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Annotatio

Perimetric Coordinates for Four Particles

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In a recent article RASIEL and KARL [*1*] explored the possibility of introducing coordinates $\{u_i\}$ for four particles which would be similar in nature to the three-particle perimetric coordinates introduced by PEKERIS [*2*]. Their conjecture was that these coordinates do not exist for four particles.

If the notation of RASIEL and KARL [*1*] is used,

$$\boldsymbol{R} = \boldsymbol{B}\,\boldsymbol{U} \tag{1}$$

where

$$\boldsymbol{R} = \begin{pmatrix} r_1 \\ r_2 \\ r_3 \\ r_{12} \\ r_{13} \\ r_{23} \end{pmatrix}, \qquad \boldsymbol{U} = \begin{pmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \\ u_5 \\ u_6 \end{pmatrix}$$

and the $\{u_i\}$ are the coordinates sought, then the conditions on the $\boldsymbol{B}$ matrix set forth by RASIEL and KARL [*1*] can be fulfilled.

A matrix $\boldsymbol{B}$ which obeys these conditions is

$$\boldsymbol{B} = \begin{pmatrix} 1 & 0 & 1 & 0 & 2 & 2 \\ 0 & 0 & 1 & 3 & 3 & 1 \\ 0 & 1 & 1 & 2 & 0 & 2 \\ 1 & 0 & 0 & 3 & 1 & 3 \\ 1 & 1 & 0 & 2 & 2 & 0 \\ 0 & 1 & 0 & 1 & 3 & 3 \end{pmatrix}, \tag{2}$$

If this matrix is inverted to obtain the $\{u_i\}$ in terms of the $\{r$'s$\}$ it is found that the $\{u_i\}$ do not range from zero to infinity. This introduces a contradiction since the $\{u_i\}$ were assumed to range from zero to infinity in deriving the conditions which $\boldsymbol{B}$ must fulfill.

The conclusion is reached that the requirements on $\boldsymbol{B}$, as set forth by RASIEL and KARL [*1*], are not sufficient to determine the transformation.

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If the $\boldsymbol{B}$ matrix given by RASIEL and KARL as an "almost" perimetric transformation is inverted, it is again found that the $\{u_i\}$ do not range from zero to infinity.

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References

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