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Open Letter to the Nobel Committee for Physics 2016

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Open Letter to the Nobel Committee for Physics 2016

To Professor Olle Inganäs (chairman), ois@ifm.liu.se, info@kva.se

Dear Professor Inganäs,

on Feb. 11, 2016 the LIGO-team published the paper PRL 116, 061102 (2016): *Observation of Gravitational Waves from a Binary Black Hole Merger*. The experimental proof for the existence of a gravitational wave was announced: Mirrors of 40 kg had been displaced by 10^{-18} m during fractions of a second as measured with a Michelson-interferometer with 4 km arm length resulting in a strain of 10^{-21} . Scaling up these data by a factor of 10^{13} a relative accuracy must have been achieved by a hair's breadth (10 microns) in relation to the distance to the next fixed star (4 light-years). This is by a factor of 1 Million better than the relative Mössbauer accuracy of 10^{-15} obtained so far. Indeed, Rudolf Mössbauer was awarded the Nobel Prize for physics in 1961 for this achievement.

In order to substantiate this extraordinary claim, it is absolutely necessary to demonstrate experimentally LIGO's ability to measure a displacement of 10^{-18} m that is one thousandth of a proton radius. The reader is assured that the calibration of the system can be achieved by moving the mirrors by such a tiny distance with radiation pressure: *"The detector output is calibrated in strain by measuring its response to test mass motion induced by photon pressure from a modulated calibration laser beam [63]."* Ref. [63] is an unpublished e-print describing the calibration method by radiation pressure. Formula (10) gives the calculable connection between displacement and the radiation power of an auxiliary laser shining on the mirror. Unfortunately no data are given as to the laser power, wave form, number of oscillations in order to compare with the documented effect that was exerted on the mirrors by the wave GW150914, as displayed in the "discovery paper".

An enquiry with the Albert Einstein Institut revealed that such data do not exist. Prof. Karsten Danzmann declared that the calibration procedure is much more complicated than could be expected from the announcement in the discovery paper (<http://www.kritik-relativitaetstheorie.de/Anhaenge/Anfrage%20LIGO-Experiment.pdf>, document 13). In order to understand it, one would need to study lengthy technical documents such as arXiv:1007.3973v1 [gr-qc] 22 Jul 2010 which, however, does not present either a calibration curve "mirror displacement versus laser power". In view of this statement one must conclude that an experimental proof for the claimed accuracy of the system does not exist, certainly none which is intelligible and could be accepted by the scientific public. It would be easy to move the mirrors by radiation pressure similarly as the gravitational wave did on 15-09-14, but no data have been published since then that would document this calibration measurement.

In view of Prof. Danzmann's statement one must suspect that LIGO was not calibrated as announced in the discovery paper with the consequence that the claim having detected a gravitational wave is not substantiated experimentally. It is quite possible that GW150914 was a test signal injected into the system before the science run started. The second "discovery" GW151226 shows a very weak signal that is hardly discernable in the noise as admitted by the authors themselves.

In the early seventies there was a claim by Joe Weber having detected gravitational waves. Repetitions of his measurements by several groups came up with null results. Weber was not awarded a Nobel Prize, a wise decision by the Committee. In the present instance it is not easily possible to repeat independent experiments with interferometers of 4 km arm length. One should insist, however, that the LIGO-group carries out the calibration as described in their discovery paper and publishes the results. Such data were included in the previous Technical Document LIGO-T030266-00 - D 9/22/03 (<https://dcc.ligo.org/public/0027/T030266/000/T030266-00.pdf>) where much higher laser power was applied to achieve measurable displacements. Hence, it is surprising to notice that direct calibration data were not included in Ref. [63] on this far more auspicious occasion. As more events like GW150914 are expected, one should wait and see whether they materialize.

With my best regards,
Wolfgang Engelhardt