**Scrambled Science**: By 1900 physicists were convinced that light was a wave. New experimental evidence has caused physicists to change their minds. What was this evidence and how did it break the old model?

Below are examples of theoretical and experimental work that you might want to refer to. (All of the people mentioned, received Nobel Prizes for this work.)

* Which of the following facts are irrelevant to the question?
* Which give the strongest support to your argument? In what order should you use them?
* Use some of these to support a well-organized answer of fewer than 50 words.

1. By 1887 Michelson-and Morley had shown that there was no aether – no medium to carry light. P
2. In 1901 Planck explained black body radiation by supposing that the energy was emitted in packets of energy, where E = hf. P, but very hard to explain
3. In 1905 Einstein explained that the photoelectric effect showed that light was acting like a particle with an energy of E = hf. P
4. In 1913 Bohr introduced his model of electrons in distinct energy levels in hydrogen atoms. Not directly relevant
5. In 1914 Millikan’s experiments confirmed Einstein’s photon model of the photoelectric effect.
6. In 1923 the Compton Effect showed that light quanta collided with electrons, conserving energy and momentum just like two billiard balls colliding. P (hard to explain, most convincing to physicists at the time)
7. In 1924, de Broglie predicted that electrons have a wavelength = h/p. Not directly relevant
8. In 1927 de Broglie’s formula was confirmed by Thompson and Davisson by showing electron interference with crystal as diffraction gratings. Not directly relevant
9. By 1940 reliable single photon detectors were developed. **P, easiest to understand**
10. In 1961 the double slit experiment was performed with electrons. Not directly relevant

The simplest evidence that light is not a wave comes from single photon detectors where light arrives at a specific location and time. Similar evidence comes from black body radiation, no aether and the photoelectric and Compton effects. This wave-particle duality is also shown by electrons.

46 words