

# What is a wave?

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November 14, 2014

What is a wave? Is a wave a “thing”, or is it merely a way of speaking about pieces of stuff changing in a certain way in time? This is related to William of Ockham’s ideas about motion, that “motion” does not deserve to be thought about as a thing but merely as a convenient way of discussing the position of things at different points in time. The following are some references I assembled about waves.

Lamb [24, p. 369, §236]  
Preston [33, p. 412, §289]  
Basset [2, p. 163, §405]  
Whewell [49, Book IV]  
Whewell [50, Book VIII]  
Russo [37, p. 229]  
Crombie [9, p. 126]  
Philoponus [29, p. 149]  
De anima [17, §447]  
Einstein and Infeld [16, p. 100]  
Vitruvius [21, p. 11]  
Thagard [45, p. 39]  
Thorndike [46, p. 32]  
Pretor-Pinney [34, pp. 35, 81, 161, 269]  
Truesdell [48, p. 71] and [47, pp. CXXI–CXXIII]  
Clagett [7, p. 74]  
Hofstadter and Sander [20, p. 209],  
Sambursky [40, pp. 138–141] and [41, pp. 89, 100–104] and [39, p. 22–29]  
Needham [28, pp. 8–10]  
Beare [3, pp. 93–95]  
Hankinson [19, p. 240]

## References

- [1] Andrew Barker. *The Science of Harmonics in Classical Greece*. Cambridge University Press, 2007.
- [2] Alfred Barnard Basset. *A treatise on hydrodynamics, volume II*. Deighton, Bell and Co., Cambridge, 1888.

- [3] John I. Beare. *Greek theories of elementary cognition: from Alcmaeon to Aristotle*. Oxford University Press, 1906.
- [4] Léon Brillouin. *Wave propagation and group velocity*. Academic Press, 1960.
- [5] M. F. Burnyeat. How much happens when Aristotle sees red and hears middle C? Remarks on *De Anima* 2.7–8. In Martha C. Nussbaum and Amélie Oksenberg Rorty, editors, *Essays on Aristotle's De Anima*, pages 421–434. Oxford University Press, 1999.
- [6] Joseph C. Y. Chen. *Early Chinese Work in Natural Science: A Re-examination of the Physics of Motion, Acoustics, Astronomy and Scientific Thought*. Hong Kong University Press, 1996.
- [7] Marshall Clagett. *Greek Science in Antiquity*. Dover Publications, 2001.
- [8] H. F. Cohen. *Quantifying Music: The Science of Music at the First Stage of Scientific Revolution, 1580–1650*, volume 23 of *The University of Western Ontario Series in Philosophy of Science*. Kluwer, 1984.
- [9] A. C. Crombie. *Science, Optics, and Music in Medieval and Early Modern Thought*. Hambledon Press, London, UK, 1990.
- [10] Olivier Darrigol. *Electrodynamics from Ampère to Einstein*. Oxford University Press, 2000.
- [11] Olivier Darrigol. *Worlds of flow: A history of hydrodynamics from the Bernoullis to Prandtl*. Oxford University Press, 2005.
- [12] Olivier Darrigol. The acoustic origins of harmonic analysis. *Arch. Hist. Exact Sci.*, 61(4):343–424, 2007.
- [13] Olivier Darrigol. *A history of optics from Greek antiquity to the nineteenth century*. Oxford University Press, 2012.
- [14] Sigalia Dostrovsky. Early vibration theory: physics and music in the seventeenth century. *Arch. History Exact Sci.*, 14(3):169–218, 1975.
- [15] René Dugas. *A history of mechanics*. Dover Publications, 1988. Translated from the French by J. R. Maddox.
- [16] Albert Einstein and Leopold Infeld. *The evolution of physics*. Simon and Schuster, 1966.
- [17] Kenelm Foster and Silvester Humphries. *Aristotle's De anima in the version of William of Moerbeke, and the Commentary of St. Thomas Aquinas*. Yale University Press, 1951.
- [18] Casper Hakfoort. *Optics in the Age of Euler: conceptions of the nature of light, 1700–1795*. Cambridge University Press, 1995.

- [19] R. J. Hankinson. *Cause and explanation in ancient Greek thought*. Oxford University Press, 2001.
- [20] Douglas Hofstadter and Emmanuel Sander. *Surfaces and essences: analogy as the Fuel and Fire of Thinking*. Basic Books, 2013.
- [21] Keith J. Holyoak and Paul Thagard. *Mental leaps: analogy in creative thought*. The MIT Press, 1996.
- [22] Ian Johnston. *Measured Tones: The Interplay of Physics and Music*. CRC Press, third edition, 2009.
- [23] Frederick G. Kilgour. Vitruvius and the early history of wave theory. *Technology and Culture*, 4(3):282–286, 1963.
- [24] Horace Lamb. *Hydrodynamics*. Cambridge University Press, fourth edition, 1916.
- [25] David C. Lindberg. *Theories of Vision from al-Kindi to Kepler*. University of Chicago Press, 1976.
- [26] Neville McMorris. *The natures of science*. Associated University Presses, Cranbury, NJ, 1989.
- [27] Peter D. Miller. *Applied asymptotic analysis*, volume 75 of *Graduate Studies in Mathematics*. American Mathematical Society, 2006.
- [28] Joseph Needham. *Science and Civilisation in China, vol. IV. Physics and Physical Technology, part 1: Physics*. Cambridge University Press, 1962.
- [29] John Philoponus. *On Aristotle On the Soul 2.7–12*. Ancient Commentators on Aristotle. Bloomsbury, 2014. Translation and commentary by William Charlton.
- [30] Jean Piaget. *The Child's Conception of Physical Causality*. Kegan Paul, Trench, Trübner & Co., London, 1930.
- [31] Allan D. Pierce. *Acoustics: An Introduction to Its Physical Principles and Applications*. Acoustical Society of America, Woodbury, NY, 1989.
- [32] Thomas W. Piper. *Acoustics, Light and Heat*. George Philip & Son, London, 1880.
- [33] Thomas Preston. *The theory of light*. Macmillan and Co., London, second edition, 1895.
- [34] Gavin Pretor-Pinney. *The wavewatcher's companion*. Bloomsbury, London, 2010.
- [35] Fredric Raichlen. *Waves*. The MIT Press, 2012.

- [36] Bertrand Russell. *The Analysis of Matter*. Kegan Paul, Trench, Trübner & Co., London, 1927.
- [37] Lucio Russo. *The forgotten revolution: How science was born in 300 BC and why it had to be reborn*. Springer, 2004. Translated from the Italian by Silvio Levy.
- [38] A. I. Sabra. *Theories of Light: From Descartes to Newton*. Cambridge University Press, 1981.
- [39] Samuel Sambursky. *Physics of the Stoics*. Routledge and Kegan Paul, London, 1959.
- [40] Samuel Sambursky. *The physical world of the Greeks*. Routledge and Kegan Paul, London, second edition, 1960. Translated from the Hebrew by Merton Dagut.
- [41] Samuel Sambursky. *The physical world of late antiquity*. Routledge and Kegan Paul, London, 1962.
- [42] Alan E. Shapiro. Kinematic optics: a study of the wave theory of light in the seventeenth century. *Arch. Hist. Exact Sci.*, 11(2/3):134–266, 1973.
- [43] John N. Shive and Robert L. Weber. *Similarities in physics*. John Wiley & Sons, New York, 1982.
- [44] Paul Thagard. *Conceptual Revolutions*. Princeton University Press, 1992.
- [45] Paul Thagard. *Computational Philosophy of Science*. The MIT Press, 1993.
- [46] Lynn Thorndike. *A history of magic and experimental science, vol. II*. Columbia University Press, 1923.
- [47] Clifford Truesdell. *Leonhardi Euleri Opera omnia, series II, volumen 12: Rational Fluid Mechanics, 1687–1765*. Orell Füssli, Zürich, 1954.
- [48] Clifford Truesdell. The mechanics of Leonardo da Vinci. In Clifford Truesdell, editor, *Essays in the History of Mechanics*, pages 1–83. Springer, 1968.
- [49] William Whewell. *The philosophy of the inductive sciences, vol. I*. John W. Parker, London, second edition, 1847.
- [50] William Whewell. *History of the inductive sciences from the earliest to the present time, vol. II*. D. Appleton and Company, New York, third edition, 1870.
- [51] E. T. Whittaker. *History of the Theories of Aether and Electricity: From the Age of Descartes to the Close of the Nineteenth Century*. Longmans, Green, and Co., London, 1910.
- [52] Augustine Ziggelaara. How did the wave theory of light take shape in the mind of Christiaan Huygens? *Ann. Sci.*, 37(2):179–187, 1980.

- [53] J. B. Zirker. *The Science of Ocean Waves: Ripples, Tsunamis, and Stormy Seas*. Johns Hopkins University Press, 2013.