The MM Experiment with Radio Frequencies gives Positive Results

Wolfgang Sturm [a]

The conversion of the MM experiment (Michelson-Morley) to radio frequencies uncovers a historical construction error, which results in the null result. After its repair, the MM experiment works perfectly even with radio frequencies and achieves a positive and plausible measurement result in the simulation and in reality.

1. *Introduction*

The conversion of light experiments to radio frequencies (RF) has advantages, e.g:

1. With radio frequencies you measure amplitudes, with light only energies.
2. A reduced precision of the components is sufficient in RF experiments.
3. Monochrome, coherent and variable sources are RF lab standard.
4. The transportation of RF in flexible cables saves optics.
5. A short circuit at the end of a RF cable acts as a mirror.
6. A simplified directional coupler acts as a beam splitter.
7. RF signals can be directly processed electronically.
8. RF experiments are robust and cheap.
9. There are free simulation programs.

This is in contrast to the wavelength-related reduced resolution in phase comparisons and the fact that the eye cannot see anything directly. For example, the popular fringes.

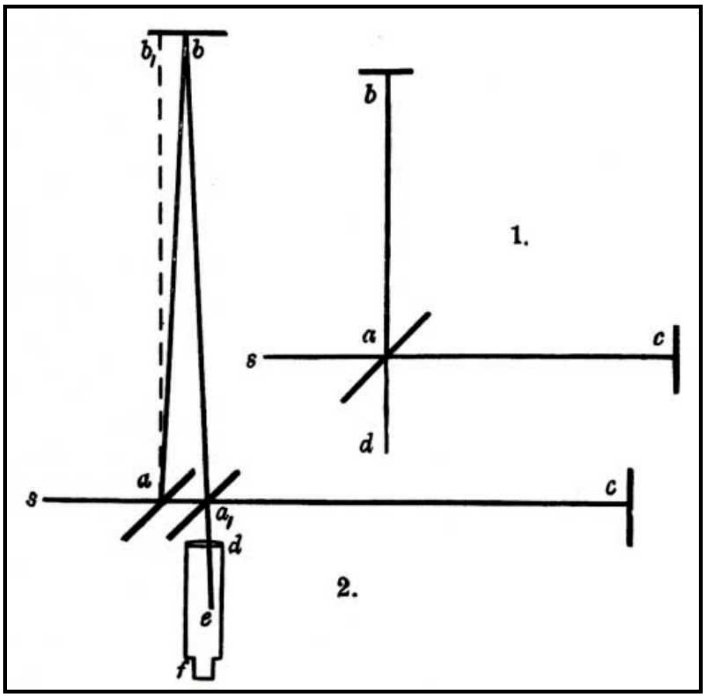
RF conversions have proven successful in the analysis of optical experiments. For example, many QM mysteries have been solved.

The MM experiment is converted to RF. A historical design error is uncovered, resulting in the null result. After its repair, the RF-MM experiment works perfectly and gives a positive and plausible result.

---

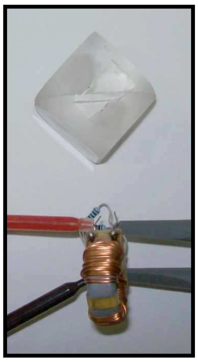
[a] foghunter@web.de

2. Conversion of the MM experiment to radio frequencies

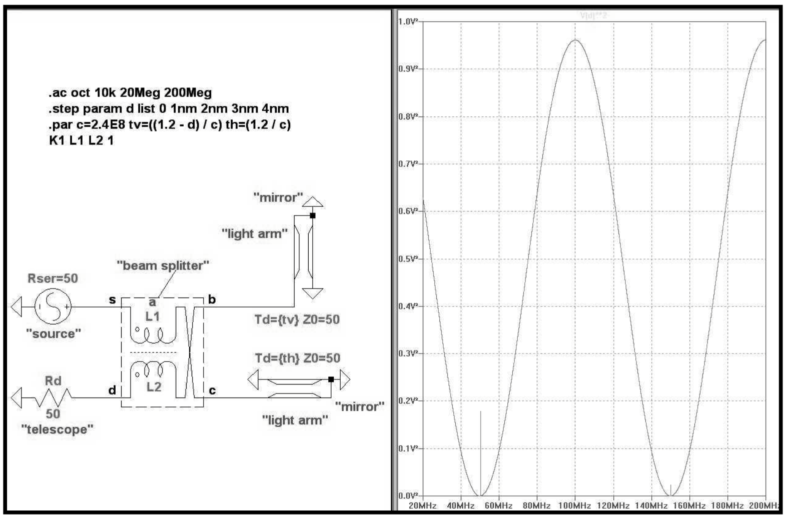


The central component of the interferometer used in the MM experiment [MM1887] is the beam splitter “a”. The monochrome and coherent light source “s”, two orthogonal light arms “b” and “c” (fitted with mirrors at the end) and the telescope “f” are adapted to it. Moving the system to the left should cause an aberration from “a” to “a1” and thus a changed interference pattern in the telescope.

An aberration cannot be measured by RF experiment because the wave is bound to a cable. Length contraction, on the other hand, should be measurable.



In [Stu23] it was proven that an optical beam splitter and a 1:1 transformer show the same behavior. The wave at “s” is divided into two waves of half amplitude and opposite phase. The output “b” is rotated by 180° to “s” and “c”.

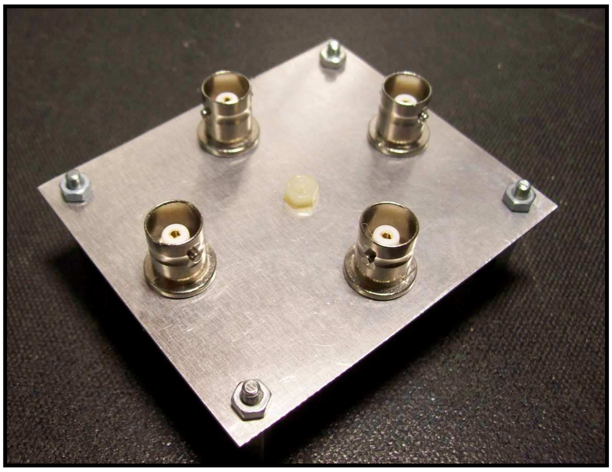


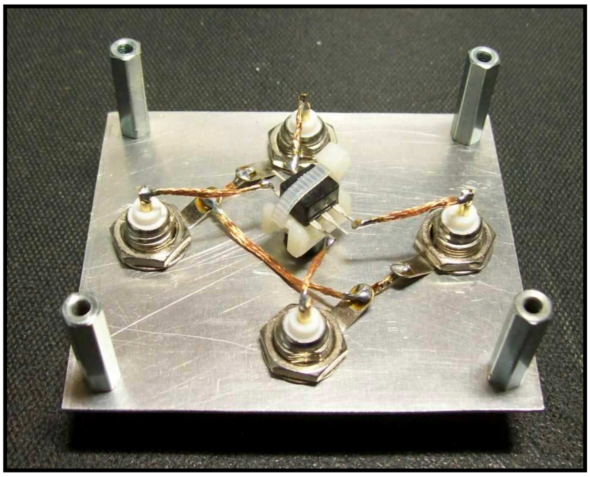
```
.ac oct 10k 20Meg 200Meg
.step param d list 0 1nm 2nm 3nm 4nm
.par c=2.4E8 tv=((1.2 - d) / c) th=(1.2 / c)
K1 L1 L2 1
```

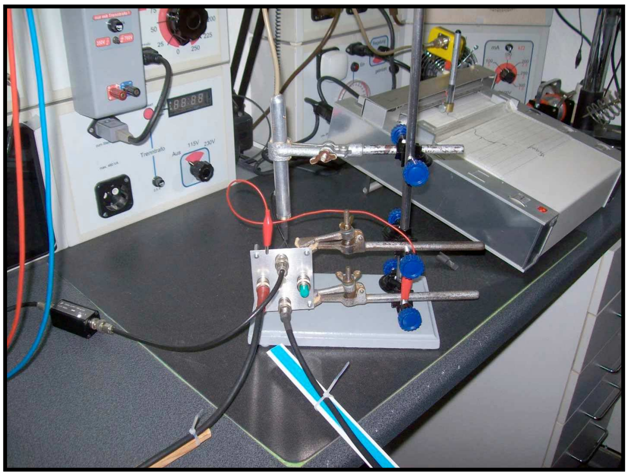
The light arms with end mirrors are replaced by 1.2 meters of coaxial cable (c_{cable} = 2.4 10^8 m/s) with short circuits at the end. The squared voltage at “Rd” corresponds to the familiar brightness. Destructive interference can be seen at 50 and 150 MHz and constructive interference at 100 MHz.

In the simulation, the vertical light arm is reduced in steps up to four nanometers, which results in no visible differences in the superimposed recorded curves. Due to the wavelength, the RF interferometer is decades less sensitive than the optical original.

In practice, the RF beam splitter is built with a low-capacitance mounted RF transformer (T1-1T, 50 Ohm, 0.08 - 200 MHz from Mini-Circuits):







A RF probe and a sensitive recorder are used to measure the voltage at resistor “Rd” (green cap). The source is a DSS oscillator (black box on the left). The beginnings of the two arms can be seen below. The left arm points to the west. The other arm is swung between west and south.

The practical setup confirms the simulation and reproduces the zero result.

3. *The measuring bridge vs. the Michelson interferometer*

In technology, weak differences are measured using a differential measurement in a measuring bridge. One bridge path is influenced by the measured variable. The other is not.

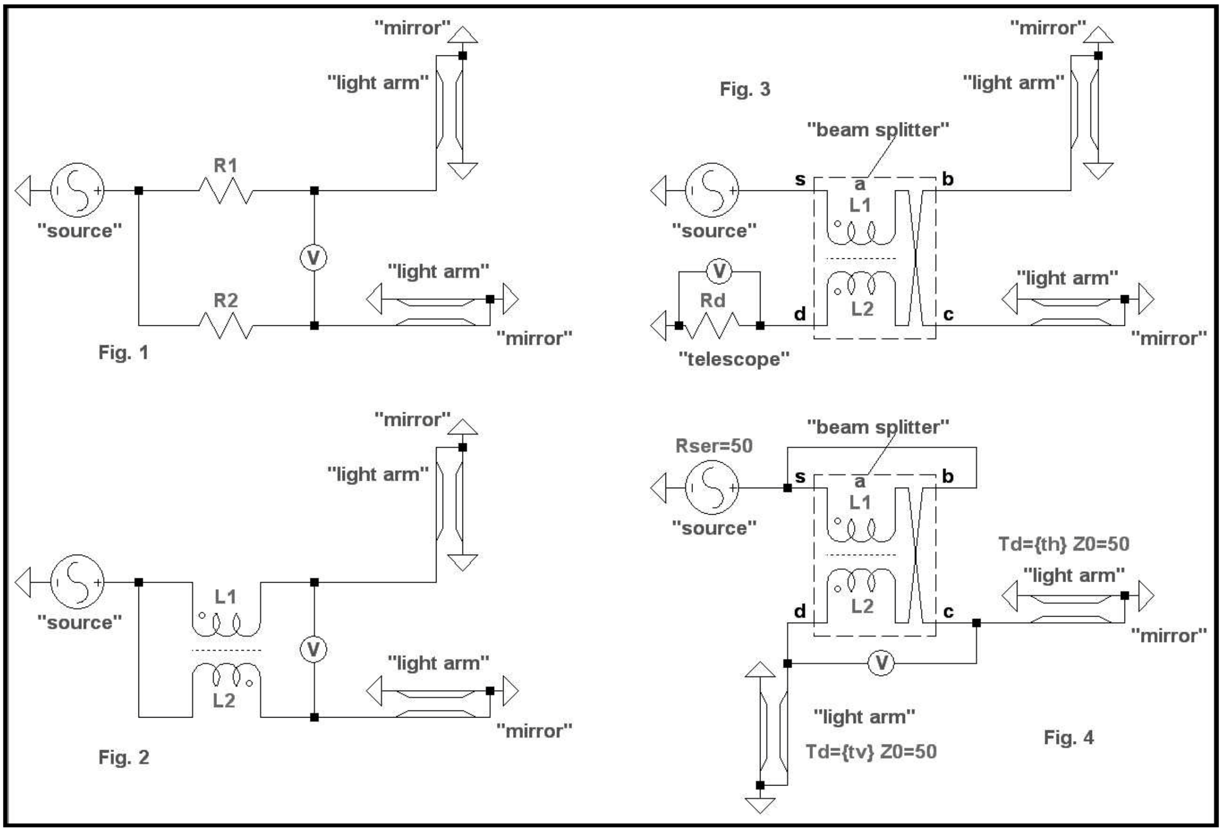


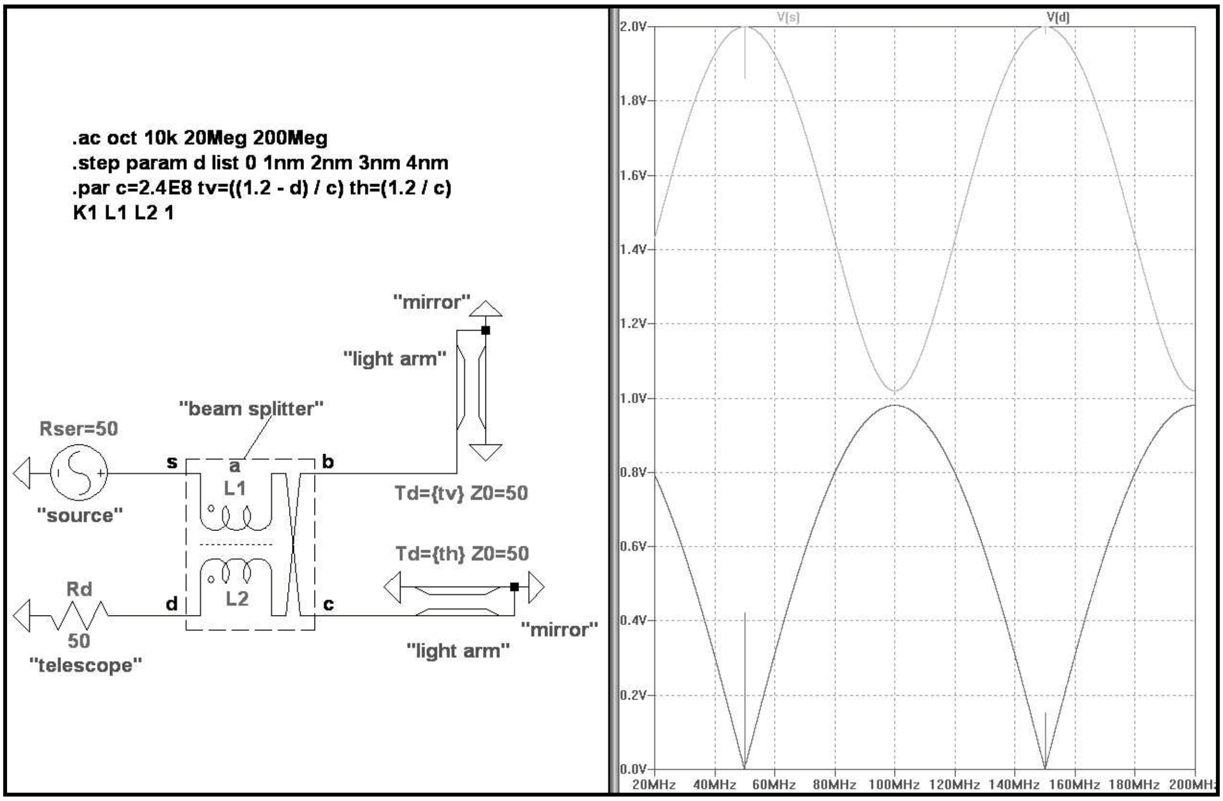
Fig. 1 is a classic measuring bridge. Both light arms work in phase. If the bridge balance changes, a differential voltage is measured between the light arms. Increased resistors R1 and R2 increase the sensitivity.

In **Fig. 2**, R1 and R2 have been replaced by two coupled inductors. The currents in opposite directions compensate L1 and L2. As soon as the bridge balance is disturbed, both inductive resistances and thus the sensitivity increase. That increase the imbalance and so on...

Fig. 3 shows the RF implementation of the Michelson interferometer so far.

The same voltage (at least in terms of magnitude) must be measured at all neighboring connections of a measuring bridge in balance.

In the normal case (**Fig. 1**, **Fig. 2** and **Fig. 4**), this condition is forced by connecting both bridge paths to the same source. Whether **Fig. 3** also fulfills this condition can be checked by measuring the voltage equality at “s” and “d”:



```
.ac oct 10k 20Meg 200Meg
.step param d list 0 1nm 2nm 3nm 4nm
.par c=2.4E8 tv=((1.2 - d) / c) th=(1.2 / c)
K1 L1 L2 1
```

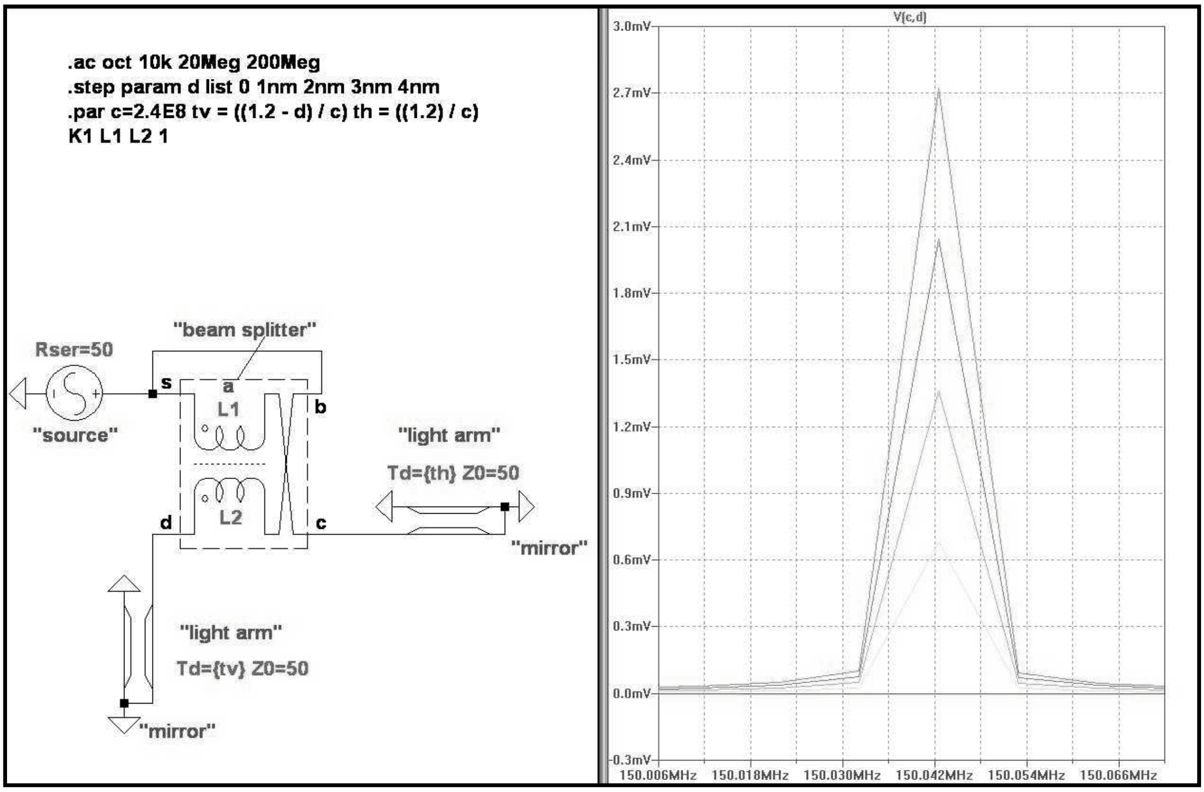
.The voltages at “s” and “d” are recorded on the right. The voltages of both bridge paths are different at all frequencies.

The Michelson interferometer is therefore not a working measuring bridge, which directly explains all “zero results”. The device is simply insensitive.

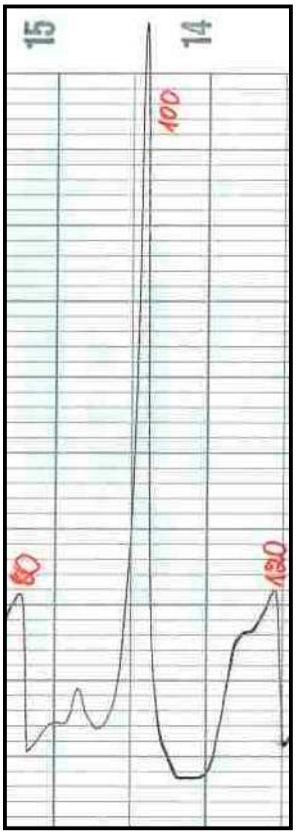
In **Fig. 4**, the MM interferometer from **Fig. 3** is converted into the classic measuring bridge shown in **Fig. 2** and tested.

4. The interferometer according to Fig. 4 works in the simulation

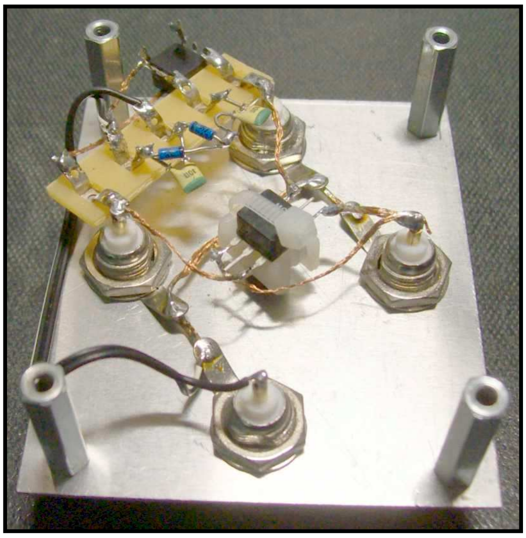
Fig. 4 can measure length differences in the nanometer range in the simulation if the source frequency is additionally set to a resonance peak of the light arms:



```
.ac oct 10k 20Meg 200Meg
.step param d list 0 1nm 2nm 3nm 4nm
.par c=2.4E8 tv = ((1.2 - d) / c) th = ((1.2) / c)
K1 L1 L2 1
```



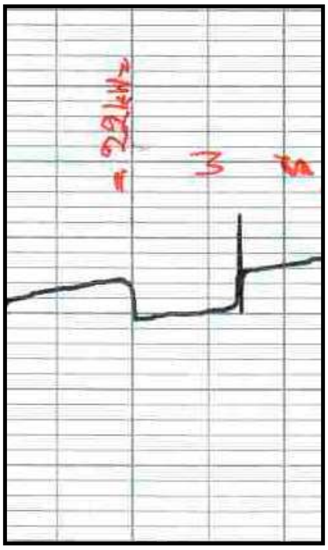
In practice, 100 MHz proved to be advantageous due to the large currents flowing then, as this increases the effectiveness of L1 and L2. Between 80 and 120 MHz there is a steep peak of around 250 mV. Both arms are therefore not exactly the same.



On the left, the beam splitter as shown in **Fig. 4** is completed with a measuring rectifier. The front socket leads to the recorder, the right socket to the oscillator. The remaining sockets lead to the two light arms.

5. The interferometer shown in Fig. 4 also works in practice

In contrast to the MM experiment, only one coaxial cable with short-circuited at the end is swung, while all other devices and settings remain unchanged. One arm therefore remains constantly aligned to the west.



1. The movable arm shows to south. The oscillator frequency is set to a steep edge of the 100 MHz peak. The voltage “S” is then recorded (from right to left) for one minute. A drift can be seen, which is caused by the minor drop in the battery supply of the source.
2. Both arms are then aligned parallel to the west. The 5 mV lower voltage “W” is recorded for a good minute.
3. The oscillator frequency is then adjusted (-22 kHz) so that the voltage “S” is reached again and the voltage is recorded for another two minutes.

All non-linearities and unknown peak slopes are compensated by this protocol. The frequency change (- 22 kHz / 100 MHz) is the measurement result.

As the experiment is carried out with slow electrons the calculation is not relativistic. The ratio of the frequencies corresponds to the ratio of the change in velocity to c = 3 10^8 m/s:

$$\mathbf{v = c\ (-22\ kHz\ /\ 100\ MHz) = -6.6\ 10^4\ m/s.}$$

Some notes:

- The orbital speed of the sun in our galaxy is 2.2 10^5 m/s. The orbital speed of the earth around the sun is 2.8 10^4 m/s. A measured value in this range seems plausible.
- The change in voltage is not caused by the bending of the cable.
- At other times of day I can measure different speeds.
- Different readings between west-east and north-south confirm the observations of completely other experiments: [Stu21], [Stu22] and [Mlo23].

6. Conclusion

Rewiring the MM-experiment to a classic bridge and the utilization of the arm resonances makes the RF-interferometer so sensitive that it shows a positive and plausible result in simulation and practice. The robustness and the simple and inexpensive design is impressive.

This work focuses on analyzing and repairing the hardware of the experiment and was driven by personal curiosity.

There is no motivation to repair the optical original backwards (in my opinion, this would require 4 additional mirrors). There is also no interest in making any measurements at different times of the day and year (it was only a question of whether the device showed a zero result or not). And there is also no interest in questioning the parts of modern physics that refer to the null result of the MM experiment (and will continue to do so).

But I will support anyone who feels called to these “jobs”.

[MM1887] Michelson and Morley, On the relative motion of the Earth and the Luminiferous Ether, American Journal of Science, No. 203. Nov. 1887, p. 333 ff.
[Stu23] Sturm, Measurements Clear the Fog of Quantum Interference, 2023, https://vixra.org/abs/2311.0133
[Stu21] Sturm, One-Way-Light Speed Measurement, 2021, https://vixra.org/abs/2112.0112
[Stu22] Sturm, A Message from the Ether, 2022, https://vixra.org/abs/2201.0070
[Mlo23] Młodziankowski and Sturm, Microgravity Radar, https://vixra.org/abs/2304.0173