

## **A Re-examination of the concept of Ether in Einstein's Special Theory of Relativity**

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The proposal is that - the present way that ether is defined by physics textbooks has led to confusion and it would not be the way that Einstein would have defined it. Once the ether is defined correctly there is a better link between Einstein's physics and the rest of classical physics back to Galileo's physics.

### **Introduction**

According to Einstein in a lecture delivered in 1920 [1] the ether still exists but in a different form, this is contrary to what is normally taught as following from his Special theory of Relativity. I wish to highlight in this article that it is a semantic problem, that the way that the term "ether" has been defined is contrary to the way that Einstein would have defined it.

This defining the ether contrary to how Einstein would have meant the word has led to many conceptual difficulties with understanding his theories. When defined the way that he would have meant, the mathematics links together in a more comprehensible form.

There are similar problems in the rest of modern physics, which my investigations have revealed to me [2] and that once one compensates for these then the physics makes a great more sense. The origins of modern physics theories are from Boscovich's theory, [3] but because of this confusing and inappropriate defining of terms and linking to mathematics in a confusing way, it has meant that this link is not so easily apparent.

I shall deal with the following:

1. Case 1 : deals with what was being looked for in the MM (Michelson Morley) experiment.
2. Case 2 : deals with what was instead discovered by the MM experiment.
3. The difference between case 1 and case 2 : There has been a misunderstanding what these cases indicated.

## 1. Case 1

Let's consider an idealised scenario of two swimmers, in a stream that flows at 4 metres per second between parallel banks 90 metres apart. [4] The two swimmers, who both swim at a rate of 5 metres per second in still water. Swimmer A goes 90 metres downstream and back, while swimmer B swims from one side of the bank to the other and back.

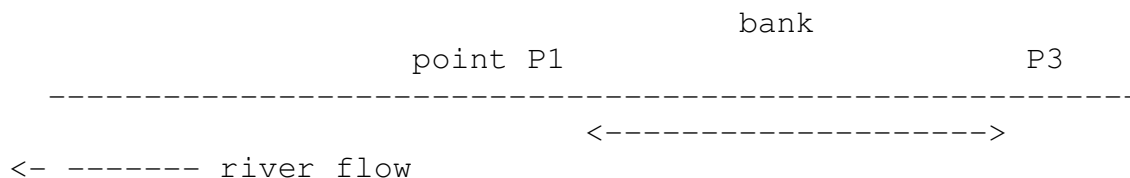
As with all such idealised cases, things are totally unrealistic. The speeds of the swimmers are too fast to be realistic for a start. But along with all this we are assuming uniform constant velocity, while 'real' swimmers would have variable speed as they tire etc. Also the stream is also assumed to be flowing parallel banks at a fixed constant rate.

This idealised case is only illustrating what would happen in the scenario of constant uniform velocity, with its all its simplifications to make calculations easy.

For swimmer A , obviously, the current will help him on his way down and hinder him on his return, and his rates of swimming will be 9 metres per sec and 1 metre per sec respectively in going and returning, and the total time will be:

$$90 \text{ metres} / 9 \text{ metres per sec} + 90 \text{ metres} / 1 \text{ metres per sec} = 100 \text{ secs}$$

He swims from point P1 to P3 then back to point P1:



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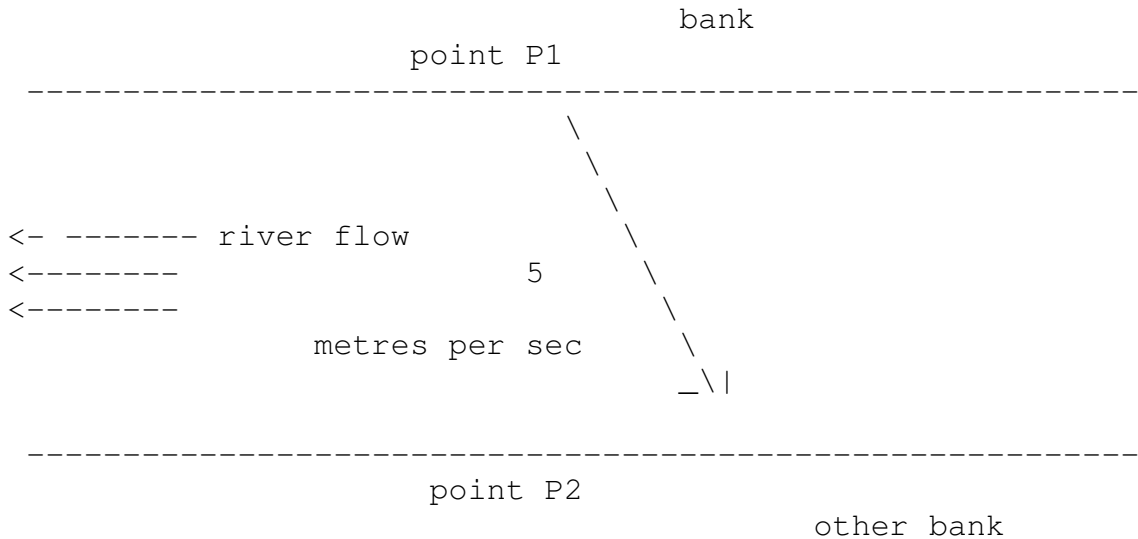
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river

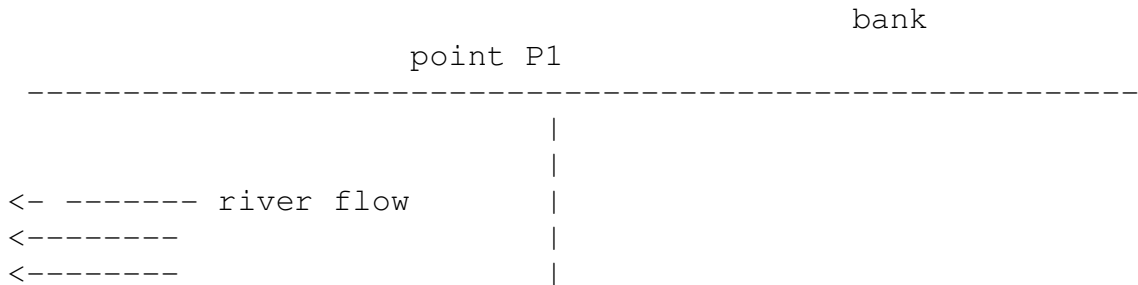
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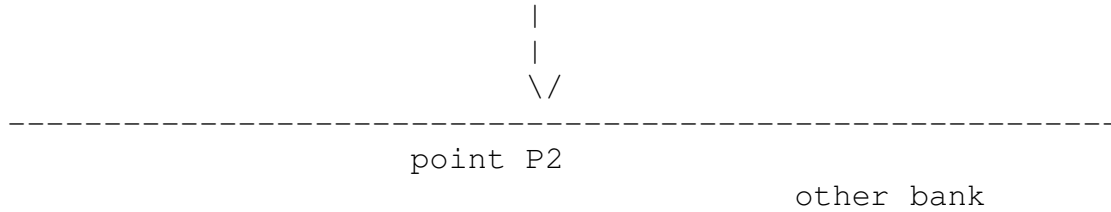
other bank

The second swimmer B sets off simultaneously with the first, proceeding straight across to a point on the opposite bank, and then swims back. To head straight he will have to head diagonally order to allow for the effect of the current.

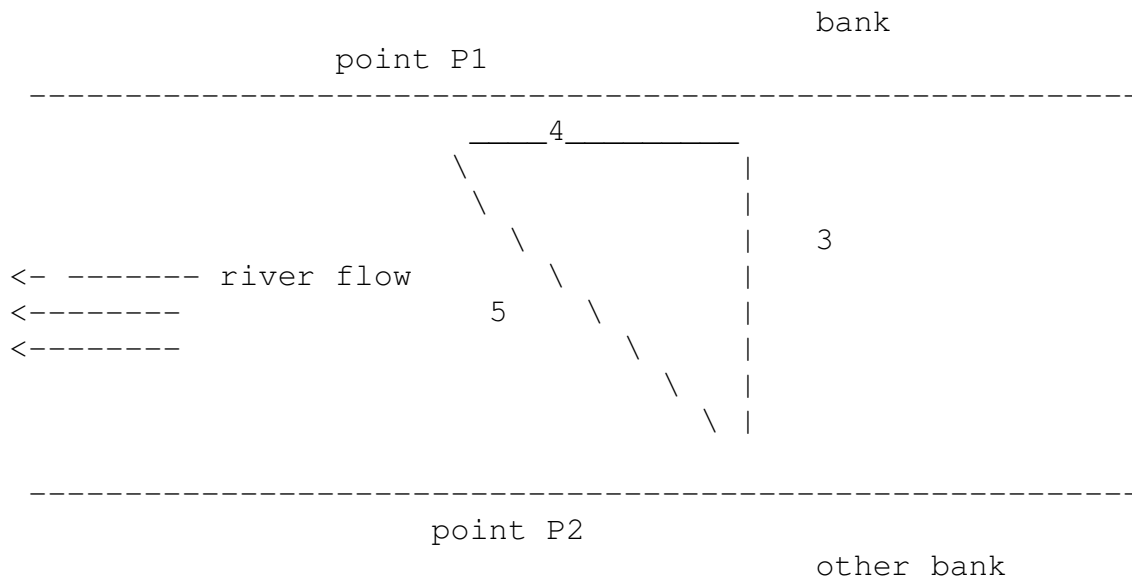


As he swims in this direction the current is pushing him into following a straight line from bank to bank:



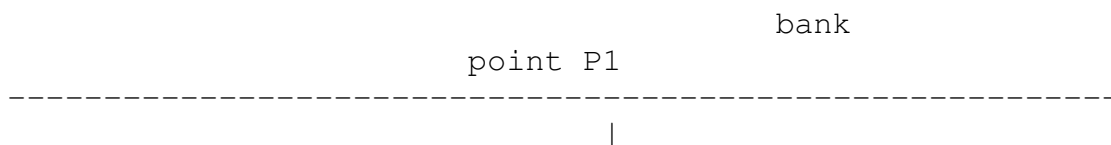


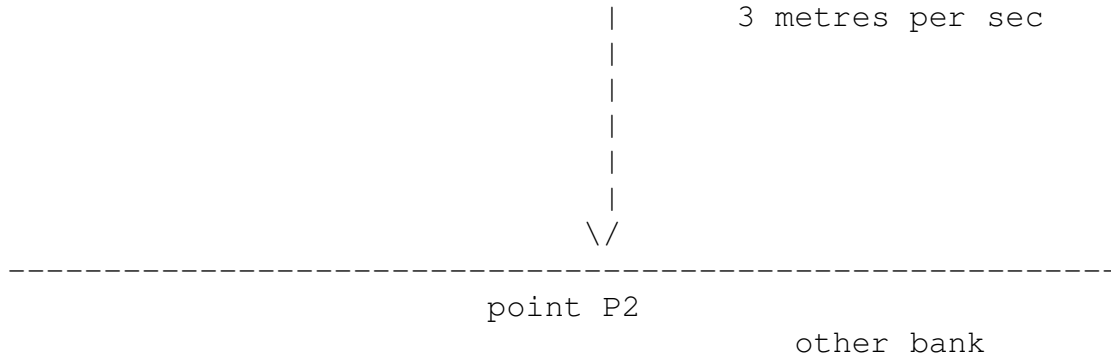
The velocity as he travels from P1 to P2 is obtained from the vector addition of the current's velocity and his swimming velocity. (Really in other words using Pythagoras's theorem.)



Triangle is 3 squared + 4 squared = 5 squared.

In order to get to point P2 (which is directly opposite to P1 on the other bank), the swimmer has to take the direction indicated by the side "5" i.e.. he takes that direction and has velocity 5 metres per sec. The river current acts in the direction along side "4" and has velocity 4 metres per sec., which pushes the swimmer so that he reaches point P2 and not a point further along on the other bank.





i.e. 3 metres per sec from point P1 to point P2

distance is 90 metres between banks, so takes  $90/3 = 30$  seconds

Similar situation for the return trip, with time 30 seconds.

So, total time for swimmer B to go from P1 to P2 back to P1 is 60 seconds.

Swimmer A takes 100 secs

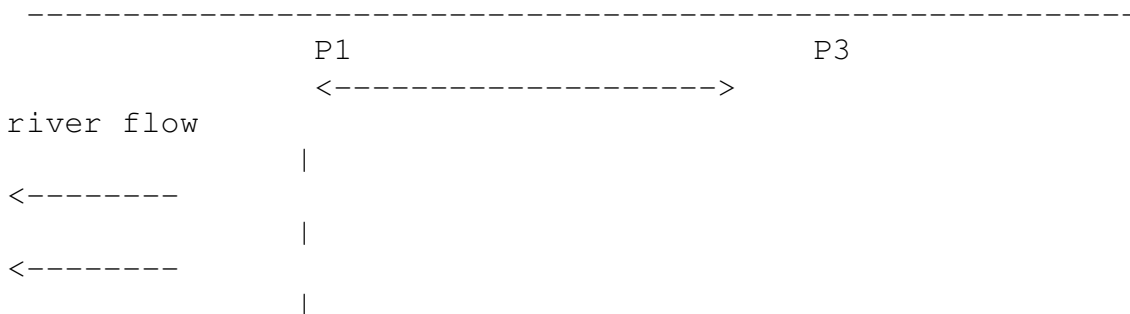
Swimmer B takes 60 secs.

This type of result was not observed in the MM experiment, hence it was concluded that the 'ether' analogous to the river flow does not exist.

Let us call this case 1.

Now let us consider a very similar scenario and call it case 2:

**2. Case 2**



|  
|  
P2

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other bank

The points P1, P2, P3 are now on boats. The swimmers set off from boat P1. And the boats are allowed to drift due to the effect of the river flow.

Swimmer A as he swims from P1 to P3 has velocity  $5 - 4 = 1$  metre/sec.

Boat P3 flows towards him at a rate of 4 metres/sec

Swimmer A sets out to swim 90 metres from P1 to P3, but he swims less than this, because P3 floats towards him part of the way.

In 18 secs, A gets to P3, A travels 18 metres, and P3 has floated 72 metres towards him.

He then sets off to return to P1, he travels at  $5 + 4 = 9$  metres/ sec

P1 has floats away from him, in the 18 secs he took to get to P3, but the distance between P1 and P3 is still 90 metres (since all boats drift at the same rate).

In a further 18 secs, P1 drifts  $18 \times 4 = 72$  metres, add that to the original 90m metres = 162m

162 metres divided by 9 metres per sec = 18 secs for the journey from P3 back to P1.

Total journey time for this swim is  $2 \times 18 = 36$  secs

Swimmer B swims from P1 to P2 at a rate of 5 metres/ sec in what he thinks is a straight line. But both him and P2 drift downstream due to the current.

90 metres is completed in 18 secs when travel at rate of 5 metres/ sec, and return journey also takes 18 secs.

So, his total time is 36 secs also.

Thus in this case 2, there is no difference in the journey times of swimmer A and swimmer B.

### **3. The Difference between Case 1 and Case 2**

The difference between case 1 and case 2 is simply that in case 1, the points P1, P2, P3 are fixed and do not drift with the velocity of the current. While in case 2, the points P1, P2, P3 drift.

Case 1 is not observed by the MM experiment, instead case 2 is observed. Let us call the Ether in case 1 "Ether 1" and that in case 2 as "Ether 2". The MM experiment then shows that Ether 1 does not exist, while Ether 2 exists.

The ether acts like any medium, such as this river and everything drifts under its influence.

Thus in case 2 the Ether obeys what is called the Principle of (restricted) Relativity. (The principle is restricted here to the simplistic case of uniform velocity. While acceleration and other factors would modify that principle.)

Whereas in case 1, this principle is not obeyed.

Case 1 is entirely artificial. If we had paid attention to Galileo, we would have known that physics does not obey the scenario of case 1.

He had the problem of why he believed that the Earth moved, when there seemed no observation in his day to indicate that.

It was commonly believed that if the Earth moved, then dropping a ball from a tower would mean that the ground moved as the object fell, and so the ball would not hit the ground directly below.

Galileo's answer to this was the Principle of Relativity (as restricted to uniform velocity). He pointed out that if one dropped a ball from the mast of a ship travelling at uniform velocity (no shaking etc. - in other words another idealised case), then an observer on the ship would see the ball fall straight down to the ground. Whereas an observer ashore would see the ball following a curved path. The point however, was that an observation made on a moving

ship (with uniform velocity) of a falling ball, looked the same as an observation from a stationary ship, for those on board the ship. This was the Principle of (restricted) Relativity: one could not tell the difference between an observation while travelling at uniform velocity, and an observation while stationary.

The observer on the ship can look ashore and say whether he was moving with respect to the shore. But if he is being awkward when he sees that movement, then he claims that he does not know whether it is his ship that is moving or whether the shore is moving. It would be more apparent, if we consider two ships at sea with no other landmarks (once again in idealised scenario). On one ship, an observer observes the other ship moving with respect to him. But he does not 'really' know if that other ship moves, or if it his ship that moves.

Galileo compared the motion of the Earth to these ships. If we observe that the sun moves with respect to us, we cannot tell whether it is the sun moving or the earth moving, this is with the proviso - if there is uniform velocity. (Complications mean there is more than uniform velocity in realistic cases, but what is presented here is a simplistic idealisation.)

Ether 2 obeys the Principle of Relativity. While in case 1, Ether 1 does not obey that principle, hence that idealisation is false and is not in agreement with the physics that Galileo was initiating. Michelson and Morely were looking for a result from light, that was not in agreement with Galilean physics!

Since Ether 2 exists we can still describe light as being a wave in a medium. But the way that many physics text books are written does not make this clear, and the presentation to the student is that light waves do not travel in a medium; which is grossly wrong.

Some people describe light as travelling in 'empty space' without need of a medium. If one wishes to think of it that way, then it should be emphasised that 'empty space' is acting as if it were a 'medium'. This is what Einstein meant when he said "...according to the general theory of relativity space is endowed with physical qualities [i.e. 'empty space' acts as if it were the ether]; in this sense, therefore, there exists an ether." [5]

## References

- [1] Sidelights on Relativity, Einstein, 1922
- [2] The Unified Field Theory Coverup, General Science journal, Roger J Anderton
- [3] The Relationship between Light and gravity vol.1, Minerva , UK, Roger J Anderton
- [4] The Mainstream of Mathematics, Edna E Kramer, Oxford University press, USA 1951, 1955 , adapted from information given from p 265.
- [5] Sidelights on Relativity, Einstein, 1922 p 23

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