Comment on "First order ether drift experiment" [Phys. Essays 23 , 473 (2010)]

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Abstract This is a comment on Wang's first order ether drift experiment [Phys. Essays **23**, 473 (2010)] that reconfirmed the Michelson-Morley experiment, in which the conclusion was "the ether is at rest with regard to the earth's surface." Wang's experiment directly observed the ether drift velocity with regard to the earth's surface.
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1. Introduction

In 2010, Wang[1] published very interesting as well as important paper titled "first order ether drift experiment," in which he directly observed the ether drift velocity. The earth's spin velocity at Tennessee (which is at the latitude of 35.18°) was expected to be 0.38 km/s. The experimentally measured velocity was reported to be 0.30 ± 0.94 km/s (the statistical error was 0.94 km/s). Wang assumed stationary ether, therefore concluded that "The data have shown an unquestionable null result."

Let us make the ether clear. In the treatise, Maxwell[2] described "We have now to shew that the properties of electromagnetic medium are identical with those of the luminiferous medium." (Maxwell[2], p. 431) Thereafter "Let us next determine the conditions of the propagation of an electromagnetic disturbance through a uniform medium, which we shall suppose to be at rest, that is, to have no motion except that which may be involved in electromagnetic disturbances. Let G be the specific conductivity of the medium, K its specific capacity for electrostatic induction, and μ its magnetic 'permeability'." Thus, he considered that the properties of the luminiferous medium are the conductivity, the permittivity, and the permeability. Hertz[3] noted that "We shall call ε the specific inductive capacity and μ the magnetic permeability of the substance." Thereafter, "There is nothing wrong in saying that these constants are equal to unity for the ether;" (Hertz[3], p. 200). We follow Maxwell as well as Hertz that the property of the ether is represented by the permittivity ε_0 and permeability μ_0.

Two important ether dragging models have been produced: one is Fresnel's model[4] of a partial ether drag determined by Fresnel's dragging coefficient, and the other is Stokes' model[5] of complete ether drag. Stokes[5] noted that "I shall suppose that the earth and planets carry a portion of the aether along with them so that the aether close to their surfaces is at rest relatively to those surfaces, while its velocity alters as we recede from the surface, till, at no great distance, it is at rest in space." In the gravitational field of the earth, we assume the Stokes' model of complete ether drag; ether is dragged by the gravitational field.

The conclusion of Michelson-Morley[6] paper in 1887 was "the ether is at rest with regard to the earth's surface." In 1924, the Michelson-Gale-Pearson[7] experiment was performed to determine the effect of the earth's rotation on the velocity of light. They assumed a fixed ether to the earth-centered locally inertial (ECI) coordinate system and the principle of invariant light speed. The experimental results provided the angular velocity of the earth demonstrated the existence of fixed ether. Wang's experiment directly observed the experimental data of Michelson-Gale-Pearson experiment.

We agree to Wang's experimental results, however do not agree to his conclusion; thus we comment on his paper.

2. Wang's first order ether drift experiment[1]

Wang's experiment was simple and intuitive. He used a linear array photo sensor, not an interferometer, in the experiment as shown in **Fig. 1**. He reported that "The rotational velocity and the orbital velocity of the earth, and the galactic orbital velocity of the solar system with respect to the ether have been measured to be, respectively, 0.051 km/s, -0.19 km/s and 0.30 km/s, with a statistical error of 0.94 km/s. These velocities are merely 14%, 0.6% and 0.15% of the kinetic velocities of the earth and the solar system with respect to the Milky Way."

We consider that Wang's experiment measured the velocity of the earth's spin in the ether; the expected value is 0.38 km/s. Therefore, the expected shift is 5.5 m $\times 0.38/300{,}000 = 7.0\times10^{-6}$ m. The shift of 7 μm is less than one pixel (7.8 μm) of the photo sensor. He reported that the whole data taking process lasts approximately 40 minutes, the temporal drift during this time period is reduced to less than 3 pixels, or 24 μm. He showed a typical plot of the laser beam position on the linear array detector as shown in **Fig. 2**, which showed a sinusoidal curve that varied around ± 3 pixels (±24 μm). This variation is 3 times greater than our expected value of 7 μm. In his experiment, Wang concluded the drift velocity to be 0.30±0.94 km/s.

3. Discussion

Although it is assumed around ±1 pixel variations, typical experimental data in **Fig. 2** show three times large (±3 pixels) sinusoidal variations. Wang concluded 0.30±0.94 km/s; therefore we predict that averaged variations are around ±1 pixel, and maximum variations are around ±3 pixels. We consider that observed value of 0.30 km/s is the ether velocity at Tennessee.

4. Conclusion

In the first order ether drift experiment, Wang assumed Fresnel-Lorentz ether; therefore the conclusion was "null result". If the Stokes' model of complete ether drag was assumed, the conclusion was the ether drift velocity with regard to the earth's surface is 0.30±0.94 km/s.

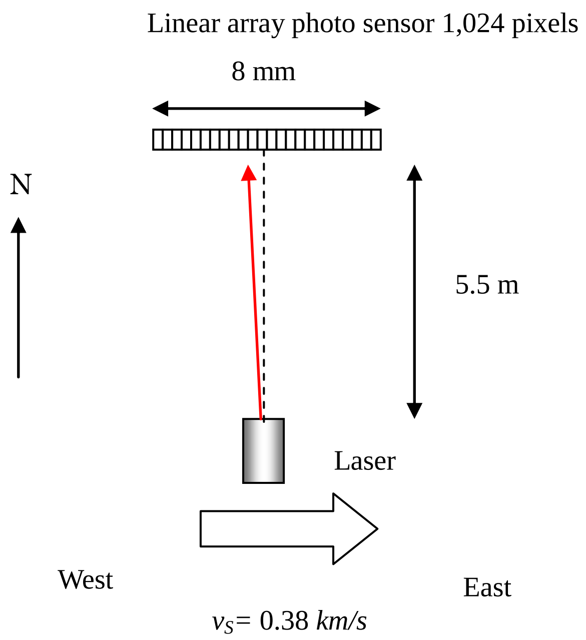

Fig. 1 Wang's first order ether drift experiment using a linear array photo sensor. Earth's spin velocity v_S is 0.38 km/s at Tennessee.

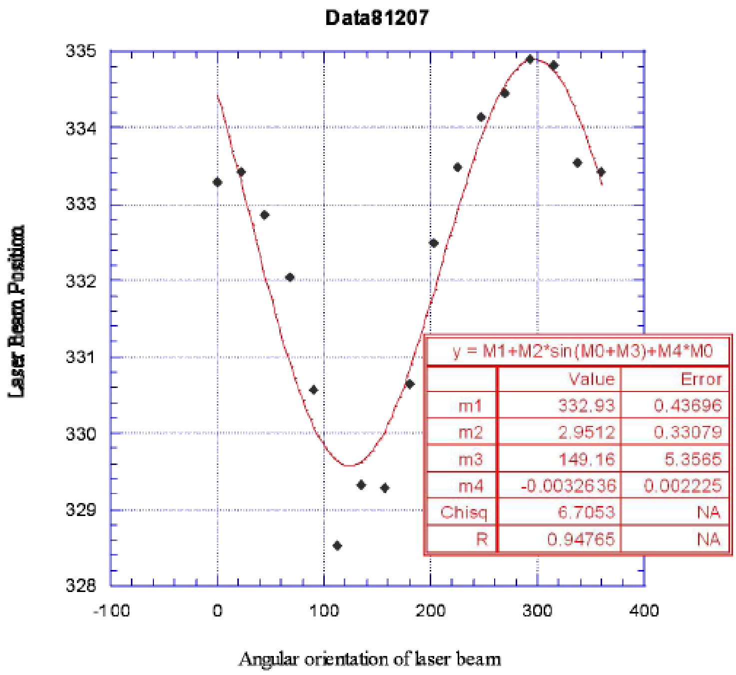

Fig. 2 Wang's first order ether drift experiment[1]

References

1) L. Wang, Physics Essays, **23**, 473, (2010).
2) J. Maxwell, "*A treatise on electricity and magnetism,*" Volume 2, Oxford, Clarendon Press, (1873). https://archive.org/stream/ATreatiseOnElectricityMagnetism-Volume2/Maxwell-ATreatiseOnElectricityMagnetismVolume2#page/n453/mode/2up/search/wave
3) H. Hertz, *"Electric Waves: Being Researches on the Propagation of Electric Action with Finite Velocity through Space" Dover Publications, (1893). ISBN 1-4297-4036-1.* https://books.google.co.jp/books?id=8GkOAAAAIAAJ&printsec=frontcover&hl=ja&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=falseA.
4) A. Michelson, and E. Morley, American Journal of Science, Third Series, **34**, 333, (1887), http://www.aip.org/history/gap/PDF/michelson.pdfhttp://en.wikisource.org/wiki/On_the_Relative_Motion_of_the_Earth_and_the_Luminiferous_Ether.
5) A. Michelson, H. Gale, The Astrophysical Journal, **61**, 140-145, (1924), http://adsabs.harvard.edu/abs/1925ApJ....61..140M