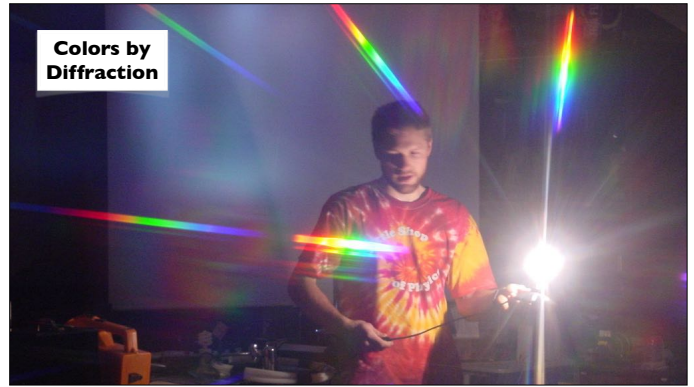


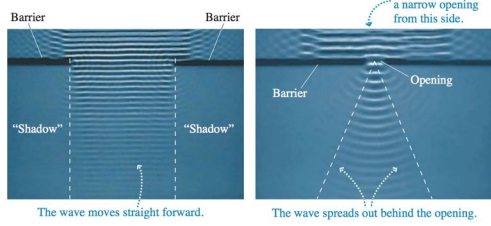


The position of the circle depends on your location.

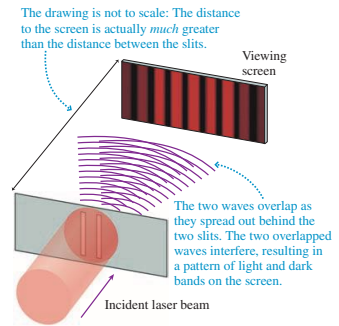


Colors by Diffraction

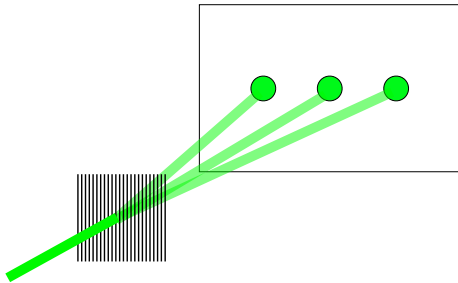
Diffraction



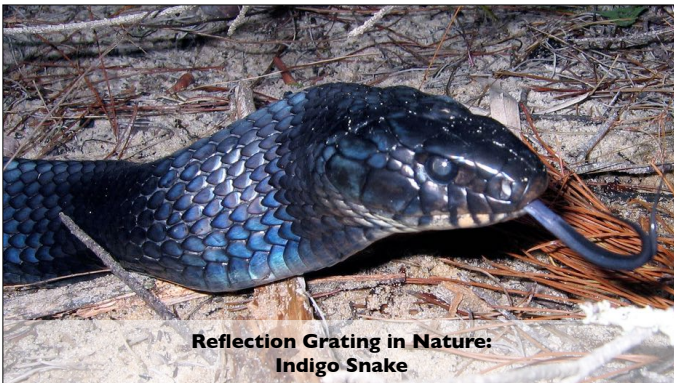
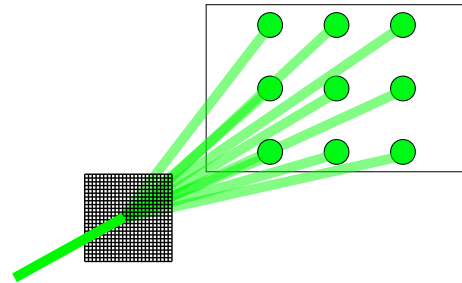
Interference



Single axis grating



Double axis grating

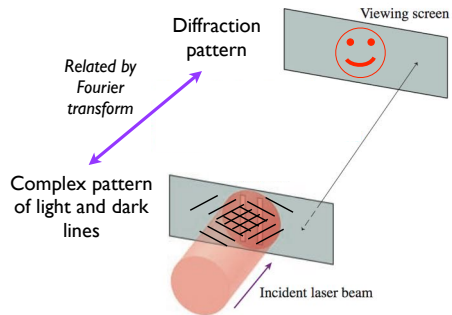


Reflection Grating in Nature:
Indigo Snake

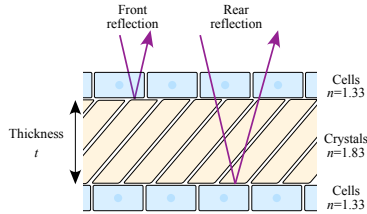


Reflection Grating in Nature:
Ground Beetle Colors

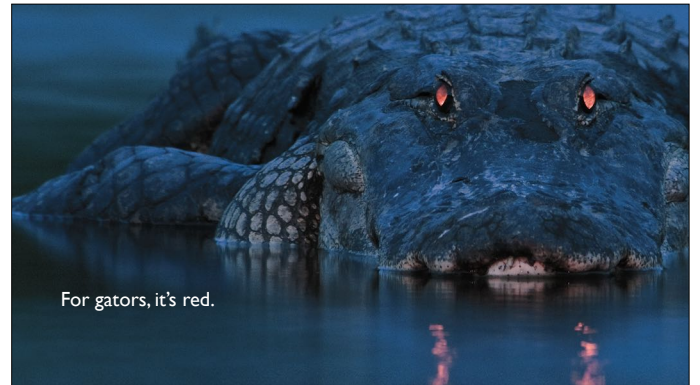
Holography



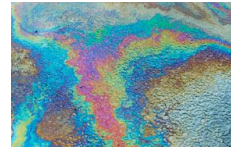
Colors by Thin-Film Interference



Constructive interference between the two waves leads to strong reflections at certain colors.



Interference Colors

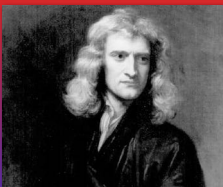


Thin-film interference

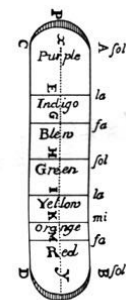
Interference occurs between the waves reflected from the two surfaces of a thin film with index of refraction n . A wave that reflects from a surface at which the index of refraction increases has a phase change.

| Interference | 0 or 2 phase changes | 1 phase change |
|--------------|---|---|
| Constructive | $2t = m \frac{\lambda}{n}$ | $2t = \left(m + \frac{1}{2}\right) \frac{\lambda}{n}$ |
| Destructive | $2t = \left(m + \frac{1}{2}\right) \frac{\lambda}{n}$ | $2t = m \frac{\lambda}{n}$ |

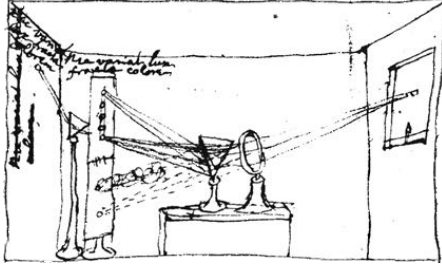
How Many Colors in the Rainbow?



Now, back to the story....



The First Experiments: Isaac Newton



Why Seven?

Newton originally had five colors:

Red
Yellow
Green
Blue
Purple



Why seven?
Correspondence with music.