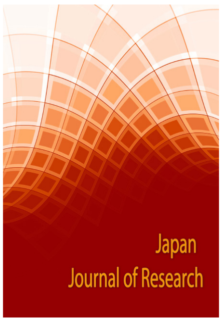
Japan Journal of Research

Perspective



Redeeming Albert Einstein in Debates with Niels Bohr Regarding Wave-Particle Duality and Restoring Objectivity to Science

Sarma N Gullapalli

Independent Researcher, Warwick, Rhode Island, USA

Correspondence
Sarma N Gullapalli
Independent Researcher, Warwick, Rhode Island, USA

Abstract

To explain Young's Double Slit Experiment Niels Bohr postulated his Complementarity Principle according to which if the observation is for interference pattern the particle will change to wave. Albert Einstein had objected: how can inanimate particle know what the observation is about? Experiments have confirmed Bohr's Complementarity Principle. Upon investigation, the author was able to explain all experiments without invoking Complementarity Principle, using only coherence and alignment considerations. This research recently culminated in revolutionary finding by the author, that particle always remains particle and its wave function always remains wave, no mysterious change from particle to wave or vice-versa and published a paper in the Journal of High Energy Physics and Cosmology (JHEPGC), 9, 596 – 601, widely acclaimed by readership and reviewers. It restores objectivity to science and opens new vistas of research developing new concepts, advancing science.

- Received Date: 13 Mar 2024
- Accepted Date: 19 May 2024
- Publication Date: 23 May 2024

Redeeming Albert Eistein

Who was correct about wave-particle duality? Niels Bohr or Albert Einstein?

Niels Bohr was correct, Albert Einstein was also correct
1925 Photograph by Ehrenfest (Wikipedia)

Wave Particle Duality: Particle Always Remains Particle and Its Wave Function Always Remains Wave

The Revolutionary Finding

Divisible Wave Function follows all probable paths, defining probability for each, while the indivisible particle follows only one path, as illustrated in Figure 1 for reflection and transmission and for Young's Double Slit Experiment, the subject of Niels Bohr – Albert Einstein debates on Wave – Particle Duality.

In the case of beam splitter, there are two potential paths that the photon can take: reflected path with probability r and transmitted path with probability t, probabilities r and t determined by the physics of interaction of the photon with the surface – for reflected path as if the photon was reflected and for transmitted path as if photon was transmitted. In the case of Young's Double Slit Experiment, when a single photon is incident on the screen with two slits, there are two potential paths, one through each slit. In the path through the upper slit

Citation: Gullapalli SN, Redeeming Albert Einstein in Debates with Niels Bohr Regarding Wave-Particle Duality and Restoring Objectivity to Science. Japan J Res. 2024;5(3):024

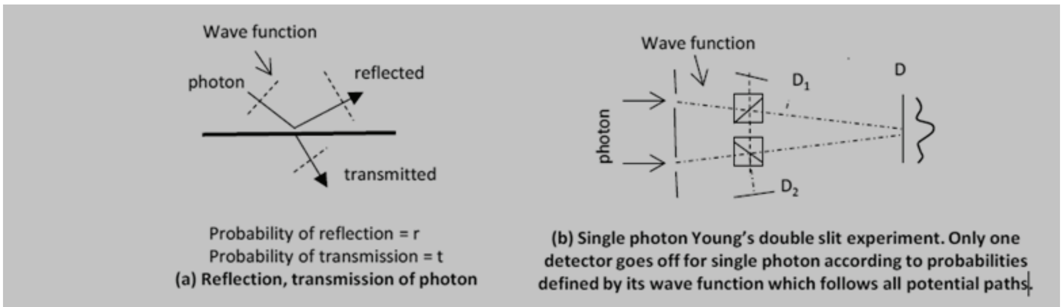


Figure 1. Indivisible particle follows only one path, its divisible wave function follows all paths.

***Figure 1**. The vaporization temperature for both H_2O and CO_2 as a function of pressure (the solid curves). X marks the critical conditions of these materials. The short-dashed lines indicate the pressure-temperature conditions (beyond the critical points) at which the 'dense' supercritical H_2O and CO_2 exist. The long-dashed lines indicate the possible routes that dense supercritical H_2O-CO_2 mixture and/or liquid H_2O-CO_2 mixture may precipitate on the Earth's surface from its proto-atmosphere after accretion. Mars total atmospheric pressure of both H_2O and CO_2 right after accretion and solidification is too small to shown in the present scale (indicated by an arrow along the vertical axis). At such a low pressure, H_2O and CO_2 would act rather independently except possibly for forming some HCO_{3-}. Thus, H2O degassed from Mars would condense directly to form an ocean when Mars surface cooled down below 100°C, leaving behind CO_2 in the proto-atmosphere.*

there is a beam splitter with two potential paths, one reflected and one transmitted. Likewise for the path through lower slit. Divisible wave function of the single incident photon follows all potential paths, defining probabilities for each potential path. Experimental results have shown that when a single photon is incident, only one detector goes off, either D1 or D2 or a single detector D in the array at the final screen. That is, the indivisible particle follows only one of the potential paths according to probability. When successive single particle are incident, the statistics of the counts at detectors D1, D2 and those in array D are the probabilities defined by the wave function for each of them; the complex probability amplitude is the vector sum of complex probability amplitudes of wave function components reaching through both slits, and if the coherence length and corresponding coherence time are larger than path difference, and are sufficiently aligned in direction and polarization, a stable interference pattern is observed at array D, no mysterious change from particle to wave or vice-versa.

Conflict of interest

The author declares no conflicts of interest regarding the publication of this paper.

References

1. Wheeler JA, Zurek WH. Quantum Theory and Measurement. Princeton University Press, Princeton, 1984;183.
2. Jacques V, Wu E, Grosshans F, et al. Experimental realization of Wheeler's delayed-choice gedanken experiment. Science. 2007;315(5814):966-968. doi:10.1126/science.1136303
3. Kim YH, Yu R, Kulik SP, Shih Y, Scully MO. Delayed "Choice" quantum eraser. Phys Rev Lett. 2000;84(1):1-5. doi:10.1103/PhysRevLett.84.1
4. Ma XS, Kofler J, Qarry A, et al. Quantum erasure with causally disconnected choice. Proc Natl Acad Sci U S A. 2013;110(4):1221-1226. doi:10.1073/pnas.1213201110
5. Einstein A, Podolsky B, Rosen N. Can Quantum-Mechanical Description of Physical Reality Be Considered Complete? Physics Review. 1935;47:777-780. Doi: https://doi.org/10.1103/PhysRev.47.777
6. Gullapalli SN. Explaining Duality, the Only Mystery of Quantum Mechanics, without Complementarity or "Which Way" (Welcher-Weg). Proceedings of International Conference on Quantum Mechanics and Applications , Atlanta, 20-21July 2018. https://vixra.org/quant/1712.0558
7. Dicke RH. Interaction-Free Quantum Measurements: A Paradox? American Journal of Physics. 1981;49, 925-930. https://doi.org/10.1119/1.12592
8. Angelo RM. On the Interpretive Essence of the Term "Interaction-Free Measurement": The Role of Entanglement. Foundations of Physics. 2008;39, 109-119
9. Elitzur AC, Vaidman L. Quantum Mechanical Interaction-Free Measurement. Foundations of Physics. 1993; 23, 1-14.
10. Vaidman L. The Meaning of the Interaction-Free Measurements. Foundations of Physics. 2003;33:491-510. https://doi.org/10.1023/A:1023767716236
11. Kwiat PG, White AG, Mitchell JR, et al. High-Efficiency Quantum Interrogation Measurements via the Quantum Zeno Effect. Physical Review Letters. 1999;83, 4725-4728. Doi: https://doi.org/10.1103/PhysRevLett.83.4725