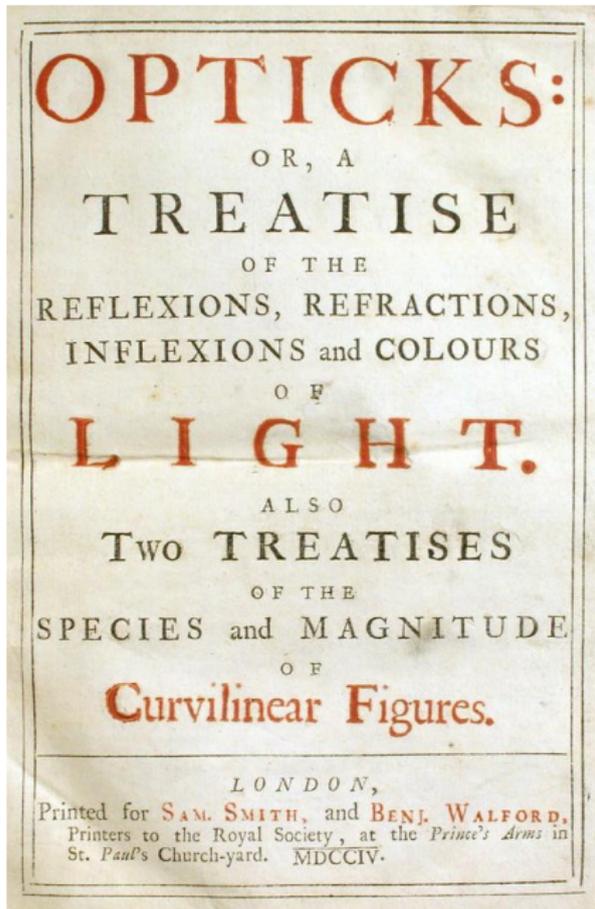


Lecture 36

Newton on Ether

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Scientific Thought I
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- *My Design in this Book is not to explain the Properties of Light by Hypotheses, but to propose and prove them by Reason and Experiments.*
- Discoveries include that white light is composed of rays of different colors.
- Concludes with “Queries.” We’ll look at some of them.

Query 18

Heat transfer through a vacuum (348–349)

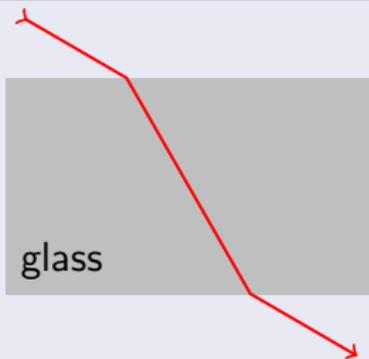
If in two large tall cylindrical Vessels of Glass inverted, two little Thermometers be suspended so as not to touch the Vessels, and the Air be drawn out of one of these Vessels, and these Vessels thus prepared be carried out of a cold place into a warm one; the Thermometer in vacuo will grow warm as much, and almost as soon as the Thermometer which is not in vacuo. And when the Vessels are carried back into a cold place, the Thermometer in vacuo will grow cold almost as soon as the other Thermometer.

Explanation (349)

Is not the Heat of the warm Room convey'd through the Vacuum by the Vibrations of a much subtler Medium than Air, which after the Air was drawn out remained in the Vacuum?

Newton called this medium “ether” (352).

Refraction of light



Light bends towards the perpendicular when it goes from a less dense to a more dense medium.

Explanation (349–350)

Doth not the Refraction of Light proceed from the different density of this Ætherial Medium in different places, the Light receding always from the denser parts of the Medium? And is not the density thereof greater in free and open Spaces void of Air and other grosser Bodies, than within the Pores of Water, Glass, Crystal, Gems, and other compact Bodies?

Internal reflection



Light inside a more dense medium is reflected at the surface if the angle is shallow enough.

Explanation (350)

When Light passes through Glass or Crystal, and falling very obliquely upon the farther Surface thereof is totally reflected, the total Reflexion ought to proceed rather from the density and vigour of the Medium without and beyond the Glass, than from the rarity and weakness thereof.

Inflection of light



Light passing near solid bodies is inflected.

Explanation (350)

Doth not this Ætherial Medium in passing out of Water, Glass, Crystal, and other compact and dense Bodies into empty Spaces, grow denser and denser by degrees . . . ? And doth not the gradual condensation of this Medium extend to some distance from the Bodies, and thereby cause the Inflexions of the Rays of Light, which pass by the edges of dense Bodies, at some distance from the Bodies?

Explanation of gravity (350–351)

Is not this Medium much rarer within the dense Bodies of the Sun, Stars, Planets and Comets, than in the empty celestial Spaces between them? And in passing from them to great distances, doth it not grow denser and denser perpetually, and thereby cause the gravity of those great Bodies towards one another, and of their parts towards the Bodies; every Body endeavouring to go from the denser parts of the Medium towards the rarer?

Newton wrote (in a letter to Richard Bentley):

It is inconceivable, that inanimate brute matter should, without the mediation of anything else, which is not material, operate upon and affect other matter without mutual contact. (xxvi)

- 1 What evidence did Newton offer for the following?
 - (a) There is an etherial medium that fills even what we would ordinarily regard as a vacuum.
 - (b) The density of this ether is greater the less matter is present in a place.
 - (c) Outside a dense body this ether is less dense close to the body than it is further away.
- 2 What did Newton suggest is the cause of gravity? According to this explanation, what is the reason why stones near the earth's surface fall? What is the reason why the planets orbit the sun?



Isaac Newton.

Opticks.

Dover, 1979.

(Numbers in parentheses are page numbers of this book.)

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