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Physical justifications and possible astrophysical manifestations of the projective theory of relativity

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The 'projective theory of relativity' is a theory developed by American geometers such as Oswald Veblen and Dutch geometers such as Johannes Schouten, mainly between 1930 and 1935. This theory differs radically from Kaluza-Klein type theories, conformal theories of spacetime or theories such as the 'de Sitter projective relativity' although it shares with these theories geometric aspects in spaces of dimension 5. Moreover, certain versions of this theory can also be designed independently of any given spacetime metric contrarily to the precedent ones. Nevertheless, other versions can eventually include (pseudo-)Riemannian structures as substructures.

The peculiarity of the projective geometries involved in this projective theory of relativity was that it was based on spaces of dimension 5, parameterized by so-called 'homogeneous coordinates.' Since then, no physical observables could be ascribed to these homogeneous coordinates, and in particular, during the elaboration of this theory which consequently fell completely into oblivion.

We will present how this projective theory of relativity can be fully justified physically from the causal structures and localizing protocols involved in 'relativistic localizing systems' that extend 'relativistic positioning systems.' In other words, we explain the correspondence between 'homogeneous coordinates' of the projective theory of relativity and the physical observables defined in relativistic localizing systems.

Then, a theoretical overview of the projective geometry involved in this theory will be presented with some physical interpretations.

Also, possible astrophysical manifestations will be presented based on projective effects and/or invariance of interactions or observations with respect to projective transformations.

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