

## Re: Photon bend another photon

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- *From:* [rambus2005@xxxxxxxx](mailto:rambus2005@xxxxxxxx)
  - *Date:* 19 Aug 2006 13:41:08 -0700
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Randy M. Dumse wrote:

<[rambus2005@xxxxxxxx](mailto:rambus2005@xxxxxxxx)> wrote in message  
[news:1156001002.217451.177670@xx](mailto:news:1156001002.217451.177670@xx)

Nice post. A small correction, though, the "box full of photons" is a bad example. What you are measuring is the effect of the increased "pressure radiation" which manifests itself as a measurable force, not the increased mass of the system.

Thanks. I hear, and appreciate, your objection. I even worried a bit about putting it as I did. Notice I had chosen mass-energy, as opposed to the more correct stress-energy, to more easily be understood by the current audience. I also included a pressure comment to keep the door to larger concepts open. So you are right that in this example pressure plays the major role.

But I don't know if I am comfortable saying the mass of the system does not increase. I feel if I left out the box completely, and the "system" was just the two (antiparallel) photons it would still have mass.

But given the box is closed, you don't know what's inside. You can measure the mass of the system. Weight it, or try to accelerate it. In either case, it exhibits mass. Calling it mass, or calling it "pressure radiation manifesting itself as a measurable force" seem just two ways of looking at the same thing due to equivalence.

Would you call the "mass without mass" of Wheeler's geon due to pressure radiation? I wouldn't. Would radiation thrown down a black hole increase its radiation pressure component? or does it just become "mass".

So I don't see the mirrored box as a terribly bad example, just one complicated by the presence of the mirrored box, to make it is easier to conceptualize two photons as a system. The mirrors help us imagine them remaining in close proximity.

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Randy M. Dumse

Caution: Objects in mirror are more confused than they appear.

Very good points. There are several reasons for steering clear of "mass" in the unfortunate "photon in the box" example.

1. As you well point out, the box is closed, so we can only observe the increase in inertia. If one does the computations, one can show that the increased inertia is due to the forces tangential to the vertical box walls resulting from pressure radiation.

2. The forces at point 1 are dependent on the direction of the photons, parallel or antiparallel. In the case of a parallel pair photons the resulting "invariant mass" is  $\sqrt{(\Sigma E)^2 - (\Sigma p)^2} = 0$  while in the case of antiparallel case the "invariant mass" is  $\Sigma E$  (because  $\Sigma p = 0$ ). This fact produces a "paradox", the "mass added to the photon box" is direction dependent which does not bode well with the notion of mass being a scalar. This is why I call the "photon in a box" a very unfortunate example. I emailed Baez on this, he corrected the website a little, but not enough.

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