The Parker Solar Probe May Shed Some Light on Light Itself

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Abstract

As the Parker Solar Probe passes near the Sun at record-breaking speeds, it may experience a slight shifting of the images taken by its WISPR cameras because of Fizeau-like dragging in the optics. The probe was not designed to maximize this effect, so it might become noticeable only because of a grain of dust on one of the WISPR lenses. If the shifting is detected and found to be proportional to the probe's speed relative to the Sun's rotation, it would provide evidence that there is a medium for the propagation of light and that this medium rotates with the Sun.

Some of the best scientific discoveries are accidents.

Chemistry professor Christian Schönbein had to be sneaky about running his experiments. His wife, Emilie, did not allow him to use her kitchen for his work. But one day, when she was away, he heated strong acids on the stove. He would have gotten away with it, but his flask broke and spilled hot acid on the floor. He quickly cleaned up the mess with the nearest thing he could find, which was Emilie's cotton apron. Then he hung it up to dry in the heat of the stove. This is how he accidentally invented a new way of making nitrocellulose (later called guncotton), a propellent more powerful than gun powder. When Emilie's apron was dry it suddenly burned up in a flash.

The Parker Solar Probe is unlikely to make such a bang, but there is at least a slight chance that it will someday show some evidence that light travels in the gravitational fields of planets and stars. In other words, light propagates in some kind of medium, and this medium for light rotates with the planet or star that causes the gravity. Since the Parker probe passes near the Sun, it may show that this medium for light exists and that it rotates with the Sun.

It's been known for just over a hundred years that light is bent by a strong gravitational field. That is not news. What would be news is the discovery of a medium for light in which it propagates. Current theory says that light behaves the same in all inertial reference frames. In other words, it behaves the same no matter where you are or what you are doing to measure it.

It wasn’t always like that. In the early and mid nineteenth century, scientists thought that there must be some kind of aether between the stars that allowed light to reach us. It was an ancient idea that there must be some kind of medium for light analogous to air being a medium for sound.

Early scientists figured the Earth must be flying through this medium at quite a high speed. They tried diligently to detect it, but it was all in vain. They never detected any speed at all. Some thought the Earth must drag the aether with it, either partially or completely, so they ran tests on a mountaintop where they figured the dragging would not be fully complete. Still, they detected nothing. It became the most famous failed experiment.

So they resigned themselves from ever being able to detect any medium in which light propagates.

But what if the medium for light is gravity itself? In and about 1920, Einstein referred to spacetime as an “ether” of sorts, not the old aether that could not be detected but a new ether, one to which the idea of motion could not be applied. He said that there must be some kind of ether or else there would be no propagation of light. The new terminology never caught on, but perhaps he was on to something.

Even before that, some scientists have wondered if gravity is electromagnetic in origin. Light is known to be electromagnetic, and if gravity turns out to be of electromagnetic origin then it would make sense that light can be waving in the electromagnetic essence of gravity. This means, in other words, that a future discovery that the medium for light is the dominant gravitational field would be the first good evidence suggesting an electromagnetic origin of gravity.

If the medium for light rotates with the surface of the earth, this would explain why earth-based labs could not detect any motion of the supposed aether. In a lab in a building on the earth, such an “ether” would be calmer than the wind. The wind can blow across the surface of the earth but gravity does not.

If gravity rotates with the earth, it and its ether would rotate as solid as a rock.

The question could be settled by testing the one-way speed of light under various circumstances. Good luck with that. It is impossible to run any kind of stop watch from end to end fast enough and reliable enough to time the light. A round-trip test of the speed of light would not help either because we can't tell if there were any gains made in one direction that were paid pack when going the other way.

So where does the Parker Solar Probe come in?

It was not designed to test this question.

Nevertheless, it is scheduled to set records for a probe experiencing intense gravitational fields. More importantly, it is going to set records for velocity. The opportunity for discovery lies in doing new things.

If light propagates through gravity and gravity rotates with the Sun's mass, then the velocity that matters is the probe's speed relative to the Sun's rotating gravitational field. This rotation would likely be similar to the rotation of the Sun's surface.

The probe's first few passes near the Sun should not be expected to show results because they were deliberately designed to match the Sun's rotation, allowing the probe to observe one area of the Sun's surface for as long as possible. However, the probe is also designed to swing by Venus every so often to tighten its long and narrow eliptical orbit, making it pass closer to the Sun and go faster. Much faster.

The probe has cameras that are oriented as if they were looking out the side windows of an airplane. These cameras, in an instrument called the Wide-Field Imager for Solar Probe (WISPR), are the ones to watch.

What to watch for is a slight image distortion or shifting that is proportional to the probe's record-breaking high speed through the Sun's intense rotating gravitational field.

Whether it will be visible at all depends on the details of how the WISPR cameras were constructed and how susceptible they are to something best described as Fizeau dragging in the optics. As light passes through the lenses, it slows down according to the lens material's index of refraction. According to the principle of Fizeau dragging, the slowed down light would also be dragged somewhat with the probe in the direction of its motion. The faster the probe travels relative to the rotation of the Sun, the more the image is dragged.

The distortion would likely be a shifting of the entire image almost as if the camera had been turned slightly, but the effect would disappear every time the probe finishes another pass of the Sun.

Such a slight shifting of the image frame would be extremely difficult to notice. The only reference would be the expected positions of stars, but with all of the movements of the probe this is hardly a precise enough reference.

Fortunately, there has been a happy accident. One of the WISPR cameras has been ever-so-slightly marred or damaged by a grain of dust on a lens. The grain always shows up in the lower-left part of its frame regardless of which way the camera is pointing in the changing view of the stars. Depending on which lens this grain of dust lodged itself on, it might provide a useful reference or control to test for the image distortion or shifting. Hopefully, this grain of dust is on a lens far away from the image sensor. If it is too close to the image sensor, sitting on certain pixels, then it will not appear to move no matter what.

The effect would be slight at best. The WISPR cameras are small and there is only a little bit of lens or other transparent material in which the light would be dragged, two factors that would limit the effect.

Another factor is the orientation of the WISPR camera and what that does to the path of light from the grain of dust to the image sensor as compared to the direction of travel. Only the component of the angle that is orthogonal to the path of travel will be affected. Thus, a forward or backward looking image would not show much, but a sideways image would. In this one instance, it may be possible to change the orientation of the WISPR cameras to maximize the effect, or at least select raw images taken with a favorable orientation.

It is important to obtain raw images in which the image sensor pixels can be consistently identified. Cropped raw images will be useless unless the section provided is adequately identified.

On the positive side, during the probe's multi-year mission, it is possible that another grain of dust or other anomaly will show up that is better positioned to reveal the desired effect.

If the image of any fixed grain of dust moves by even a fraction of a pixel it would be quite significant. It would help us determine whether it is moving in proportion to the probe's velocity or to the probe's velocity against the rotation of the Sun. I suspect it will be the latter.

The dates on which the Parker Solar Probe is currently scheduled to set new records are known. They are 27 September 2020, 29 April 2021, 21 November 2021, 27 September 2023, and 24 December 2024. The data for those passes will be obtained by Nasa almost immediately. The public will have to wait a few months. The data first recorded on each of these dates will provide an enhanced opportunity to look for a shifted image of that grain of dust, crossing over into neighboring pixels. Once shifting is detected, the probe's repeated passes near the Sun provide as many opportunities to observe the shifting out of place at the highest velocities and its restoration in place at more normal velocities.

If no anomaly is detected, it means nothing has been proven. The Parker Solar Probe was not designed to run these tests and so there are many reasons why it would be unable to detect anything anomalous, including that the velocity might not be high enough, the equipment sensitive enough, the grain of dust distant enough from the image sensor, or the orientation not favorable for capturing the effect.

But, if such an anomaly is noticed, it may give us some insight into the relationship between spacetime and gravity. It could open doors to a better understanding of both.

Peter Horst Rehm is founder of Coulomb Labs, which is exploring the limits of Coulomb's law using a unique approach of theory and experiment inspired by the patent-law concept of non-obviousness. www.CoulombLabs.com.