Re: Bending of light not well authenticated

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2005−05/msg01631.html

- *From*: emcgraw@xxxxxxxxxx (Gene McGraw)
- *Date*: Sun, 22 May 2005 05:50:58 GMT

On Sat, 21 May 2005 "Koobee Wublee" wrote:
> I get the following two equations in accordance with most derivations
> (r dH/dt)^2 / c^2 = (1 − 2 U)^2 b^2 / r^2
> (dr/dt)^2 / c^2 = (1 − 2 U)^2 (1 − (1 − 2 U) b^2 / r^2)
>Where H = angle of the photon where at perihelion H = 0
> U = G M / c^2 / r, b = integration constant

Those are indeed the equations of motion of a pulse of light (making allowances for your ambiguous notation of two divisions in a row). Hopefully you understand that those two equations are derived from the metric by the variational technique (corresponding to Fermat's Principle of Least Time), and they represent the set of light−like extremal paths. So the hard work is already finished by this point, and all that's left is to examine the path with the appropriate values of M and b to see how much deflection there is.

If you really want to derive the deflection of light for general relativity, from scratch, you have to start with the field equations, derive the metric, and solve for the light−like paths to give the equations of motion that you cited above. From this point (which you seem to be taking as your starting point) it's fairly trivial to determine the deflection.

> I have (b = R) where R is the perihelion of the photon to the sun
> with mass of the sun = 0.

The mass of the sun is not zero, it is M, and the value of the constant of integration b is not exactly equal to M, as can be seen immediately from your second equation of motion above. Remember, the perihelion distance R is, by definition, the distance from the path to the sun at the point on the path closest to the sun, and at this minimum point the derivative dr/dt is zero. Plug this into your second equation of motion above (with r = R to signify the perihelion distance) and solve for b. This gives b = R / sqrt(1 − 2U). Do you understand this?

> The objection I have is with the integraton limit. Einstein has it at
> (r = infinity to R), and I have (r = infinity to R − dR).

There is no "dR" involved at this point. The perihelion distance R is not being varied. The variational work has already been done, and the equations of motion for light−like geodesics have already been found... they are the two equations you started with. If you are interested in understanding the calculus of variations, and how Fermat's principle leads to those equations of motion, you can learn about that on the web as well, but from this point, where you have already stipulated the equations of motion, the appropriate value of R is simply the radius of the sun (when examining starlight that just grazes the disk of the sun). There is no "dR" involved here. Do you understand this?

> Although (R >> dR), the angle of deflection is proportional to (dR / R).

No. The parameter R signifies the closest distance from the Sun of the path of light. We know the starlight we are going to examine is just grazing the disk of the sun, so we need to know how much deflection to expect for a light−like geodesic path whose closest approach to the sun is essentially the radius of the sun. We already have the equations of motion for all the light−like geodesic paths, so we just need to insert the values of M and b = R / sqrt(1 − 2U) to determine the deflection.

> By integrating from (r = infinity to R), we get only the angle of the
> photon at (r = R) which is (− 4 G M / c^2 / R)...

You're badly mistaken (again). The integration from r = infinity to R gives pi/2 + 2GM/(Rc^2), as does the integration from r = R to infinity, so the total deflection, accounting for both branches of the hyperbolic orbit, is 4GM/(Rc^2).

Do you even know what it is you are integrating? Your result is so grossly wrong that I have to wonder.

> according to choice of the impact factor (b) during the inbound trip,
> and during the outbound trip, we have the angle of the photon at
> (4 G M / c^2 / R) where (dr/dt > 0). The correct value of deflection
> is at perihelion which is (r = R − dR) where you will find the angle of
> deflection to be zero.

No. The deflection on the inbound trip is 2GM/(Rc^2) and the deflection on the outbound trip is the same (the two legs of the hyperbola are symmetrical about the perihelion). This gives a total deflection of 4GM/(Rc^2).

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- ***Follow−Ups***:
  - ***Re: Bending of light not well authenticated***
    - *From:* Koobee Wublee

- ***Re: Bending of light not well authenticated***
  - *From:* Ken S. Tucker

- ***References***:
  - ***Re: Bending of light not well authenticated***
    - *From:* Randy M. Dumse
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    - *From:* ande452
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