Re: Simple Sagnac

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2005−08/msg00005.html

- *From*: dubious@xxxxxxxxxxxxxxxxxxxxxxxxxxxx (Bilge)

- *Date*: Thu, 28 Jul 2005 23:12:39 GMT

sal:

>Again, "classical" doesn't seem to be defined here. As far as I can
>tell he's saying length contraction doesn't play a role, and you don't
>need wicked fast velocities. One thing he certainly is _not_ saying
>is that a fiber optic ring gyro can be analyzed using "classical"
>(non−relativistic) physics.

Why not? If the ring rotates with an angular velocity, w, then
the light in the direction of rotation has to travel a distance:

s = 2\pi r + wrt_1

Where t is the time required for the light to reach the point on the
ring that it started, since the ring rotated by a distance wrt in that
time. Similarly, in the opposite direction, the distance traveled is
s = 2\pi r − wrt_2. The speed of light in the ring is v = c/n, so it
travels a distance s = vt_1 in the direction of rotation and s = vt_2
in the opposite direction. then,

vt_1 = ct_1/n = 2\pi r + wrt_1 => t_1 = 2\pi r/[(c/n) − wr]

vt_2 = ct_2/n = 2\pi r − wrt_2 => t_2 = 2\pi r/[(c/n) + wr]

t_2 − t_1 = 2 n\pi r [(1/(c − nwr)) − (1/(c + nwr))]

= 2pi r [2nwr/(c^2 − (nwr)^2)]

= 4\pi r^2 [(n^2 w)/(c^2 − (nwr)^2]

>Again, I'd be more impressed with the quotes if you explain how you
>can use anything other than k+v and k−v for the velocities in the
>"classical" case, if you don't happen to have a perfect vacuum on tap
>in which to run the experiment.

The index of refraction for air at STP for 590 nm is about,
1.00029. Rearranging the above gives:

t_2 − t_1 = 4\pi w r^2/[(c/n)^2 − (wr)^2]

for n = 1.00029. 1/n^2 = 0.99942 or 99.942% c.

The index of refraction is irrelevant. The only point that it
would enter the calculation differently than just replacing
c by c/n, is if the ring was rotating fast enough that the
frequency dependence of n == n(w) mattered.

[...]
>Again, if you disagree, please explain how such an analysis could work.
>(Henri would love to know!) (Sagnac didn't assume fiber optic loops,
>of course, since they hadn't been invented yet.)

Replace c with c/n.

.

- ***Follow−Ups***:
  - ♦ ***Re: Simple Sagnac***
    - ◊ *From:* Dirk Van de moortel

- Prev by Date: ***Re: Space−time curvature***
- Next by Date: ***Re: GR ?***
- Previous by thread: ***Re: Simple Sagnac***
- Next by thread: ***Re: Simple Sagnac***
- Index(es):
  - ♦ ***Date***
  - ♦ ***Thread***