A New Class of Experiments on the True Relativistic Nature of the One-Way Propagation of Light

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The fundamental physical postulate that distinguished the theories of relativity concerns the nature of the propagation of light. However, classic experiments involving the Michelson interferometer or optical cavities are two-way experiments, second order in v/c, that cannot determine the nature of the true one-way propagation. Most one-way experiments done in the past were not capable of addressing the issue either because they were dependent on the convention in synchronizing clocks. Important space-time labelling systems like GPS and many precision tests of gravity that use light as the physical entity for the tests are dependent on the fundamental postulate on the propagation of light. After showing the ambiguity arising from the synchronization convention, and some critical problems with the earlier experiments, I will describe a new class of experiments that address the one-way propagation of light in free space and in terrestrial gravitational fields. These experiments equal Michelson's 1925 experiments, based on his proposal in 1904, in avoiding clock synchronization ambiguity, and surpass them in preserving the inertial nature of the reference frames used. Most importantly, these are the first experiments that employ a well-verified Galilean reference as comparison, which avoid hidden theoretical assumptions. I will present the results on the true one-way speed relative to slow inertial frames of reference. The theoretical implications will be briefly pointed out. The results have implications to consistent alternatives to general relativity. Follow up experiments in preparation using pulses from a fiber femto-second laser, in an interferometric configuration, will be discussed.

References:

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