



# IS SPACETIME AS PHYSICAL AS IS SPACE?

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**Abstract.** Two questions are investigated by looking successively at classical mechanics, special relativity, and relativistic gravity: first, how is space related with spacetime? The proposed answer is that each given reference fluid, that is a congruence of reference trajectories, defines a physical space. The points of that space are formally defined to be the world lines of the congruence. That space can be endowed with a natural structure of 3-D differentiable manifold, thus giving rise to a simple notion of spatial tensor – namely, a tensor on the space manifold. The second question is: does the geometric structure of the spacetime determine the physics, in particular, does it determine its relativistic or preferred-frame character? We find that it does not, for different physics (either relativistic or not) may be defined on the same spacetime structure – and also, the same physics can be implemented on different spacetime structures.

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