How to make a realistic spacetime and what it does mean

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Abstract
In this work we present some physically reasonable mathematical hypothesis usually made when one wants to present a model for a spacetime in the context of General Relativity, discuss their meaning and explain why they are “physically reasonable”, or what may happen if they are not satisfied.

Key words: Relativity, Spacetime structure, Horizon

Introduction
A question that emerges from Albert Einstein's General Relativity proposal that gravity is not a force acting on distance, but a deformation of spacetime is “what then is the shape of spacetime?”. In order to look for an answer to such a question, one has to make some basic mathematical assumptions on the nature of the given spacetime, but such assumptions must be laid over reasonable physical basis in order to be effective. This work intends to present a set of assumptions to be adopted for the definition of a physically acceptable spacetime and to justify that choice in a language that can be reasonably understood by the lay public.

Results and Discussion
In order to develop the discussion, the student had to search, first of all, which are the working hypothesis adopted by physicists on General Relativity to restrict the kind of manifold a spacetime can be. In order to do it, the books [2] and [3] of the reference list were consulted, just as the introduction of [1], that presents some thoughts on even deeper hypothesis concerning spacetimes, such as its continuity, for example.

On the other hand, to try to make the images clearer to the great public, examples were sought that could illustrate spaces with the characteristics presented. Some ideas in this way were took from videos of science communication from Youtube channels like ViHart and Sixty Symbols.

Conclusions
Despite the wide recognition of Albert Einstein for his work, and a general understanding that his theory of gravity has something to do with the bending of space, little is known, even by undergraduate physicists, about the exact nature of General Relativity. A presentation of its building blocks, as done in this work, is therefore an useful collaboration to the widespread understanding of Einstein's work.

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2 HAWKING, S., ELLIS, G. The Large Scale Structure of Spacetime. Cambridge University Press.
3 SACHS, R., WU, H. General relativity for Mathematicians. Springer-Verlag.