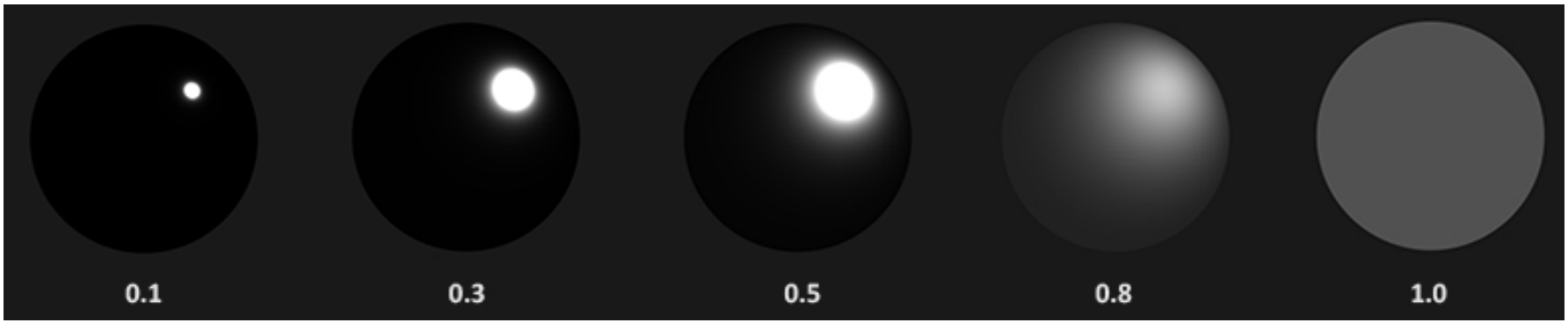
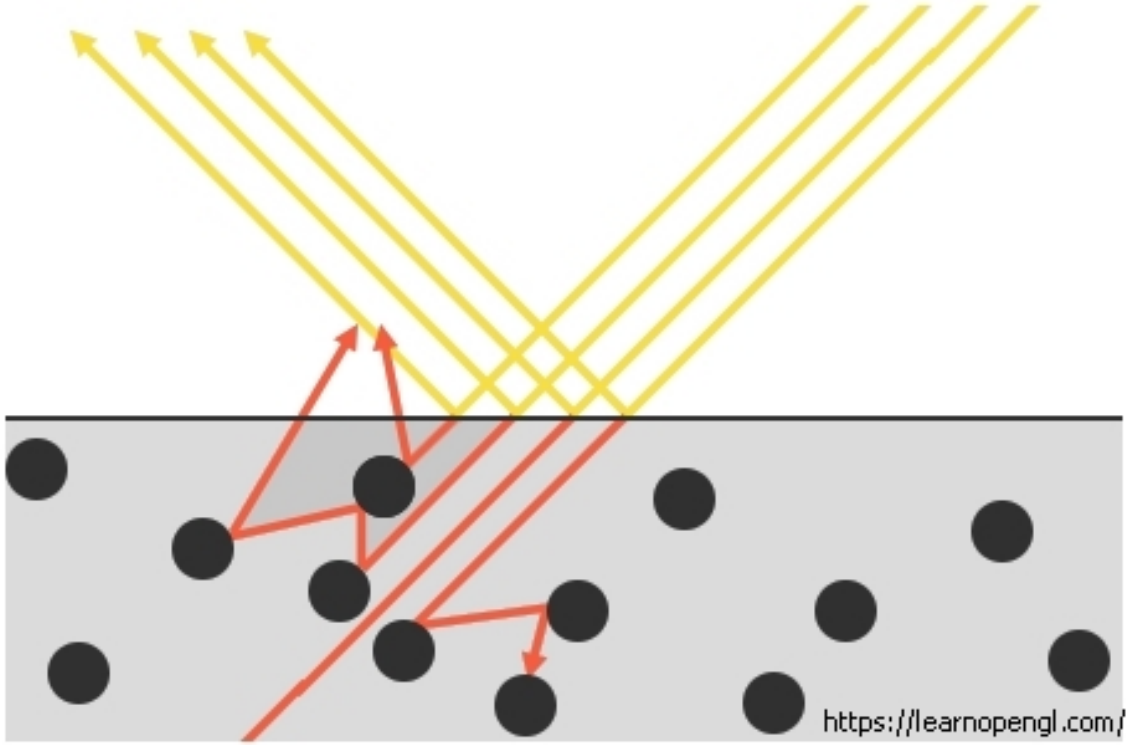


Difuffe light $\neq$ Specular light



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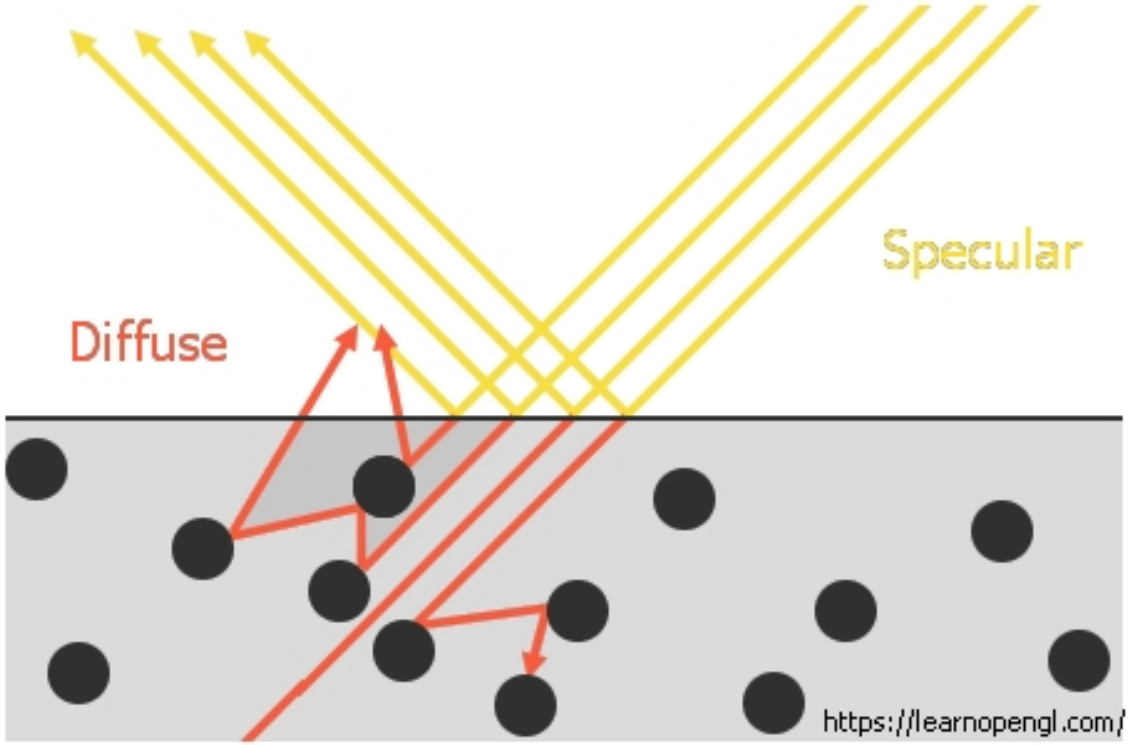

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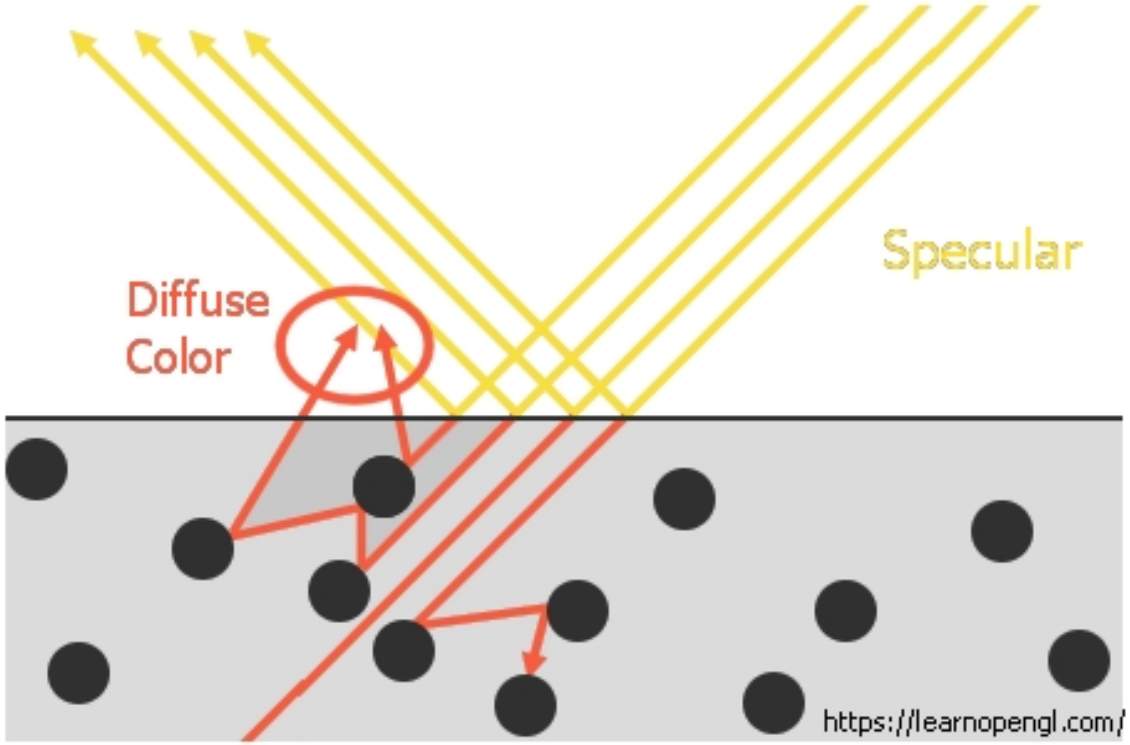

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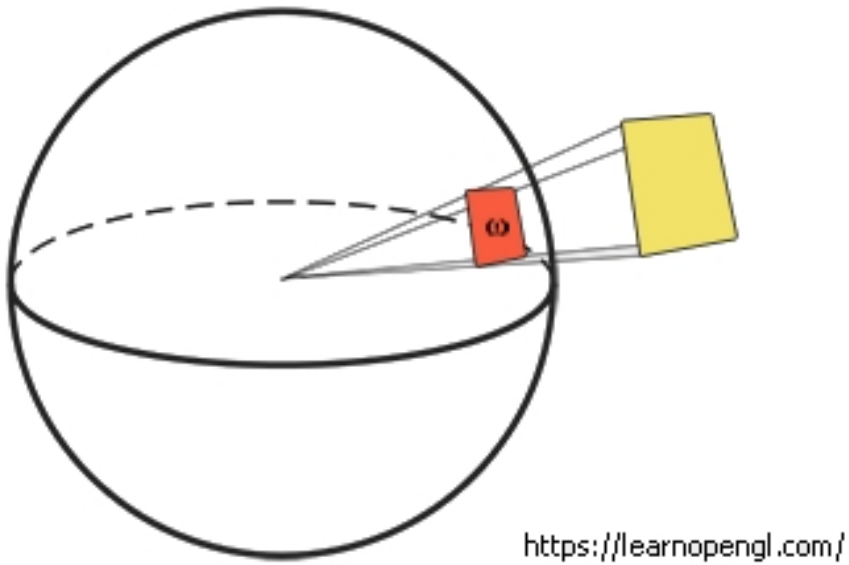

Definitions

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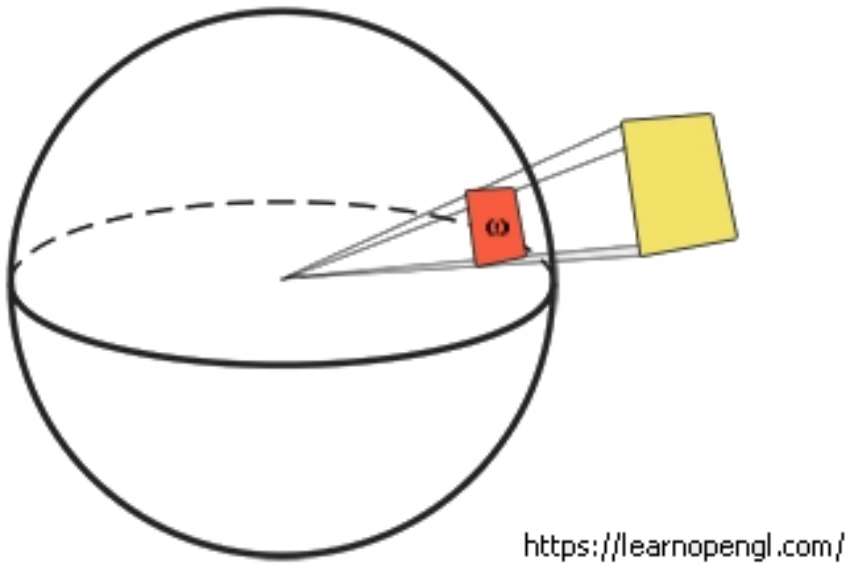
- Radiant intensity: amount of radiant flux per solid angle,

$$I = \frac{d\Phi}{d\omega}$$



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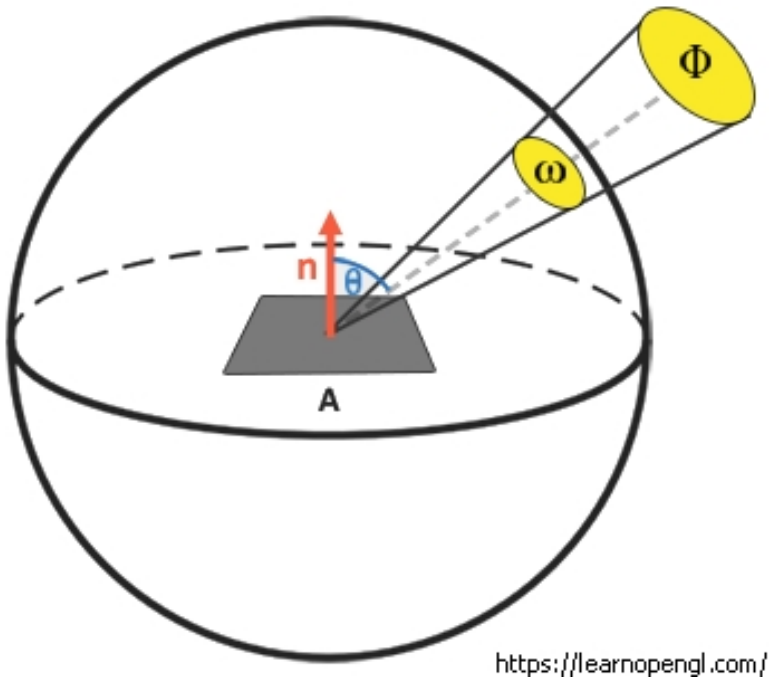
$$L = \frac{d^2\Phi}{dAd\omega cos\theta}$$



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What is the radiance then?

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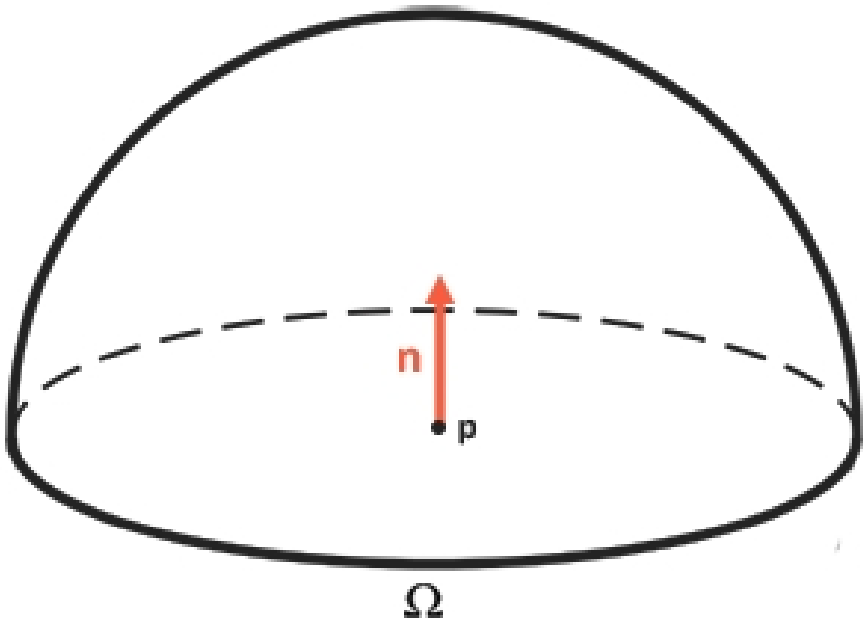

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L_0 measures the reflected sum of the lights' irradiance onto point p as viewed from ω_0.

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Perfectly smooth surface $\rightarrow BRDF = 0.0$ for all incoming light rays except the one ray that has the same (reflected) angle as the outgoing ray ω_0, $\rightarrow BRDF = 1.0$.

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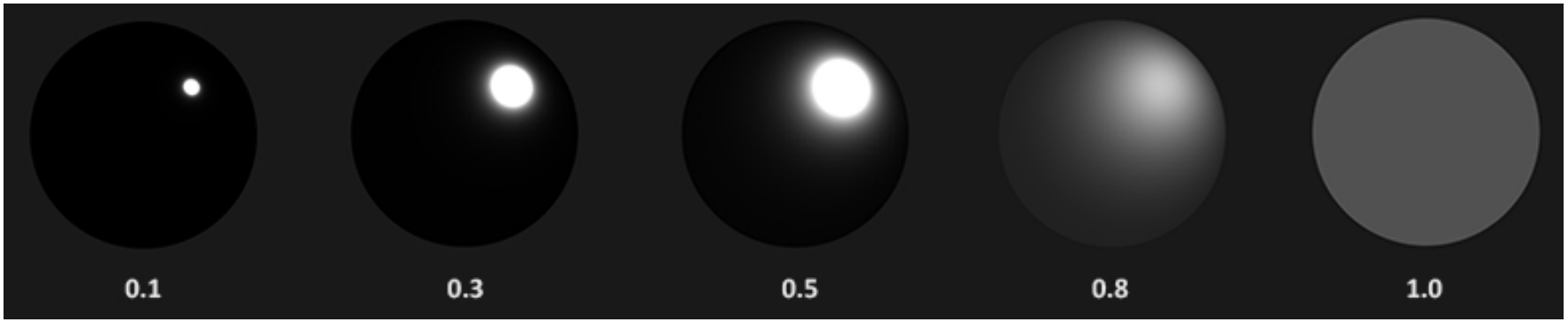
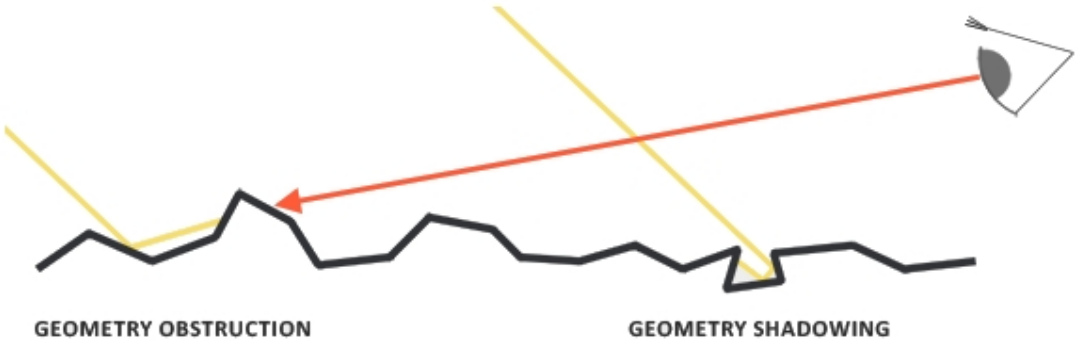
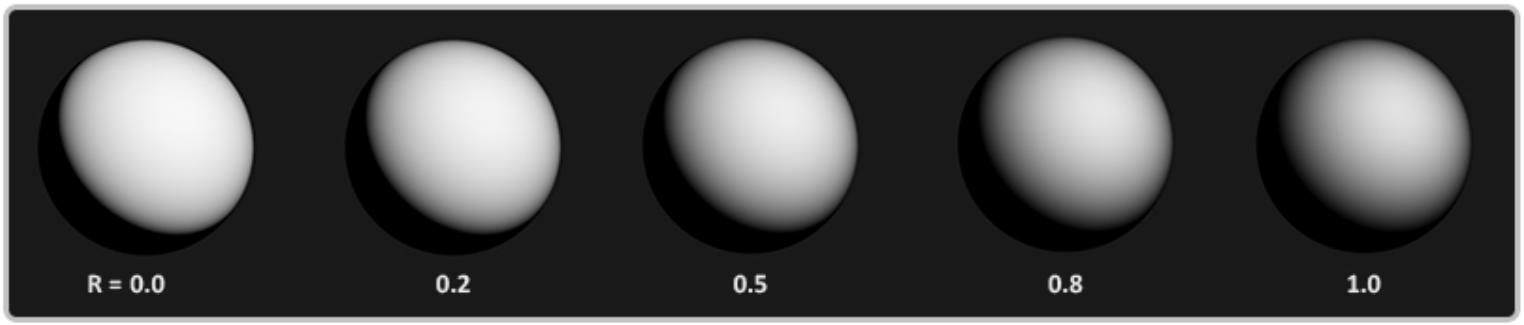
Normal Distribution



Geometry Function





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This phenomenon is known as Fresnel and is described by the **Fresnel equation**.

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