why

$\epsilon = h\upsilon$?

In memory of Max Planck

Complied by:

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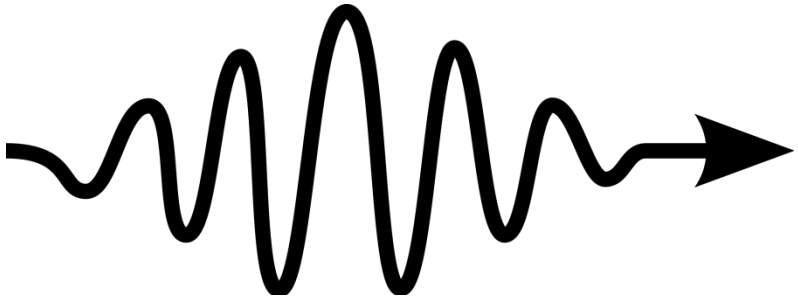
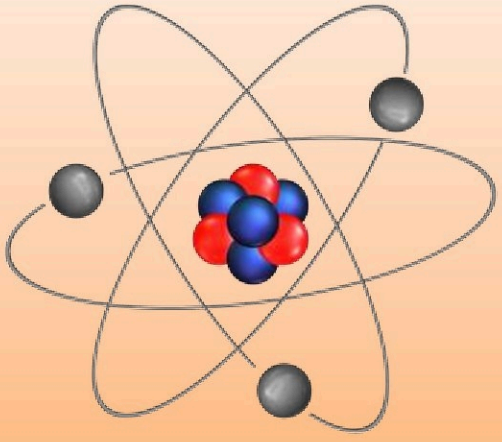
"New scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it."



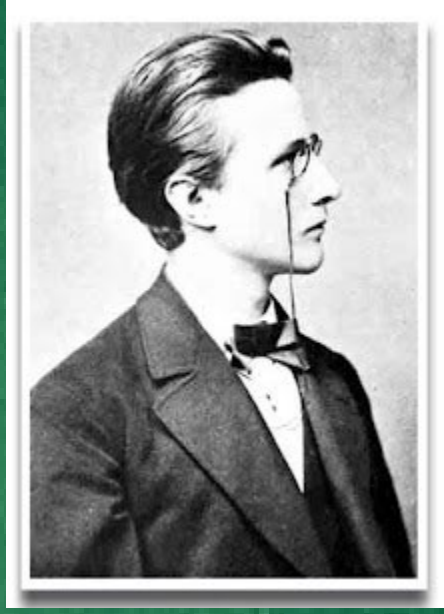
$$E = h\upsilon$$

- E = Energy
- h = Planck's constant
- υ = frequency

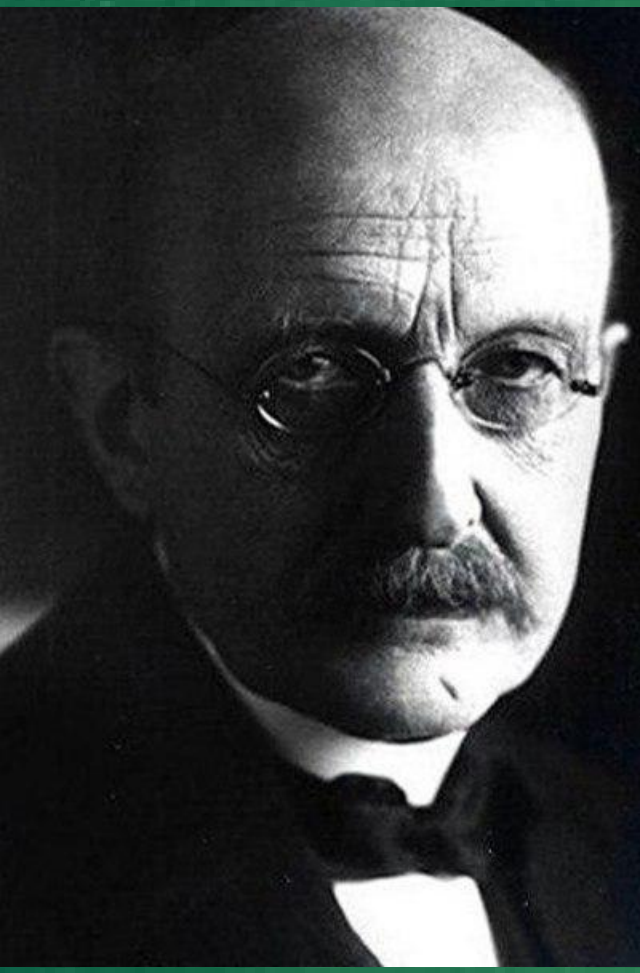


which is a fundamental equation in quantum mechanics

$$E = h\upsilon$$



This equation says that the energy carried by light which has NO REST MASS is equivalent to **Planck's constant** multiplied by its frequency. Thus, it accounts for the **quantized nature of light** and plays a key role in understanding phenomena such as the photoelectric effect and black-body radiation.

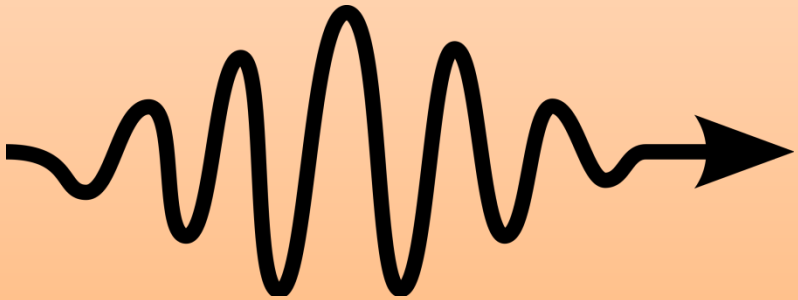


SCIENCE CANNOT SOLVE THE ULTIMATE MYSTERY OF NATURE. AND THAT IS BECAUSE, IN THE LAST ANALYSIS, WE OURSELVES ARE A PART OF THE MYSTERY THAT WE ARE TRYING TO SOLVE.

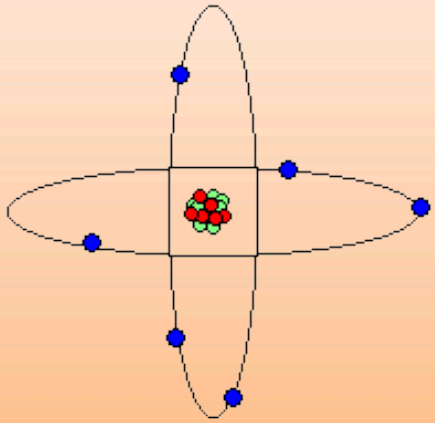
- Max Planck

$$h = 6.6260755 \times 10^{-34}\ J{\cdot}s$$

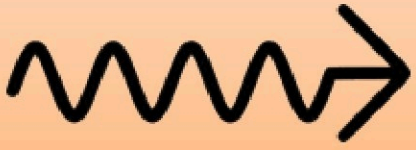
Because **Planck's constant** is very small, the frequency of the light is always greater than its energy. And some say the only thing that quantum mechanics has going for it, in fact, is that it is unquestionably correct. Since the **Planck's constant** is very small, quantum mechanics is for little things.



The birth of quantum mechanics is commonly attributed to the discovery of this equation

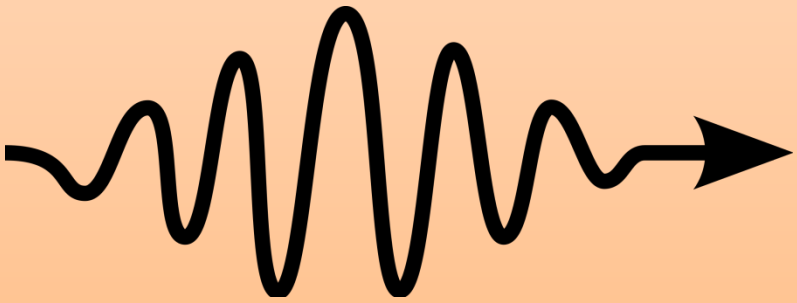


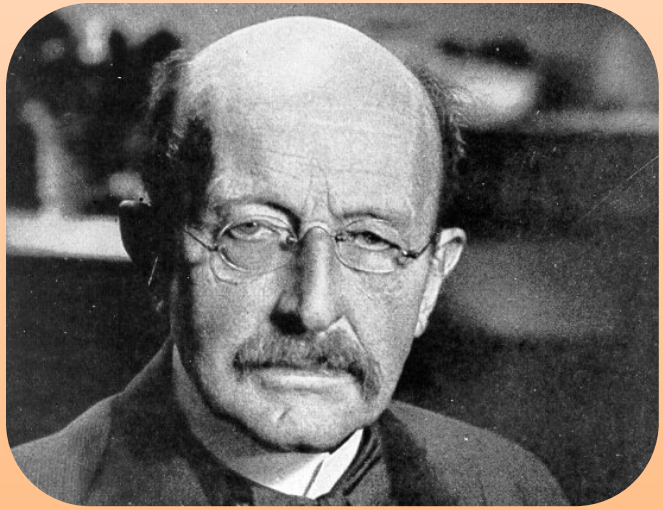
$$E = h\upsilon = hc/\lambda$$

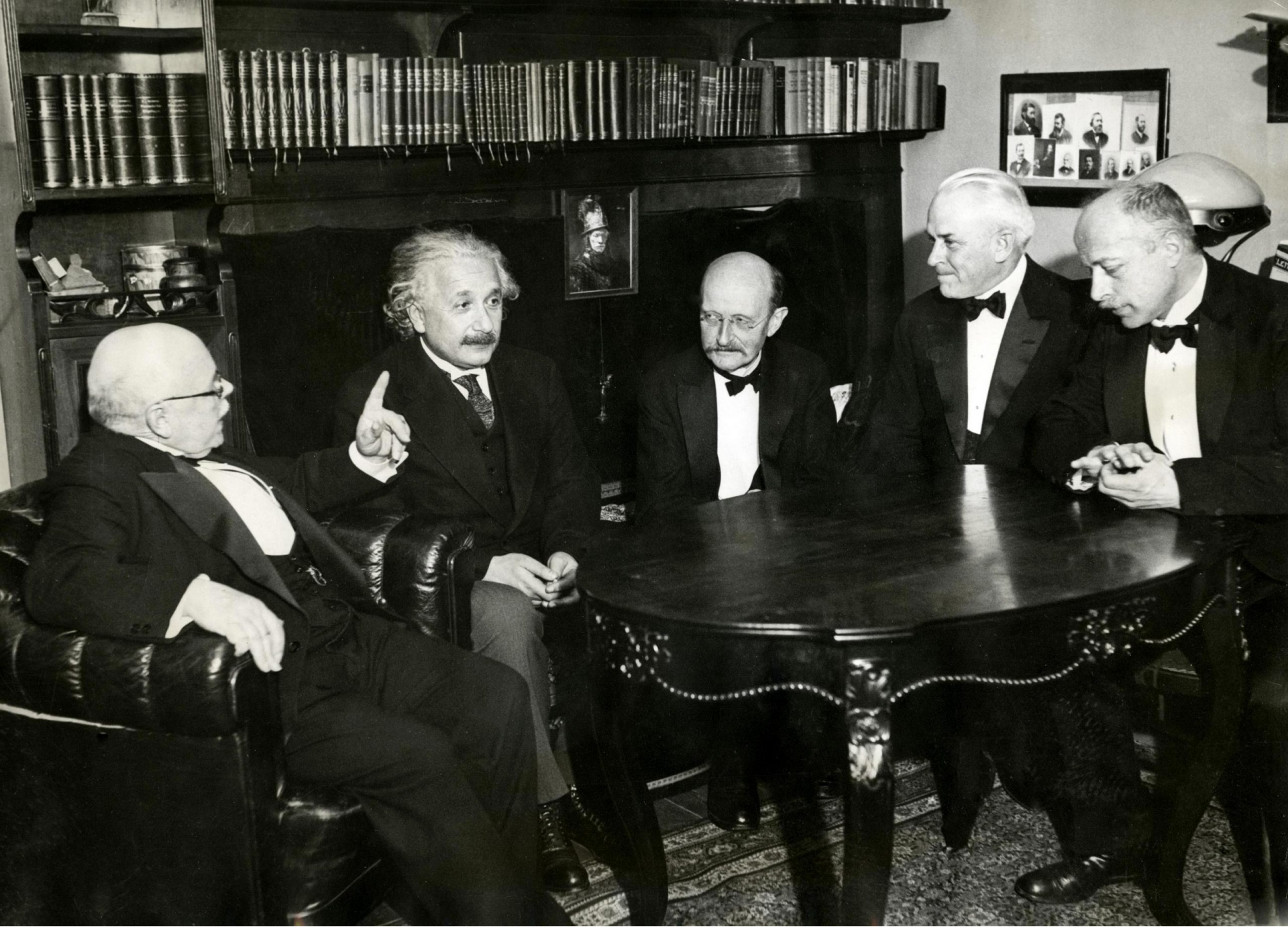


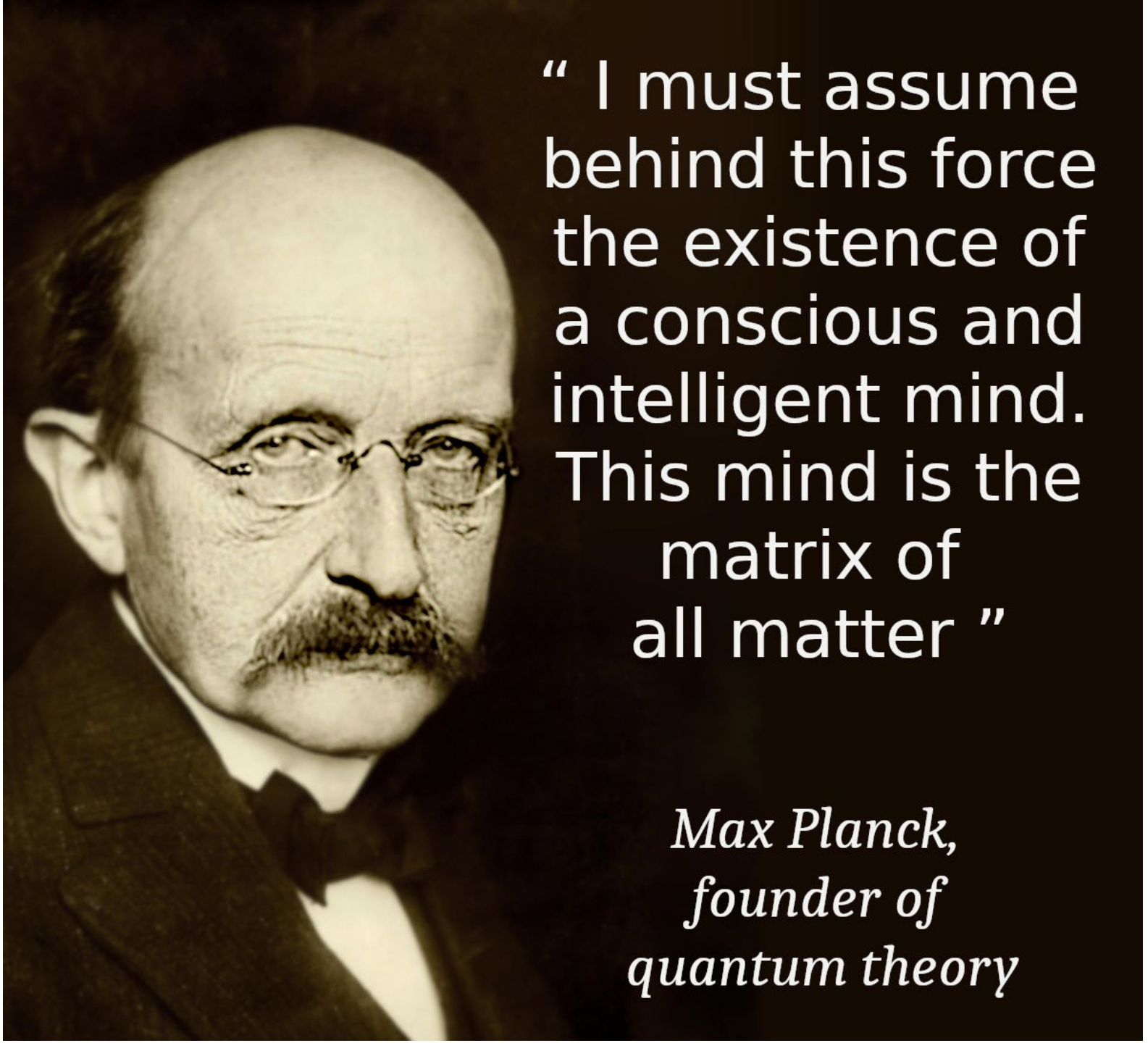
The energy will increase to infinity if the wavelength gets close to zero.

Typically one is given the wavelength of the light. It is then necessary to use this equation to convert the wavelength to energy. The **radical implication** of this equation is that light with low frequency possess lower energy than light with high frequency.

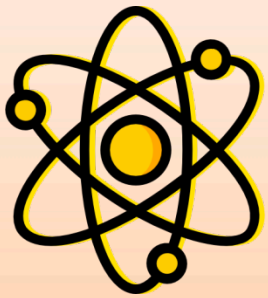




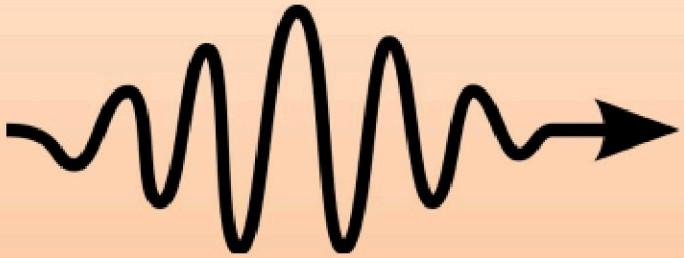


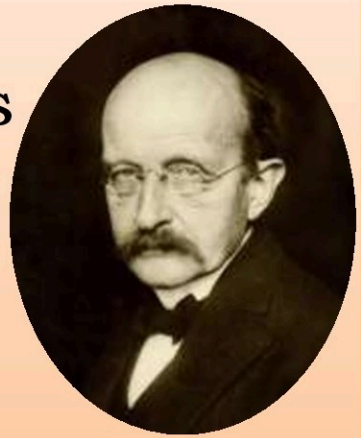

“ I must assume behind this force the existence of a conscious and intelligent mind. This mind is the matrix of all matter ”
Max Planck, founder of quantum theory

$E = h\upsilon$



$h = 6.6260755 \times 10^{-34}\ J{\cdot}s$

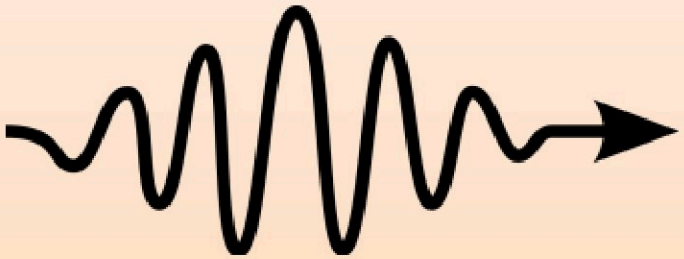




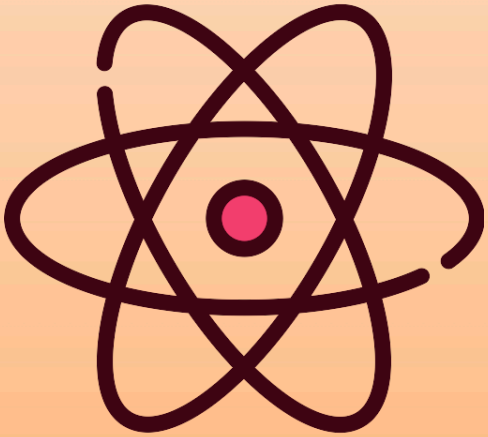
Quantum mechanical effects are too minute and unnoticeable for macroscopic objects

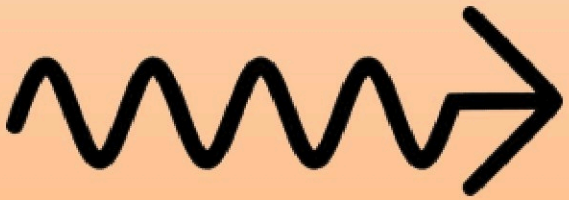
Energy is Planck's constant times frequency

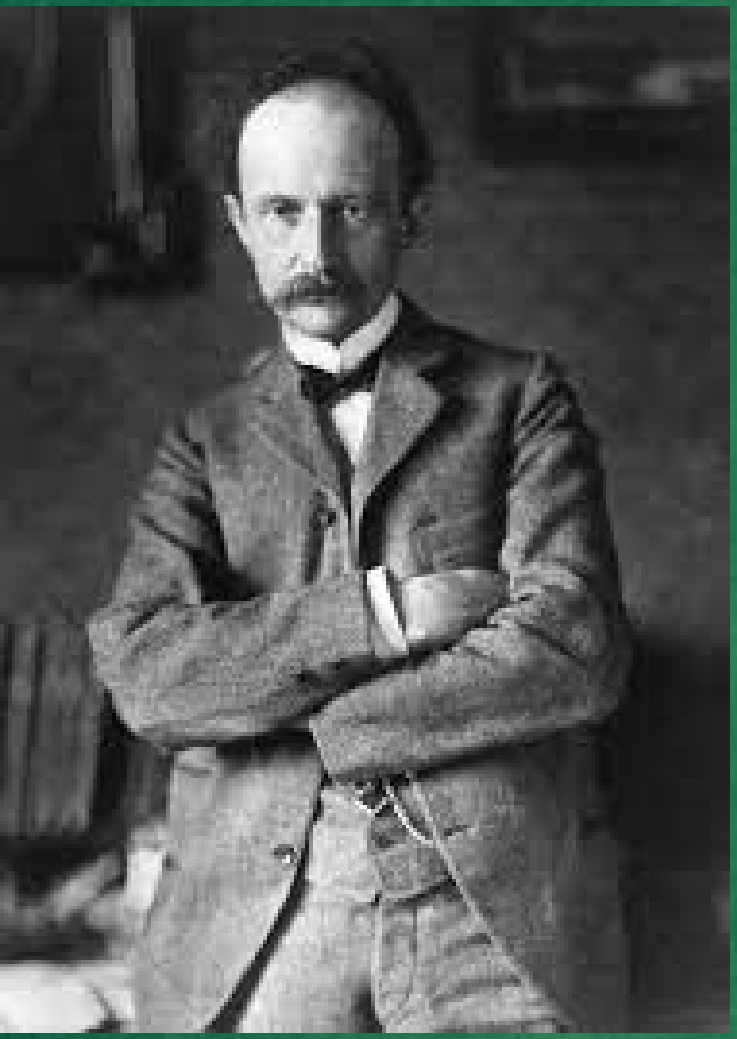
As frequency increases, energy increases



The entire **electromagnetic spectrum** — from radio waves to gamma rays, most of the light in the universe — resembles nothing but transverse waves of energy $E = h\upsilon$, which in turn are vibrating Maxwell force fields differing only in their wavelength.







Max Planck's thesis work on the second law of thermodynamics ultimately became the basis of the research that led him to discover an equation which introduced the fundamental concept of energy discreteness into physics - now known as Planck's equation which transfigured our understanding of atomic and subatomic processes, just as Albert Einstein's theory of relativity transfigured our understanding of space and time.