

# Will the quantum mechanical waves of equal de Broglie wavelength of the electrons and protons interfere in the double slit experiments?

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## ABSTRACT

In a recent paper, titled “Explanation for the observed wave-particle-duality of Light” (Tank, H.K. <http://vixra.org/abs/1402.0153>, 2014) it was explained that: “Since at very high frequencies, narrowband filtering and generation of purely monochromatic light of one Hertz bandwidth is not yet technically possible, there has been quite a wide bandwidth of waves involved, in the double slit experiments and photoelectric experiments performed so far. And since this wide ‘band’ of waves coherently add only at discrete points in space and time, we get ‘particles’ at the detectors.” Now, to further confirm the validity of this explanation, a new kind of experiment is proposed here, in which protons and electrons are accelerated at appropriate velocities  $v_p$ ,  $v_e$ , such that their de Broglie wavelengths are equal; i.e.  $(h / m_p v_p) = (h / m_e v_e)$  and let them pass through closely spaced slits so that they can interfere with each other. Similarly, in another experiment, their wave-functions:  $A \exp i ( k_p X - \omega_p t ) = A \exp i ( k_e X - \omega_e t )$ , and let them pass through closely spaced slits, and see how the two matter-waves interfere.

**Key Words:** Quantum mechanics, Matter waves, de Broglie Wavelength, Double-slit-particle-interference-experiments.

## Introduction:

It was discussed in an article titled: “Expressing energy-momentum four-vector of the Special Relativity in terms of Waves” (Tank, H. K. *Physics News* 1998: pp 136-138, <https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnc0aGV1bHRpbWF0ZXJlYWxpdiHlzaXRlfGd4OjRiOTQ2NWJmY2FkZTU0ZGY>) that de Broglie’s matter-waves are actually envelope-variations of superimpositions of the two Doppler-shifted-waves at the velocity  $v$ , of the original waves of frequency  $hf = m_0 c^2$ . The physically real waves are of the frequency  $f = m_0 c^2 / h$ . They are these physically-real Doppler-shifted waves which interfere in the double-slit-particle-interference experiments. Then in a recent paper, titled “Explanation for the observed wave-particle-duality of Light” (Tank, H.K. <http://vixra.org/abs/1402.0153>, 2014) it was explained that: “Since at very high frequencies, narrowband filtering and generation of purely monochromatic light of one Hertz bandwidth is not yet technically possible, there has been quite a wide bandwidth of waves involved, in the double slit experiments and photoelectric experiments performed so far. And since this wide ‘band’ of waves coherently add only at

discrete points in space and time, we get localized wave-packets, in the form of ‘particles’, at the detectors.” Now, to further confirm the validity of this explanation, a new kind of experiment is proposed here, in which protons and electrons are accelerated at appropriate velocities  $v_p$   $v_e$ , such that their de Broglie wavelengths are equal; i.e.  $(h / m_p v_p) = (h / m_e v_e)$  and let them pass through closely spaced slits so that they can interfere with each other. Similarly, in another experiment, their wave-functions are made equal, i.e.:  $A \exp i ( k_p X - \omega_p t ) = A \exp i ( k_e X - \omega_e t )$ , and let them pass through closely spaced slits, and see how the two matter-waves interfere.

### **Prediction and Insight:**

Based on the insight emerged from the previous papers, we can predict that: in the proposed experiment the detector will detect both more electrons and more protons at the interference-maxima; and nothing un-usual; because, de Broglie’s matter-waves are only ‘*envelop-variations*’ of the more-fundamental-waves of frequency,  $f = m_0 c^2 / h$ . The interpretation of de Broglie’s waves, emerging from this discussion, is different from the ‘probabilistic interpretation’ proposed by Max Born, known as Copenhagen Interpretation of quantum mechanics.