Re: Four−Velocity and four−acceleration question.

Source: http://sci.tech−archive.net/Archive/sci.physics/2005−02/10579.html

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From: GR_GR (*nyb_at_colorado.edu*)
Date: 02/22/05

Date: Mon, 21 Feb 2005 23:30:05 −0700

Dave Snead wrote:
> a . u = du/dtau . u = 1/2 d/dtau (u . u) = 1/2 d/dtau(−1) = 0

Your factor of 1/2 makes sense using the argument I gave. However,
perhaps you can be a bit more clear as to your argument for the factor
of 1/2.

> "GR_GR" <nyb@colorado.edu> wrote in message
> news:cveeh6anf1@peabody.colorado.edu...
>
>>Hello,
>>
>>I am taking GR, and am working on a homework question.
>>
>>The question asks me to show that the four−acceleration is orthogonal to
>>the four−velocity. Or, a.b = 0.
>>
>>I am having some difficulty with this problem, and would appreciate some
>>pointers.
>>
>>Here is my work so far:
>>
>>Hartle eq. 5.29 states:
>>
>>u.u = −1
>>
>>I know that for two general four−vectors a and b,
>>
>>a.b = eta_(alpha,beta) a^alpha b^beta
>>
>>
>>(I am not sure of ASCII convention for writing subscripts and
>>superscripts, perhaps someone can tell me the standards used on Usenet?)
>>
>>
>>Therefore,
>>
>>u.u = eta_(alpha,beta) u^alpha u^beta

>>
>>
>>Using mathematica notation:
>>
>>Dt[u.u,tau] = Dt[eta_(alpha,beta) u^alpha u^beta]= Dt[−1,tau] = 0
>>
>>0 = eta_(alpha,beta)(u^beta a^alpha + u^alpha a^beta)
>>
>>I am not sure how to proceed from here. A naive way to progress from here
>>is to simply say that we can write the above as:
>>
>>0 = eta_(alpha,beta)(u^beta a^alpha)+eta_(alpha,beta)(u^alpha a^beta)
>>0 = a.b + b.a = 2 a.b
>>
>>and the answer is:
>>
>>a.b = 0
>>
>>
>>However, I have a feeling that I may be missing some subtlety in how I am
>>treating the four−vectors.
>>
>>Thanks for your time.
>>
>
>
>