A New Crucial Experiment for Relativity

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Abstract

Dayton Miller performed an experiment in 1925–1926 that, at face value, contradicted relativity theory. The strongest argument against Miller's experiment is that subsequent Michelson-Morley experiments yielded increasing consistency with relativity, disagreeing with Miller's results. But subsequent experiments were not valid replications of Miller's. Specifically, they failed to replicate the medium in the light path and the scale of Miller's experiment. A valid replication must either be exact or be demonstrably equivalent with regard to its crucial sensing region. The unexplained effects seen by Miller demand exact replication. The proposed experiment is crucial for special relativity but is more than a replication of Miller. This proposed Crucial Experiment should use a Michelson-Morley apparatus with a 4.25 m arm length as Miller used. The novelty of this experiment is that the light path should be in a chamber that can be operated from near zero to one atmosphere. Predictions: (1) At one atmosphere, the result will agree with Miller's and contradict relativity. (2) Near zero atmospheres, the result will agree with Georg Joos' and agree with relativity. (3) Intermediate pressures will yield intermediate results.

1 Background

1.1 Origins of Ether

Maxwell's formulation of electromagnetism in 1860 described the wave motion of electromagnetic radiation including light. The medium that was assumed to transmit the waves was called ether.

1.2 Experiments

The Michelson-Morley experiment was a test of an ether theory, specifically to determine the velocity of the Earth through an ether assumed to be fixed in the solar system. Michelson and Morley in 1887[1] measured a velocity "certainly less than one fourth" of the orbital velocity of Earth, which is 30 km/s. Their experiment was a refutation of the ether theory. After years of preparation, Dayton Miller of Case conducted an elaborate Michelson-Morley experiment, taking data in four time periods in 1925–1926.[2] The results were similar to the 1887 test, but with smaller probable error. Taken at face value, it refuted both ether theory and relativity.

Many similar Michelson-Morley experiments have been conducted from Joos' in 1930 to the present, never reproducing Miller's results and getting progressively closer to values predicted by relativity.

1.3 Relativity

In the context of the failure of the ether theory, special relativity was introduced by Albert Einstein in 1905. Relativity had numerous experimental confirmations with one of the most influential being in 1919 when general relativity was confirmed in an observation involving the bending of starlight by an eclipsed Sun. Mainstream opinion progressively hardened in favor of relativity in the following decades.

Aware that Miller's experiment contradicted relativity, Shankland, co-authered an oft-quoted paper in 1955 attributing Miller's results to experimental error.

1.4 Background Summary

- Relativity was confirmed by essentially all experiments except Miller's.
- Miller's experiment, if upheld, would refute relativity.
- Miller's results, which contradicted relativity, have not been replicated in spite of numerous trials.
- Shankland ascribed Miller's results to experimental error.
- These circumstances eliminated Miller's experiment as a refutation of relativity.

2 Replication Examined

This section is a novel examination the validity of the claimed replications of Miller's Michelson-Morley experiment.

2.1 Requirements for Replication

2.1.1 The Sensing Region

In a Michelson-Morley experiment an input beam is split into two beams which then travel perpendicular to each other. Each of the two beams is reflected from mirrors that leave their direction parallel/anti-parallel to their direction after the split. Finally, the perpendicular beams go through the beam splitter again and come out parallel to each other. The two perpendicular paths of the two separate beams constitute the sensing region.

2.1.2 The Sensing Parameters

- The sensing medium is the physical medium in the sensing region. It is usually air or vacuum.
- The sensing length is the length of the path between successive reflections of the separated beams. That path has no intermediate reflections.
- The number of traversals of the sensing length may also be relevant.

A replication of Miller's experiment must either exactly replicate Miller's sensing region or must guarantee to preserve any legitimate effects that Miller recorded. Instrumentation outside the sensing region is irrelevant.

Since we do not know the full mechanism that produced Millers result, we cannot be certain that any modification to his sensing region will preserve the effects Miller recorded. The conservative approach is to duplicate Miller's sensing region, including the sensing medium and sensing length, exactly.

2.2 Miller's Sensing Parameters

Miller, in 1925–1926, used ambient air as the sensing medium. His sensing length was 4.25 m. The full sensing length was traversed 14 times and a half-length was traversed 2 times by each of the separate beams.

2.3 Replication Candidates

Joos, in his 1930 Michelson-Morley experiment, used vacuum as the sensing medium and his sensing length was about 3m. This does not replicate Miller's parameters.

Herrmann, in 2009, used vacuum as the sensing medium and his sensing length was 5.5cm. This does not replicate Miller's parameters.

All other replication candidates used a sensing length less than that of Joos, and most used a vacuum sensing medium; therefore they do not replicate Miller's parameters.

2.4 Replication Conclusion

Based on the differences of the parameters of the sensing region between Miller's experiment of 1925–1926 and all candidate replications, we must conclude that Miller's experiment has never been replicated, contrary to all claims.

Miller's experimental results have not been replicated because Miller's experiment has not been replicated.

3 Analyses of Miller's Data

3.1 Shankland's Analysis

Shankland et al published a paper in 1955[3] that ascribed Miller's experimental results to"statistical fluctuations" and "local temperature condition".

Shankland became chairman of the Case Physics Department following Miller and received the 1925–1926 experiment's records directly from Miller. Shankland was a friend of Einstein and is considered biased by many including DeMeo who presents an in-depth account of both Dayton Miller's work and Shankland's critique.[4]

3.2 Allais' Analysis

Maurice Allais published a paper in 2003 strongly supporting Miller and refuting relativity.[5] Alias used a general mathematical method and found striking regularities in Miller's data including but beyond what Miller found. Allais declared that relativity was "totally invalidated by the observational fact".

Allais wrote: "In fact, as far as temperature effects are concerned, Shankland et al. only present hypotheses and doubtful reasoning. They themselves emphasize that the available temperature data are quite insufficient to perform precise analysis"

Allais, who was French, is nearly unknown in the Anglophone world as he was reluctant to publish in English. Although he was awarded the Nobel Prize in Economics for 1988[6] he had an early interest in physics and, as an experimentalist in gravitation, he established the Allais Effect. Allais was awarded the French Legion of Honour, and was elected to the U.S. National Academy of Sciences and corresponding academies in France, Italy, and Russia.

4 A Crucial Experiment

4.1 Replication of Miller Needed

We have seen above that

- Dayton Miller's 1925–1926 experiment, taken at face value, refuted relativity.
- Maurice Allais mathematically analyzed Miller's data in 2003 and concluded that his data refutes relativity.
- Miller's experiment has never been replicated. Many very accurate Michelson-Morley experiments have been performed, but all with the wrong parameters.
- Einstein said: "If Dr. Miller's results should be confirmed, then the special relativity theory, and with the general theory in its present form, falls."[7]

Miller's experiment has never, ever been properly addressed. A proper, controlled replication of Dayton Miller's 1925–1926 experiment, must finally be performed. Such an experiment will either show that

- Miller's experiment was in error and relativity remains unchallenged, or
- Miller's experiment is vindicated and relativity theory falls.

4.2 Replication of Miller

A proper replication of Miller's experiment is a Michelson-Morley experiment that must include Miller's Sensing Parameters, given above. Modern instrumentation can be incorporated, as that lies outside the sensing region. This will eliminate the potential for human bias, eliminate the human toil that Miller experienced, and permit more rapid and more lengthy observations. Raw data should be published for anyone to analyze.

4.3 Beyond Replication

However, the experiment can be more than a replication of Miller. Since the density of the sensing medium is suspected of affecting the result, I suggest making the gas pressure an experimental variable. In this way, it should be possible to replicate Miller's non-null result at atmospheric pressure and to replicate Joos' null result at a vacuum by running the same apparatus at these two pressures.

Intermediate results should be interesting as well. Assuming the above experiment gives results agreeing with Miller and Joos, data can be taken at pressures intermediate between near-zero and one atmospheres and above one atmosphere. These data points should fall on a monotonic curve. This would be far more credible than one or two isolated data points.

Even more interesting would be to run two synchronized, isolated experiments at perhaps 100 feet from each other. Correlated "noise" in the data from the two experiments would be strong evidence for disturbances in an ether pervading both experiments.

Notes

[1]Michelson, Albert Abraham & Morley, Edward Williams (1887). "On the Relative Motion of the Earth and the Luminiferous Ether".American Journal of Science 34: 333345.

[2]Dayton C. Miller, "The Ether-Drift Experiment and the Determination of the Absolute Motion of the Earth," Rev. Mod. Phys., V5, N3, pp. 203-242 (Jul 1933).

[3]R. S. Shankland, S. W. McCuskey, F. C. Leone, and G. Kuerti,"New analysis of the interferometric observations of Dayton C. Miller" Rev. Mod. Phys. 27, 167178 (1955).

[4]http://www.orgonelab.org/miller.htm

[5]http://allais.maurice.free.fr/English/yellow01.htm. See also Editors Note at http://allais.maurice.free.fr/English/yellow02.htm

[6]`http://www.nobelprize.org/nobel_prizes/economics/laureates/1988/`

[7]"Science" New Series, Vol 62, N 1596 July 31, 1925.
http://allais.maurice.free.fr/English/Einstein2.htm

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