The group theory of Poincaré

HOME: The Physics of Bruce Harvey

Lorentz did not realise that the transform equations would also work from the moving system to the stationary system. The 19th century had been a time of great developments in what we call "Modern Mathematics". In particular, the use of matrices in co-ordinate transformations and the analysis of algebraic structures including group theory. Poincaré[1v] applied this knowledge to the Lorentz transforms and proved to his own satisfaction that together with rotations and translations, the Lorentz transforms formed a group. If this was so then the Lorentz transforms would also be valid from the moving system to the stationary system and between any two moving systems. [This was published on June 5th 1905]

That is to say that given three observers, S in the stationary system and A and B each in a moving system, knowing the transforms from S to A, and from S to B, it should be possible to calculate the transforms between A and B. The problem is that this task seems impossible. The author had earlier disputed the group theory publishing a paper on his web-site and arguing the case in the newsgroup *sci.physics.relativity*. In 2005 he started work on a more rigorous statement of the case, however much improved functionality of software and hardware together with dogged determination led to a solution of the problem of calculating the transform between A and B. The paper had to change direction.

The author is still of the opinion that the so called "Lorentz Group" is not a group, but never the less, a set of physically meaningful transforms between a number of inertial frames does form a primitive algebraic structure with sufficient properties to ensure that Lorentz transforms are valid between any two inertial frames. This hangs on the fact that the Lorentz transforms are linear transforms which can be expressed through matrix multiplication thus inheriting the algebraic properties of matrix algebra. We shall explore this at length in the following sections.