Kopeikin and the Speed of Gravity (updated)

Written by Administrator
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Can you believe that the speed of Gravity ... only in 2003 had been proved to be equal to the speed of light?

Amazing ... only in 2003!

Take a look on:

http://metaresearch.org/media%20and%20links/press/SOG-Kopeikin.asp

or read here:

Kopeikin and the Speed of Gravity

hes from experience. Experience comes from bad judgment.

Meta Research   Press Release

"The speed of   gravity"

Abstract. New findings were announced on 2003/01/08 by S. Kopeikin, claiming to have measured the "speed of gravity" and finding it essentially equal to the speed   of light. These findings are invalid by both experimental and theoretical   standards because the quantity measured was already known to propagate at the   speed of light. The hyped claims therefore do a disservice to science in   general and the advancement of physics in particular because

the announced   findings do not represent the meaning of the actual experimental results and cannot possibly represent the physical quantity heretofore called "the speed   of gravity", which has already been proved by six experiments to propagate   much faster than light, perhaps billions of times faster. Several mainstream   relativists have also stated their disagreement that the experiment really   measured what it claimed to measure.

Background

In   2001, S. Kopeikin proposed an experiment to test the speed of gravity [[1]].   However, his result as described would have been a hybrid of   near-instantaneous effects and lightspeed-delayed effects. The physical   interpretation in his proposal (but not the math or the experiment itself) was   objected to by T. Van Flandern [

[2]

]   and independently by H. Asada [

[3]

].   The experiment was then funded and carried out in 2002 September, with results   initially expected last October. When no results were forthcoming yet in   December, a rumor began circulating in USENET newsgroup sci.physics that the   results were not coming out in accord with expectations and were being   scrutinized. On December 30, Kopeikin posted a new paper on the internet   containing new algorithms and formulas for the analysis [

[4]

],   incompatible with his own pre-observation published formulas. On 2003 January   8, he gave an oral talk at the Seattle meeting of the American Astronomical   Society (AAS) announcing his numerical results, continuing to claim that they   measured "the speed of gravity": cg = (0.95+/-0.25)c, where c is the speed of   light.

The physical meaning of "the speed of gravity"

Although   gravitation and relativity are technical subjects, the mistake made by Kopeikin is not unlike measuring the speed of a falling apple and claiming   that is the speed of gravity. The following section provides the background to   understand what actually was done wrongly.

All gravitational   phenomena unique to Einstein's general relativity (GR), such as light bending,   gravitational redshift, perihelion advance, and Shapiro delay of radio or   radar signals, arise in a static or near-static gravitational potential field,   also sometimes called in

various contexts by the names "the gravitational   field", "the space-time medium", "the light-carrying medium", "aether", or   "elysium". Disturbances of this potential field or medium are called   "gravitational waves". According to GR, such waves propagate at the speed of light, as do all other phenomena associated with the potential field that   propagate at all. This gravitational wave speed has been confirmed directly by   measures of the aforementioned phenomena unique to GR, and indirectly by   binary pulsar observations. There is no current dispute about this, and no   expectation of any other result for the propagation speed of gravitational   waves. However, the name notwithstanding, "gravitational waves" have nothing to do with gravitational force. They are ultra-weak disturbances of the   potential field or space-time medium due to the acceleration of bodies. So   far, they have proved too weak to detect directly in any laboratory or   astrophysical experiment. They are certainly far too weak to have any   observable influence on any macroscopic body in their path.

By contrast,   gravitational forces are large, readily detected, and control the dynamics of   most of the visible universe. Gravimeters easily detect the gravitational   force from, and motion of, a person entering a room, for example. The   propagation speed of gravitational force is bounded by six experiments to be   much faster than the speed of light [[5]].   For example:

n   In 1825, Laplace determined that the   minimum speed of gravity consistent with observations was at least 10 million   times the speed of light, c.

n   Modern, high-precision solar system   observations show that the direction from which the Sun's light comes, and the   direction toward which the Sun's gravity pulls us, are not the same. The   former is retarded by the time it takes light to travel from Sun to Earth, 8.3   minutes; and the latter is not retarded by any detectible amount.

n   Eclipses of the Sun by the Moon occur   about 40 seconds before the time of the Sun's maximum gravitational pull on   the Moon. The delay indicates that light and gravity do not have the same   propagation speed.

n   A 1997 laboratory experiment by Walker   & Dual showed that gravitational signals propagated much faster than light   signals.

n   Binary pulsars (with large masses and   speeds) show that the speed of gravity must be at least 20 billion times the   speed of light.

In classical   Newtonian gravitation, that propagation speed is infinite [[6]].   But instead of getting closer to GR if propagation in Newtonian gravity is   reduced to the speed of light, the gravitational model disintegrates and fails   to represent reality in a gross way. Nature insists that gravitational forces   must propagate without any delays nearly as large as light-speed delays.

The transition from   equations governing the potential field (Einstein equations) to equations   governing the force or 3-space acceleration of gravity (equations of motion) involves forming the gradient of the potential (the slope of the potential   well). The issue of the "speed of gravity" (meaning propagation speed of   gravitational force) revolves around whether one uses an instantaneous or   retarded gradient. If nearly instantaneous, that corresponds with   approximately infinite propagation speed for gravitational force. If the   gradient is retarded by light-propagation speed, orbits become growing spirals   that quickly depart from any observed motion. The physical significance of   this difference – that gravity appears to act instantly, and light appears to   act with delay – is what has been the subject of discussion and debate for the   last decade.

Propagation delay is not important for gravitational potential because the   potential field is already present near any source mass, and does not need to   propagate to get there. Its shape is described by the Einstein equations, or   for some purposes by retarded potential equations (analogous to the   Lienard-Wiechert potential in electrodynamics). Propagation delay effects   depend on the propagation speed to the first power. By contrast, relativistic phenomena depend on c^2, where c (the speed of light) then plays the   role of the permeability or permittivity of space-time (its stiffness or   resistance to curving) or the index of refraction of the space-time medium (in   flat space-time interpretations of GR). So any use of terms containing c ^{2} would have nothing to do with propagation speed. If we let vg represent the   physical propagation speed of gravitational force (not the same thing as Kopeikin's cg!), propagation delay would be proportional to vg to the first   power.

Einstein's GR, while not addressing the speed of gravity directly, always   adopts infinite speed for it when deriving equations of motion [[7]],   even in Einstein's own work [[8]],   by dropping any retardation for the gradient of the gravitational potential   field. That is, of course, the primary manifestation for any propagation delay   for gravitational force; and dropping it effectively sets that propagation   delay to zero, or its propagation speed to infinity.

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A   common thought experiment asks: "What would happen to the Earth's orbit if the   Sun suddenly ceased to exist?" The answer is now clear. The usual relationship   "force is the gradient of the potential" would instantly end. The Sun's   potential field would then begin to dissipate, taking 8.3 minutes to dissipate   out to the distance of the Earth's orbit; so effects such as light-bending and   clock-slowing would persist for that long. But the Newtonian component of   gravitational force, the force that keeps Earth in its orbit, would cease   almost instantly, and Earth would fly off along a straight line like a weight   on a spinning merry-go-round that broke free from its moorings.

Kopeikin's experiment

Kopeikin's latest paper on the internet, giving the basis for his findings   announced at the AAS meeting, contains some egregious errors. The following   claims appear therein: "… a moving gravitating body deflects light not   instantaneously but with retardation caused by the finite speed of gravity   propagating from the body to the light ray. … We calculated this correction for Jupiter by making use of the post-Minkowskian approximation based on the   retarded Lienard-Wiechert solutions of the Einstein equations. … Speed of   gravity cg must enter the left side of the Einstein equations (2) … This will   lead to the wave operator depending explicitly on the speed of gravity cg."

None   of these statements is correct even in GR, provided only that "the speed of   gravity" retains its classical meaning for the past two centuries of force   propagation speed. The Einstein equations require the potential field of all   bodies to act from the body's instantaneous direction, not its retarded   direction, because they set propagation delay for the gradient to zero. But   Kopeikin adopts the Sun acting from its instantaneous position and Jupiter   acting from its retarded position, which is inconsistent. In fact, although   the Sun moves 1000 times more slowly than Jupiter, it is 1000 times more   massive, making any hypothetical retardation effects comparably important. The   Lienard-Wiechert equations consider retardation in mutual distance, but not in   direction – the latter being a much larger effect of propagation delay. And   the parameter on the left side of the Einstein equations is c^2, and   therefore has nothing to do with the speed of gravity, as we noted above. This   does not prevent Kopeikin from calling it "cg" and solving for this parameter   as if it were the speed of gravity, which is what he has done.

Sadly, Kopeikin   here ignores both the existence of a long-standing controversy about the speed   of gravity (defined as the propagation speed of gravitational force) [5] and the

aforementioned arguments raised against his original interpretation by others. Kopeikin used the notion that this experiment might determine "the speed of gravity" to aggrandize the experiment, and perhaps also to justify funding for doing it. Yet the cg parameter measured is more closely related to the speed of light *per se* than anything else.

To clarify, it is well known to physicists that electromagnetic signals (whether light passing the Sun or quasar radio signals passing Jupiter) are not bent or slowed by the force of gravity, but by passage through a gravitational potential field. A potential field slows the rates at which clocks tick, produces gravitational redshift, bends light, and retards radar and radio signals. Gravitational force, by contrast, has no such effects even in fields as strong as 10^{19} g, where g = acceleration of gravity at Earth's surface [
[9]
]. Gravitational force simply produces the 3-space (Newtonian) acceleration of bodies. Kopeikin has not cleanly separated potential-change propagation effects from force propagation effects, despite an attempt to do so in his latest paper that was absent from the original paper.

Kopeikin makes another claim in his new paper: "The spectrum of plausible values of cg ranges from cg = c in general relativity to cg = infinity as advocated by Van Flandern (1998)." This is also false. Van Flandern has long maintained in USENET discussions and on the Meta Research web site [2] that Kopeikin's cg parameter is essentially equal to the speed of light. So this statement by Kopeikin is again an attempt to falsely claim that his experiment bears on the subject of the speed of propagation of gravitational force, which it does not.

However, the misrepresentation in this new paper and announcement is more serious than mixing speed-of-light and speed-of-gravity parameters. Kopeikin's new paper has modified the equations to be used in determining the speed of gravity in a fundamental way. His own formalism now rules out the possibility of cg = infinity or cg >> c in his results even before the experiment is performed. Here is why. Kopeikin now defines a new time tau = (c/cg) t to replace the coordinate time t in the Einstein equation. However, because (c/cg) is obviously forced to become very small or zero for large or infinite cg, the role of the time coordinate is diminished or suppressed altogether by this substitution, which effectively eliminates many relativistic effects already verified in other experiments. So even if the speed of "gravitational waves" had been much faster than the speed of light, Kopeikin's experiment is incapable of showing that with his present method of analysis. More than that, Kopeikin has violated scientific protocol by changing the equations to be used for the analysis *after* the results are in, thereby presumably avoiding the embarrassment of having to announce an unexpected result. We were also unable to verify one of his key references in the December 30 paper, "E. Fomalont & S. Kopeikin (2002)" which says simply "submitted to Science". But as of January 6, Science magazine has no record of such a submission.

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The basic point here about the physical meaning of the speed of gravitational force as it appears in relativity theory has been brought to Kopeikin's attention by at least two authors of published technical papers, yet is still being ignored. Now Kopeikin has altered the analysis equations after the results were in. This raises serious questions about whether Kopeikin has maintained his scientific objectivity after using the promise of a measurement of the speed of gravity to justify funding for his experiment. Almost certainly, his erroneous announcement has damaged scientific inquiry into an important and worthy matter, the speed of propagation of gravitational force.

The speed of gravity is the subject of a recent definitive paper concluding that the real physical parameter v_g must be much greater than c [[10]]. Because this paper is the third in this series to appear in mainstream journals, because both its authors are senior and widely published, because this paper was rigorously peer-reviewed (as appropriate for controversial subject matter), and because it addresses every objection raised by anyone over the past decade in a way that was satisfactory to neutral parties, including the journal editors, there is no scientifically valid excuse for ignoring or riding roughshod over these results by creating the false impression that Kopeikin's experiment supercedes these already published findings. Moreover, because the viewpoint that the speed of gravity v_g must be $\gg$ c is in good standing by the aforementioned criteria, there is no good reason why Kopeikin should refuse to debate this matter in a suitable forum. He is hereby challenged to do so.

Note added 2003/01/10: Noted relativist C. Will has now joined those who agree that Kopeikin's result measured only the speed of light and not the speed of gravity [[11]].

Note added 2003/01/18: C. Will's objections are detailed; and Peter van Nieuwenhuizen, a physicist at Stony Brook University in New York, calls the interpretation of the results by Fomalont and Kopeikin "complete nonsense" [[12]].

Note added 2003/02/09: Retired physicist K. Nordtvedt, instrumental in proposing a key test of relativity theory, is quoted in *Nature* magazine of 16 January (p. 198): "The experiment is wonderful, but it has nothing to do with the speed of gravity."

Note added 2003/03/20: J.A. Faber, Northwestern U. has calculated the expected experimental results using an infinite speed of gravity and found no difference [[13]]. He

also concludes that only the speed of light, not the speed of gravity, was   measured.

Note added 2003/05/26: Clifford Will made a presentation to the American   Physical Society explaining why Kopeikin and Fomalont's interpretation is   incorrect [[14]].

Note added 2003/06/22: C.M. Will argues that the Jupiter-passing-quasar   experiment is not sensitive to the speed of propagation of gravity [[15]].   In a related paper, S. Samuel at Lawrence Berkeley National Laboratory makes a   similar argument, and concludes that Kopeikin measured the speed of light, not   gravity [
[16]
].

Note added 2003/08/04: Stuart Samuel showed that the real effects   of the speed of gravity were at least 100 times too small to have been   measured in the Kopeikin experiment [[17]].

Note added 2004/01/14: The Kopeikin-Fomalont paper on the experimental   results, previously rejected, is restyled as a measurement of the deflection   of a light signal by Jupiter and published [[18]].

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Summary

n   S. Kopeikin misquotes Van Flandern as predicting that cg   (Kopeikin's "speed of gravity") will be infinity. Van Flandern and Vigier are   in print showing that six experiments better than Kopeikin's already show that   the speed of gravity is >> c (c = speed of light). But in posted discussions   with Kopeikin and in USENET newsgroups, Van Flandern clearly states that Kopeikin's "cg" parameter cannot be the speed of gravity and will certainly   come out near the value c, as it did.

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n   Asada followed up Kopeikin's Astrophysical Journal paper with his   own paper in the same journal showing that Kopeikin was simply measuring a   quantity that propagated at the speed of light, and was definitely not   measuring the speed of gravity.

n   Kopeikin has mostly ignored these well-founded corrections. We note   that he justified funding for his experiment by the claim that it would   measure the speed of gravity.

n   Kopeikin new paper at the Los Alamos   archive revises his protocol, equations, and methodology. Scientific method   forbids changing the protocol after the results are in, especially when it is   done to avoid an unwanted or unexpected result.

n   Kopeikin's new equations introduce a new factor, c/cg, for time in   the Einstein equations. This factor drives time intervals to zero for large   values of cg, thereby making large cg results *   **impossible*** for any   experimental data regardless of reality.

n   Kopeikin's now-forced results do a great disservice to science in   general and the advancement of physics in particular because they no longer   represent what his own experiment showed, much less the speed of gravity.

Significance to   the public supporting the research

Contrary to   Kopeikin's announced result, reference [10] shows that the speed of light is no longer a universal   speed limit. Travel and communication at unlimited speeds are now possible.   These take place in forward time, creating no paradoxes. (E.g., you can't go   back in time and kill your own grandfather when he was still a child.) Nothing   at all about the mathematical theory of relativity is altered. However, the   experimental interpretation of special relativity now favors Lorentz's version   over Einstein's. And the experimental interpretation of general relativity now   favors the force interpretation (as preferred by Einstein, Dirac, and Feynman,   among others) over the geometric interpretation ("curved space-time").

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данильченко юрій броніславович отзывы о стоматологиях где получить справку 086у путевка на бали все включено
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