# Spectrum-Based Rendering

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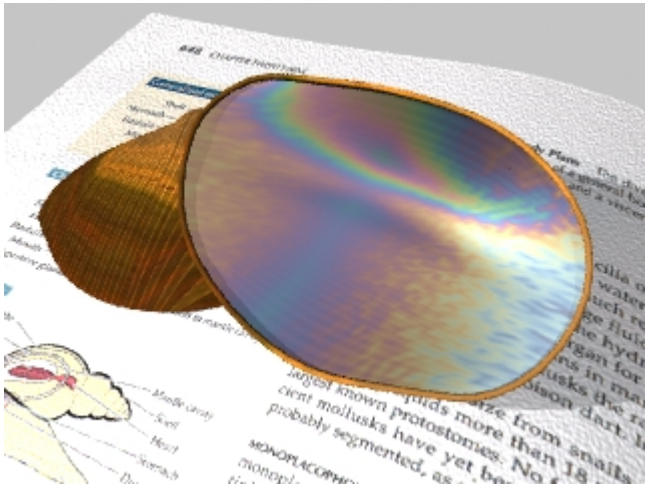
# Some Assumptions

- I nearly have no knowledge in optical theory.
  - Fourier Optics
- In fact, this presentation just provide a direction to guys who want to make “rainbow effects”.

# Outline

- Introduction
- Implementation
- Optical disk
- References



# Related terms

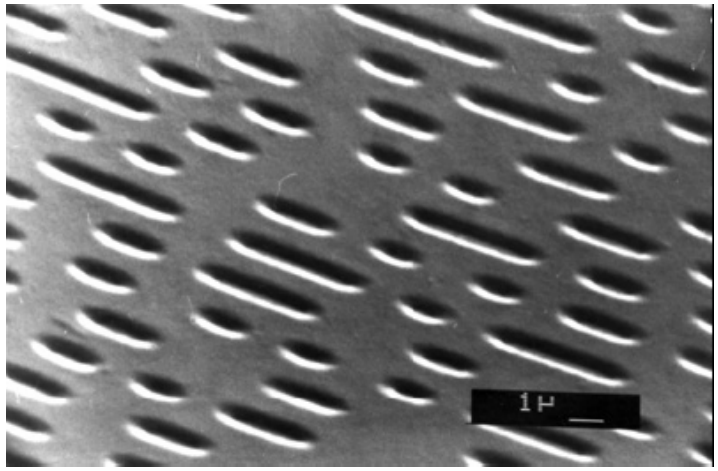
- Iridescent
- Thin-film interference
- Interference
- Diffraction
- Dispersion
- Wavelength-dependent surface interaction
- Light wave-dependent rendering

# Why this effect?

- By [Born75, Hecht98], it must satisfy two conditions.
- First, the structure must be periodic or partially periodic.
  - If a structure is totally random, the contributions due to different small pieces of the structure will cancel each other and as a result will not be observable at the macroscopic scale.
  - Similar to “aliasing” and “noise”.

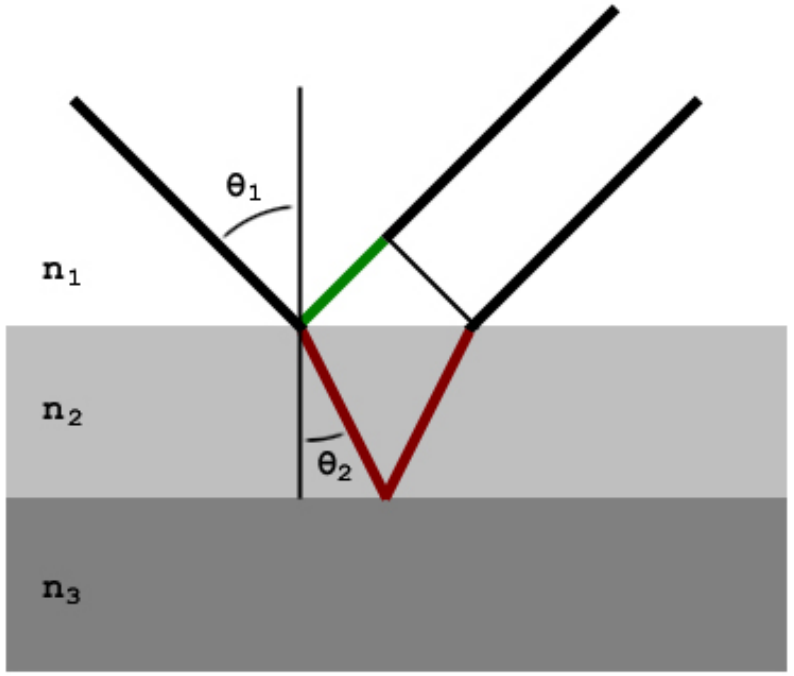
# Why this effect?

- Second, the structure's characteristic length (or periodic spacing) must be small enough so that it is comparable to the wavelengths of light.

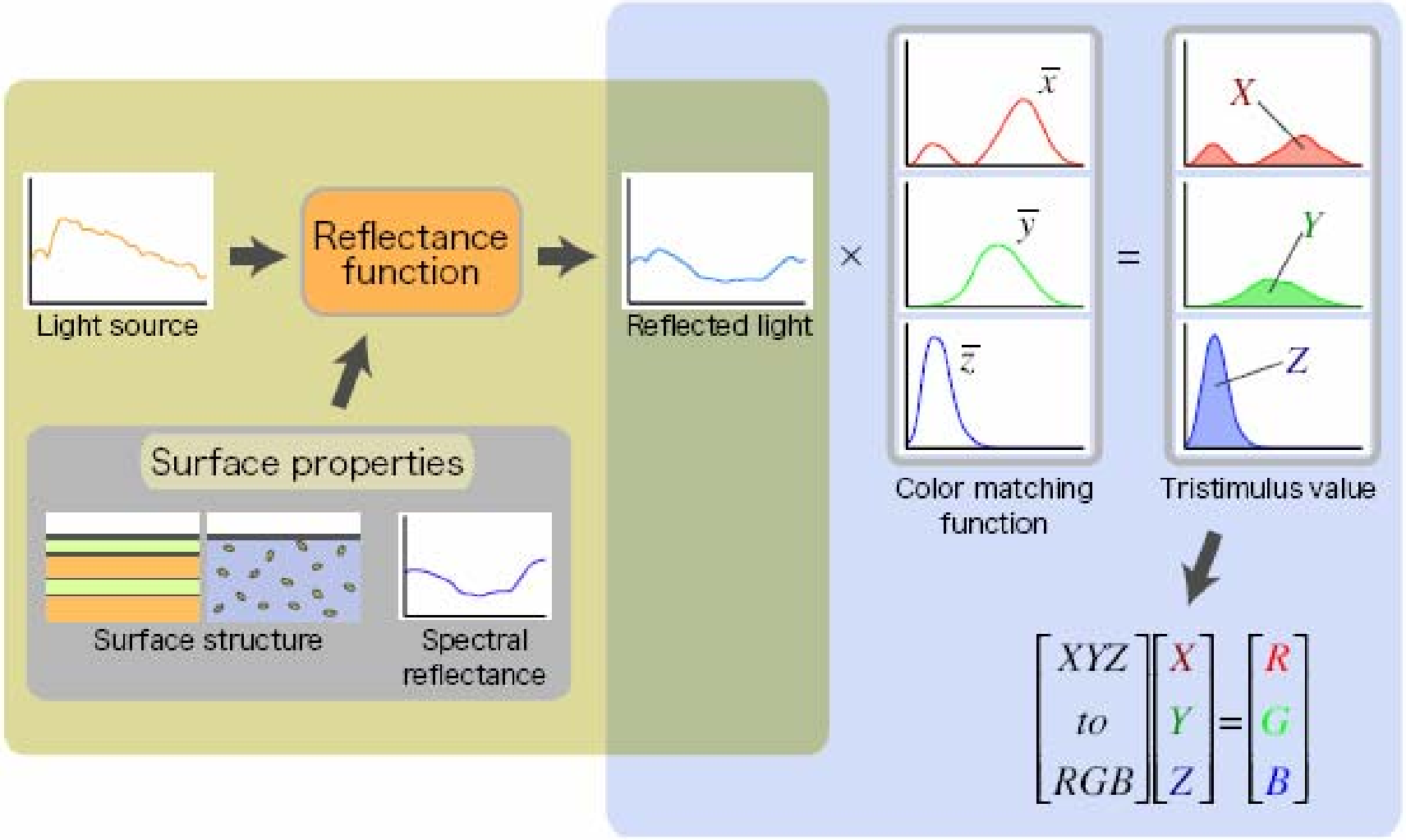


# Key factor

- How the path difference could effect the wavelength depends on how the approximate model you define.
- To modify the incident light SPD amplitude.



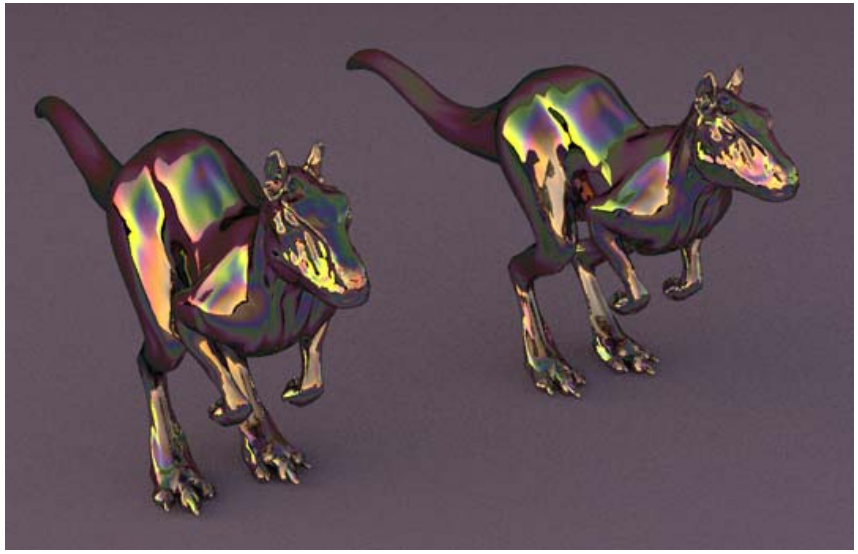
# Implementation



- To accurately simulate interference, incident light must be represented by a spectral power distribution (SPD).

# In PBRT

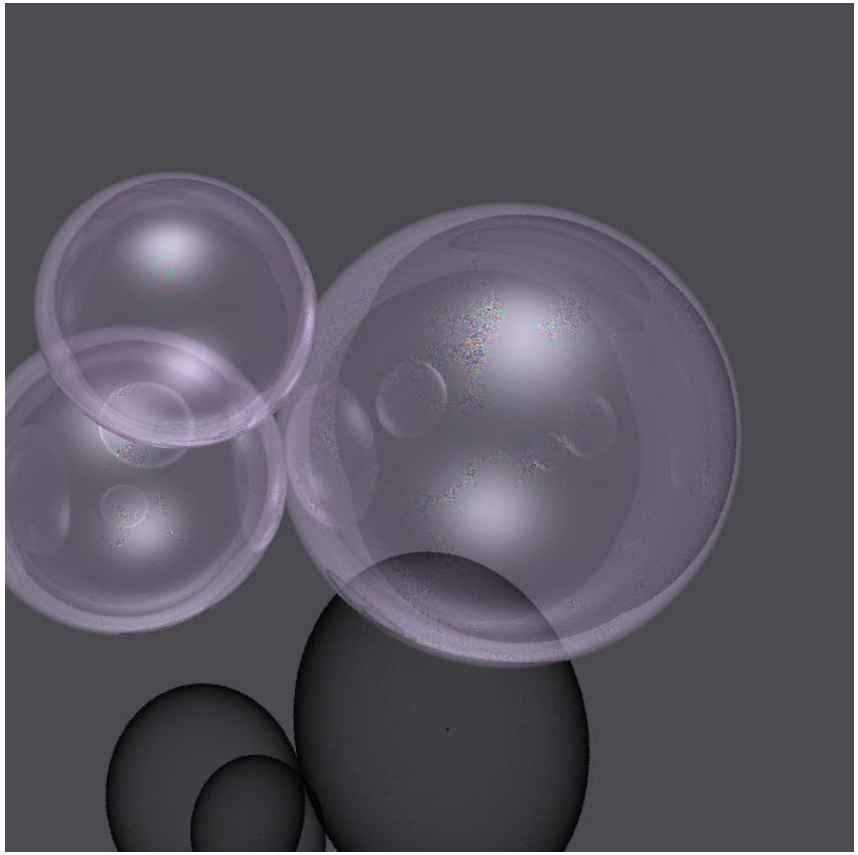
- In PBRT, light is described as c[COLOR_SAMPLES], where COLOR_SAMPLES is always 3.



- Most ray tracers work well for macroscopic objects, but when trying to render microscopic phenomena they fall short.

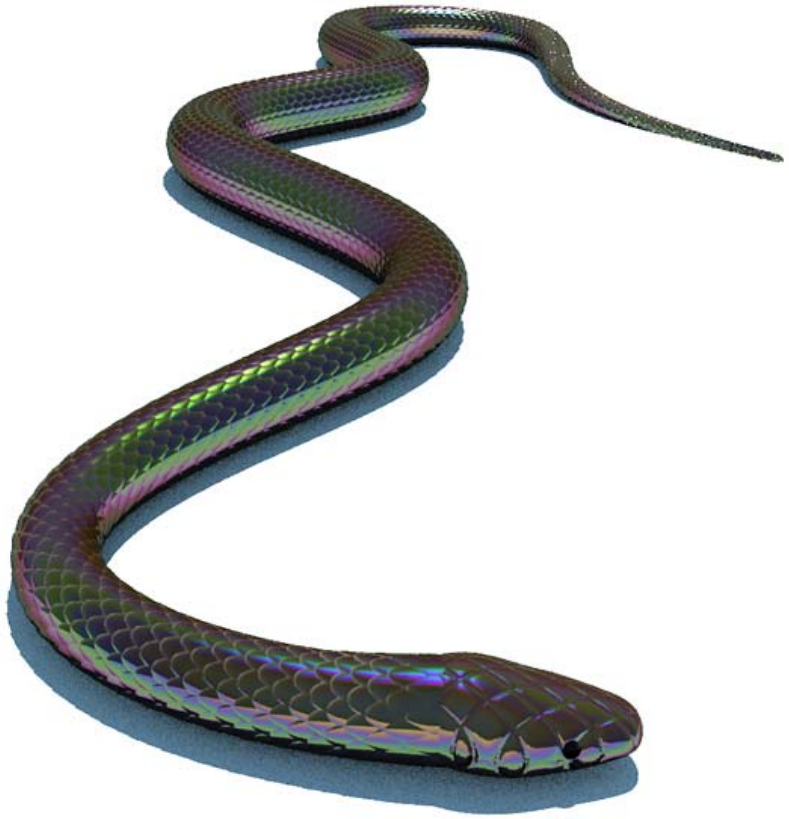
# Incident Light

- R->SPD mapping to be a box of unit height from 580 nm to 780 nm, G->SPD being a box from 500 nm to 580 nm, and B->SPD being a box from 380 nm to 500 nm.
- Use SPD tables
  - fluorescent light spectrum



# In spectrum based rendering

- Discretizing the visible spectrum by dividing the range 380nm-780nm into 5nm bins, for a total of 81 samples.
- Project to CIE XYZ.
- Mapping from CIE XYZ to RGB.

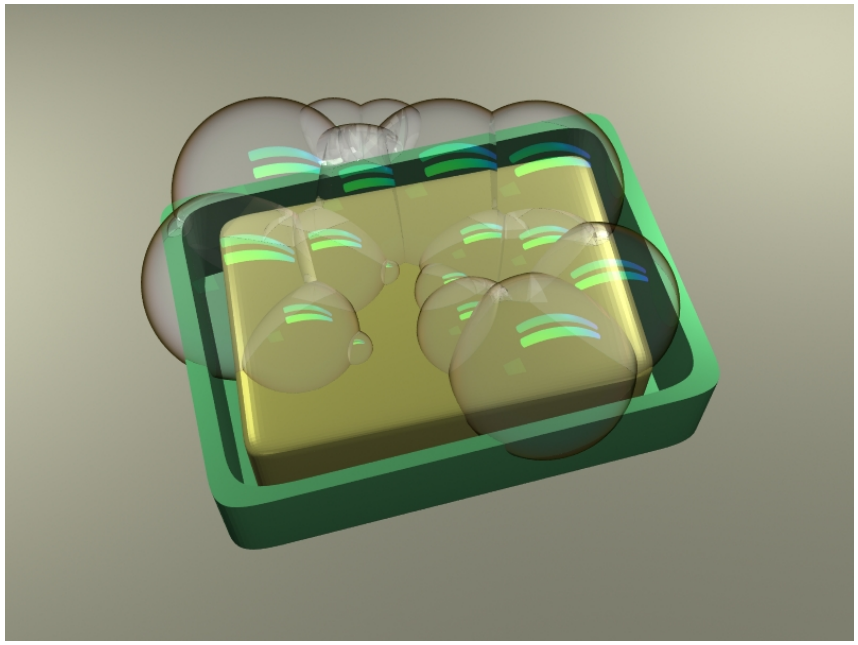


# Morpho butterfly wings

- The width of these mullions is on the order of certain light wavelengths.

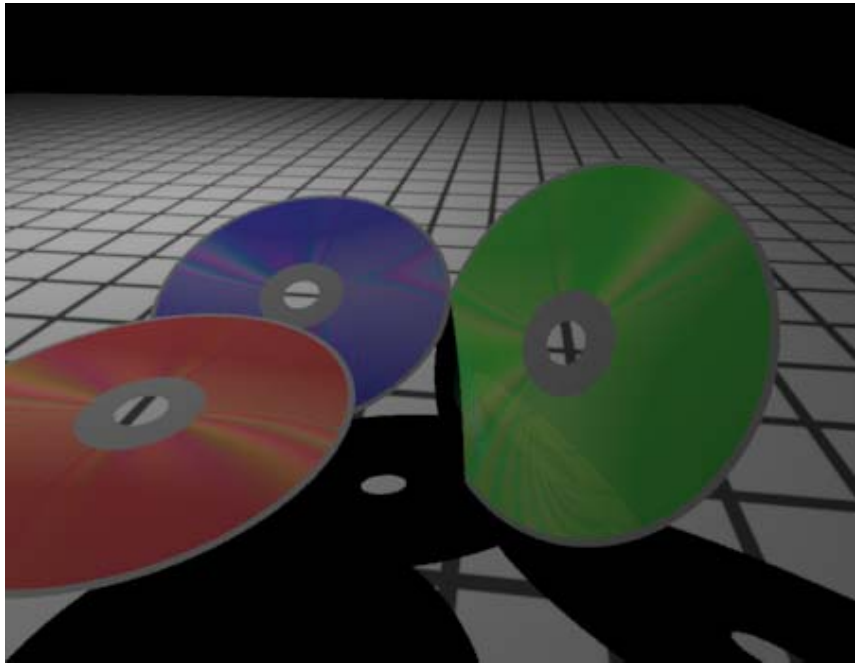
# Soap bubble

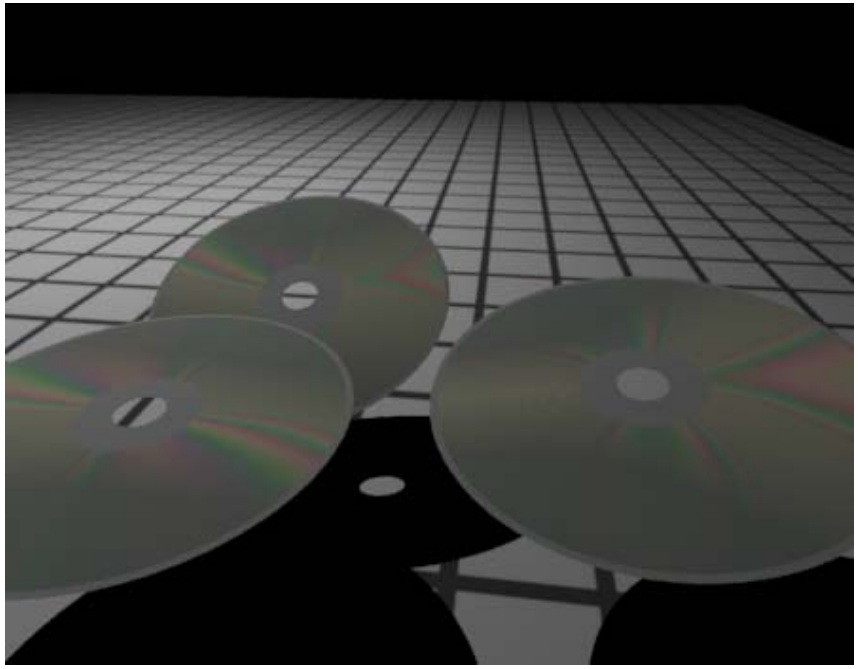
- A soap film of thickness d (useful range ~ 500 - 1000 nm)



# How to make strip effect?

- **(wi+wo)•** $\tau$ **= 0** [Sun99]





# References


- Stanford CS348B Rendering competitions.
- Sun, Yinlong, F. David Fracchia, Mark S. Drew, and Thomas W. Calvert. *Rendering Iridescent Colors of Optical Disks*. Eurographics Workshop on Rendering, pp.341-352, 2000."