Photo Finish?

After a marathon race through the Universe, clocking the gravitational wave winner may help determine if the graviton has mass.

Einstein's theory that all electromagnetic light travels at the same speed has been confirmed. Thus, any race between radio waves, x-rays and visible light would end in a photo-finish tie.

Einstein also predicted that gravitational waves travel at light speed, but this has yet to be experimentally verified.

David Ian Jones of the *NSF Center for Gravitational Wave Physics*, has proposed making measurements at the finish line to determine how gravitational waves of different frequencies would fare in a race.

D.I Jones, The Astrophysical Journal 618: L115-L118, 2005 January 10

Photons, the carriers of light, are massless, allowing light waves to travel at the maximum possible speed. Measuring the speed at which gravitational waves travel will help determine if gravitons, the carriers of gravity, are massless as well.

Highly eccentric binary systems will emit gravitational radiation at many harmonics of the orbital frequency, and will be a primary source for the LISA gravitational wave observatory. Jones considers two types of systems in the LISA band: extreme mass ratio binaries, and stellar mass galactic binaries.

Jones' approach for measuring the arrival times of the different waves places a bound on the mass of the graviton comparable to current estimates obtained by more complicated methods.

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