Re: Diagonalization in Minkowski space

Source: http://sci.tech−archive.net/Archive/sci.physics.relativity/2008−07/msg00486.html

- *From*: Darwin123 <drosen0000@xxxxxxxxx>
- *Date*: Mon, 7 Jul 2008 08:55:27 −0700 (PDT)

On Jul 7, 7:31 am, Eric Gisse <jowr...@xxxxxxxxx> wrote:

> On Jul 7, 2:33 am, Imago Mortis <meccanica.quantost...@xxxxxxxxx>
> wrote:
>
>> Dear Friends
>>
>> −−−
>> As you will soon see, I'm not a native speaking English.
>> I apologize for my poor language and I hope I'm going
>> to write almost intelligible sentences.
>> −−−
>>
>> Please, can you point the results (if any) of the theory
>> of orthogonal diagonalization of matrice, over the real
>> field endowed with the standard euclidean product, not
>> extendible to Minkowski space, i.e. depending from the
>> positive definiteness (positive non degeneracy) of the
>> product ?
>
> The dot product is not positive definite in Minkowski space.
>
> I don't really know what you are asking.
>
>> Best Regard.
>>
>> Imago Mortis

I think I know what he is asking, although I don't know the answer. I think this is a serious inquiry, although he has some difficulty expressing it. This is my best guess as to what he means. Note that relativity is an advocation, not part of what I do in my profession. So I tentatively give this interpretation as to his question, and he can correct me.
Any square matrix that is not "defective" can be diagonalized. Defective matrices are a mathematical oddity. They have fewer linearly independent eigenvectors than eigenvalues. The matrices of many "projection" operators are defective. However, the transformation operators in relativity are not defective. For example, the matrix for the Lorentz transformation is not defective, nor is it a "projection operators."
The eigenvalues and eigenvectors are determined from the matrix in any one of several possible ways. In other words, find the eigenvalues c and the eignevectors x for a square matrix M so that
c x=Mx
Then there is a diagonal matrix M' which contains the eigenvalues c, and a transformation matrix S containing the eigenvectors so that
M'=S^−1 M S.
Note that M does not have to be Hermetian, or even unitary. If M is not Hermetian, c and X will have complex numbers with imaginary components.
If by Minkowski metrix matrix he means the metric matrix, then it is not defective. So the question may be is there any time diagonalizing the Minkowski matrix is useful. Cite a reference.
You are correct that the inner product of two four vectors is not positive definite. He may be confused by that point. The inner product can be positive or negative. However, there is a physical picture that corresponds to the sign of the inner product. When the inner product of two "four vector coordinates" that separate two events is positive, the two events are time−like with respect to each other. When the inner product of two "four vector coordinates" that separate two events is negative, the two events are space−like with respect to each other. So his question may include the qualifier,
"Tell me what diagonalizing the Minkowski metric tells us about two events that are time−like with respect to each other. Please give me citations where this problem is treated."
My answer: I have no idea.
.